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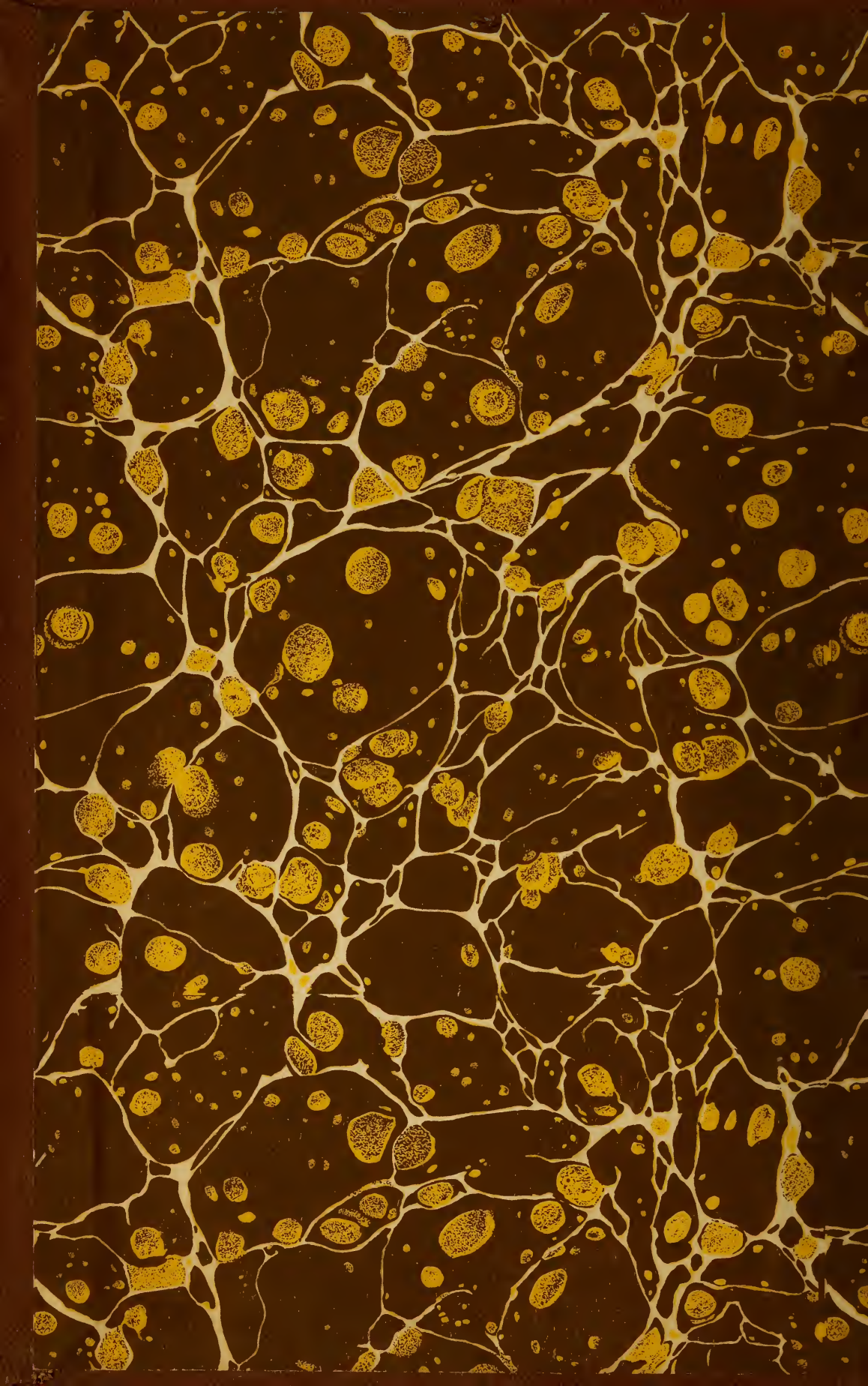

DEPARTMENT OF COMMERCE

WILLIAM F. WHITING, Secretary

STANDARDS YEARBOOK

1929

Compiled by

THE NATIONAL BUREAU OF STANDARDS

GEORGE K. BURGESS, Director

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LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF STANDARDS,
Washington, October 24, 1928.

SIR: I have the honor to submit herewith for publication the third issue of the Standards Yearbook.

In the earlier issues of this publication special attention was paid to the organization and procedure of the numerous standardizing agencies in this country with brief outlines of certain national and international agencies. The present volume contains outlines of the activities and accomplishments of not only the National Bureau of Standards and other agencies of the Federal Government and the States, counties, and municipalities, but also those of technical societies and trade associations, with special emphasis on their accomplishments during the year 1928, their programs for future work, and the methods employed by each organization to encourage or facilitate the use of its standards and specifications.

Among the special features of the present yearbook is an outline of methods employed in standardizing commercial weights and measures. There is also featured the present attempt to simplify the calendar by introducing an internationally standardized month. This subject is discussed in special contributions by Charles F. Marvin, chief of the United States Weather Bureau. Outlines are given of the activities and recent accomplishments of various foreign national standardizing bodies. Included also is a bibliography of recent publications relating to standardization contributed by courtesy of William Adams Slade, chief, division of bibliography, Library of Congress, and a brief discussion on International Cooperation in Standardization, by John Gaillard, of the American Standards Association.

The Standards Yearbook is proving of much value to manufacturers, industrial experts, and engineers, as well as to purchasing agencies both governmental and general.

Respectfully,

GEORGE K. BURGESS,
Director Bureau of Standards.

Hon. WILLIAM F. WHITING,
Secretary of Commerce.

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STANDARDS YEARBOOK, 1929

I. STANDARDIZATION OF COMMERCIAL WEIGHING AND MEASURING DEVICES

The adoption of a primary standard for each of the several units of weight or measure which enter into commercial weighing and measuring transactions is a necessary preliminary to effective regulation of the devices used in such transactions to determine the amount of merchandise bought or sold. Such standards may be material—as, for instance, a primary material standard of mass or length—or they may be established by definition—as, for instance, the establishment of a standard of capacity on the basis of the volume of a given mass of water under prescribed conditions or on the basis of cubical contents expressed in terms of a derivative of the standard of length. The preservation of the integrity of the primary standards so adopted, the development of methods whereby these standards may be translated accurately into the manifold derivatives of the fundamental units which are required for the control of commercial apparatus, and the actual comparisons necessary to standardize these derivatives are corollaries to the adoption of the primary standards.

If commercial quantity determination is to be maintained upon a uniform basis, it is essential that the standardization extend through an unbroken sequence from the primary standards to the commercial weighing and measuring instrumentalities in everyday use by the trader. The commercial phase of weights and measures control is concerned with all devices, from the most simple to the most complicated, which are utilized to determine the amounts of merchandise bought or sold or the amounts of service rendered upon a basis of weight or measure; moreover, it is properly extended beyond the mere devices themselves and embraces the manner in which the devices are used by the trader, the accuracy of his determinations, and the honesty of his representations of quantity to those with whom he deals.

It has always been considered a proper function of government to exercise weights and measures supervision and in most instances the government in any given country has been impelled to exercise

that function for the first time by nonuniformity in weights and measures which has threatened the stability of its domestic or foreign commerce. The development of the control systems in force in the world to-day has been slow. In the past the several nations gradually worked out their own standards and the methods for making these effective within their respective borders. More recently there has been concerted effort to unify the standards of weight and measure among nations. The weights and measures organizations maintained in different countries, and the details of administration, exhibit many variations. However, the importance with which this function of government is regarded is demonstrated by the persistence with which these activities have been carried on for generations, by the frequent strengthening and broadening of the laws under which weights and measures departments operate, and by the gradual expansion of facilities and personnel whereby an ever-increasing amount of service is rendered and an ever-greater degree of protection is afforded.

WEIGHTS AND MEASURES SUPERVISION IN THE UNITED STATES

There is in the United States no Federal agency in charge of the supervision of commercial weights and measures throughout the country. This function is almost entirely in the control of the various States and cities, having been left to these agencies by the Federal Congress. The Congress has, of course, recognized certain standards of length, mass, and capacity, and the several States were furnished with copies of these standards by the Government. The subsequent adoption by the States, as State standards, of the standards so furnished has resulted in uniform standards throughout the United States.

However, as the custodian of the national standards of length and mass, the National Bureau of Standards has a fundamental relation to all weights and measures activity in the country, and one of its primary functions is to test the standards of the States so that uniformity in this regard may be maintained. Again, the Bureau of Standards is specifically authorized by law to act in an advisory capacity in the promotion of uniformity of weights and measures administration, and every effort is made to do all that may properly be done in this direction. The bureau has available a large amount of technical weights and measures information, members of the staff are familiar with the practical problems arising in the field, and this information and the results of this experience are freely offered to weights and measures officials and others interested; in other words, the National Bureau of Standards endeavors to act at all times as a clearing house for weights and measures information.

In addition to the recognition by Congress of standards of weight and measure, there have been enacted a number of Federal laws on weights and measures subjects, certain of which may be enumerated as follows: The standard apple barrel law (August 3, 1912), the standard barrel law (March 4, 1915), the standard lime barrel law (August 23, 1916), the standard container act of 1916 (August 31, 1916), the standard container act of 1928 (May 21, 1928), and the net weight amendment to the food and drugs act (March 3, 1913). With the exception of the standard barrel law and the standard container act of 1928, both of which apply to intrastate as well as to interstate transactions, the laws enumerated apply only to interstate transactions.

In general, Congress has left the matter of weights and measures supervision in the hands of the individual States and they are free to enact such legislation as they deem expedient. As a result, different States have handled the problem of organizing their weights and measures control in different ways, but, although considerable diversity may exist in the details of the several organizations, one of three general plans has usually been adopted wherever any serious attempt has been made to provide adequate supervision.

The simplest of these plans is for all weights and measures supervision in a State to be exercised by the State government through a State office of weights and measures. Under this plan the actual inspection and testing of all commercial apparatus, as well as all of the supervisional activities connected with weights and measures administration, are performed by State inspectors directly under the control and supervision of the head of the State office. This plan makes possible a high degree of uniformity in weights and measures matters throughout the State, for not only are the law, the specifications and tolerances, and the rules and regulations the same in all sections, but, as a result of the unified control by the central State office of all of the field inspectors, uniform methods of inspection and test may be realized and every community of the State may be given its fair share of attention.

A second plan is a dual system with both State and local officers regularly engaged in the testing of commercial weighing and measuring devices. In practice this plan has developed several modifications; for instance, the local officers may be city or county officials, and the plan may include either group alone or a combination of the two. The State officials perform all work in certain sections of the State, as, for example, in the less thickly settled portions, where it is felt that the amount of work does not justify the appointment of resident local officers. The State department also exercises at least a general supervision over all of the weights and measures officials of the State. This plan permits of a certain flexibility

which is a decided advantage at times; it also provides resident inspectors in the more thickly populated sections of the State, where their services are most needed.

Under the third plan all actual inspectional and testing work is performed by local officials. The functions of the State department may include the general supervision of the work of the local officials, the issuance of rules and regulations, specifications and tolerances, methods of test, etc., and the periodical testing of the standards of the local officials.

Not all States, however, can be classified as having weights and measures organizations falling into one of the groups described above. Of those remaining, some States may have one or even several active local officials, while the balance have no active supervision whatsoever. Of this group it need only be said that it is extremely unfortunate that the important field of weights and measures supervision has been so slighted in so many instances.

A very brief outline of the type of weights and measures organization in the several States follows:

Alabama.—The division of weights and measures of the department of agriculture and industries (Montgomery) carries on all work except in a small number of cities and counties having local sealers.

Arizona.—The State inspector of weights and measures (Phoenix) carries on all work except in cities having populations in excess of 5,000, which are required to have local sealers.

Arkansas.—The secretary of state (Little Rock) is the custodian of the State standards, but no active supervision is carried on by the State. Legal provision is made for local sealers.

California.—The division of weights and measures of the department of agriculture (Sacramento) exercises supervision throughout the State and carries on all work in counties not having local sealers.

Colorado.—The State treasurer (Denver) is the custodian of the State standards, but no active general supervision is carried on. The State oil inspector tests devices used for the measurement of oil or gasoline. Legal provision is made for local sealers.

Connecticut.—The division of weights and measures of the State police department (Hartford) exercises general supervision throughout the State. City and county sealers carry on practically all inspectional work.

Delaware.—The State chemist (Dover) is the custodian of the State standards, but no active supervision is carried on. A regulator of weights and measures is appointed by the governor for each county.

District of Columbia.—The department of weights, measures, and markets (Washington) carries on all work for the District.

Florida.—The only State work carried on is the testing of gasoline-dispensing devices under the supervision of the commissioner of agriculture (Tallahassee). There are a number of local sealers.

Georgia.—The only State work carried on is the testing of gasoline-dispensing devices under the supervision of the comptroller general (Atlanta). There are a number of local sealers.

Idaho.—The bureau of weights and measures of the department of agriculture (Boise) carries on work throughout the State. There are no local sealers.

Illinois.—The division of standards of the department of trade and commerce (Springfield) exercises supervision throughout the State and carries on all work except in cities having populations of 25,000 or more, which have local sealers.

Indiana.—The department of weights and measures(Indianapolis) exercises supervision throughout the State and carries on some inspections. Most of the inspectional work is carried on by city and county sealers.

Iowa.—The department of agriculture (Des Moines) carries on all weights and measures work except in a few cities having local sealers.

Kansas.—The State oil inspector (Topeka), the grain weighing and inspection department (Kansas City, Mo.), and the board of health (Topeka), respectively, carry on tests of gasoline and oil measuring devices, grain scales, and other commercial weighing and measuring devices. A few cities have local sealers.

Louisiana.—The secretary of state (Baton Rouge) is the custodian of the State standards, but no active supervision is carried on by the State. The only local officials are two inspectors appointed by the governor for New Orleans.

Maine.—The bureau of weights and measures of the department of agriculture (Augusta) exercises supervision throughout the State and carries on some inspectional work. All cities and towns have local sealers.

Maryland.—The department of markets of the board of agriculture (College Park) has concurrent jurisdiction with local sealers in so far as equipment used in connection with farm produce is concerned. There is a local department in the city of Baltimore, and there are a few county sealers exercising general supervision in their respective jurisdictions.

Massachusetts.—The division of standards of the department of labor and industries (Boston) exercises supervision and carries on considerable inspectional work throughout the State. All cities and towns have local sealers.

Michigan.—The division of weights and measures of the department of agriculture (Lansing) exercises supervision and carries on considerable inspectional work throughout the State. Most of the inspectional work is carried on by city and county sealers.

Minnesota.—The department of scales, weights, and measures of the railroad and warehouse commission (Minneapolis) carries on all work throughout the State.

Mississippi.—The secretary of state (Jackson) is custodian of the State standards, but no active supervision is carried on by the State. Legal provision is made for city and county sealers.

Missouri.—No active general supervision is carried on by the State. A number of cities have local sealers, and legal provision is also made for county sealers.

Montana.—The department of agriculture, labor, and industry (Helena) and the deputy sealer of weights and measures, office of the secretary of state (Helena), respectively, exercise supervision over scales for weighing grain, and other weighing and measuring devices. With the exception of the testing of grain scales, inspectional work is carried on by city and county sealers.

Nebraska.—The department of agriculture (Lincoln) carries on all work except in a few cities having local sealers.

Nevada.—The State sealer of weights and measures (Reno) carries on all work in the State. There are no local sealers.

New Hampshire.—The State commissioner of weights and measures (Concord) exercises supervision throughout the State and carries on all weights and measures work except in cities having a population of 10,000 or more, which are required to have local sealers.

New Jersey.—The State superintendent of weights and measures (Trenton) exercises supervision throughout the State and carries on some inspectional work. The greater part of the inspectional work is conducted by municipal and county superintendents.

New Mexico.—The secretary of state (Santa Fe) is the custodian of the State standards, but no active weights and measures work is carried on by the State. Legal provision is made for county sealers.

New York.—The bureau of weights and measures of the department of agriculture and markets (Albany) exercises supervision throughout the State and carries on some inspectional work. Most of the inspectional work is conducted by city and county sealers.

North Carolina.—The State superintendent of weights and measures of the department of agriculture (Raleigh) carries on all weights and measures work throughout the State.

North Dakota.—The division of weights and measures of the department of agriculture (Bismarck) is the custodian of the State standards, but no active supervision is carried on by the State. Legal provision is made for county sealers.

Ohio.—The division of foods and dairies of the department of agriculture (Columbus) exercises supervision throughout the State and performs some inspectional work. The majority of the inspectional work is carried on by city and county sealers.

Oklahoma.—The State bureau of standards (Norman) has the custody of the State standards, but no active supervision is carried on by the State.

Oregon.—The State market agent (Salem) carries on all work in the State except in Portland, which has a local sealer.

Pennsylvania.—The bureau of standard weights and measures of the department of internal affairs (Harrisburg) exercises supervision throughout the State and carries on some inspectional work. The majority of the inspectional work is performed by city and county inspectors.

Rhode Island.—The State sealer of weights, measures, and balances (Providence) exercises supervision throughout the State. Inspectional work is carried on by city and town sealers.

South Carolina.—The department of agriculture, commerce, and industries (Columbia) carries on all weights and measures work throughout the State. There are no local sealers.

South Dakota.—The division of inspection of the department of agriculture (Pierre) carries on all weights and measures work in the State. There are no local sealers.

Tennessee.—The superintendent of weights and measures of the department of agriculture (Nashville) carries on all weights and measures work in the State except in a few cities and counties having local sealers.

Texas.—The division of weights and measures of the department of agriculture (Austin) carries on all weights and measures work in the State except in some cities which have local sealers.

Utah.—The deputy superintendent of weights and measures of the department of agriculture (Salt Lake City) carries on all weights and measures work in the State except in Salt Lake City and Ogden, which have local sealers.

Vermont.—The deputy commissioner of weights and measures of the department of industries (Montpelier) carries on all weights and measures work in the State. There are no local sealers.

Virginia.—The division of markets of the department of agriculture and immigration (Richmond) exercises supervision throughout the State and conducts some inspectional work. The majority of the inspectional work is carried on by city and county sealers.

Washington.—The division of weights and measures of the department of agriculture (Olympia) carries on all weights and measures work in the State except in several cities having local sealers.

West Virginia.—The State commissioner of weights and measures (Charleston) exercises supervision throughout the State and carries on considerable inspectional work. City and county sealers perform the majority of the inspectional work.

Wisconsin.—The division of weights and measures of the dairy and food department (Madison) exercises supervision throughout the State and carries on all work except in cities having populations of 5,000 or more, which are required to have local sealers.

Wyoming.—The dairy, food, and oil division of the department of agriculture (Cheyenne) carries on all weights and measures work throughout the State. There are no local sealers.

Territory of Alaska.—There is no territorial weights and measures organization, and no supervision is exercised.

Territory of Hawaii.—There is no Territorial weights and measures organization. Inspectional work is carried on by the sheriffs of the four municipal subdivisions of the Territory.

Philippine Islands.—The bureau of internal revenue of the department of finance (Manila) is responsible for the inspection and testing of provincial and municipal standards of weight and measure. The inspection and testing of commercial weighing and measuring devices is carried on by provincial and municipal sealers.

Porto Rico.—The bureau of weights and measures of the office of the executive secretary (San Juan) exercises supervision throughout the island and carries on a very considerable amount of inspectional work. There are 75 municipal inspectors.

WEIGHTS AND MEASURES SUPERVISION ABROAD

Governmental control of commercial weighing and measuring devices is the rule in all principal foreign countries, and in many instances this control has been regularly exercised over a long period of years. It appears, however, that in the majority of these countries the supervision authorized by law to be exercised is confined very largely to the weighing and measuring instrumentalities themselves, but little emphasis being placed upon supervision over the use of these devices or the regular checking up on the amounts of commodity actually involved in commercial transactions. In this respect, foreign laws differ from those in the majority of States in this country, where the officials are authorized to give attention to both of these two phases of weights and measures control. However, there appears at this time to be a tendency abroad to recognize the importance of both phases of the work, for we find specific provision in some recently enacted laws for the carrying on of the supervisory activities in addition to the more common mechanical activities; for instance, such laws are in effect in Canada, France, Great Britain,

Japan, the Union of South Africa, and, perhaps, in some additional jurisdictions as well.

Another difference between several foreign countries and the United States is in the matter of the character of the mechanical equipment examined. In the United States the weights and measures laws are usually so drawn as to give the officials jurisdiction over almost all instruments or devices which may be used in the commercial determination of quantity; abroad, this authority is conferred as to certain classes of apparatus only, excluding some classes which are regularly examined here. As an example, it may be mentioned that in one country abroad weights, measures, and gas meters must be tested, but weighing and measuring instruments need not be tested; in another country certain classes of measuring instruments have not been tested, although measures used for similar purposes are subject to examination; in another country certain classes of equipment are regularly reexamined after the first verification, but balances and weighing scales are tested but once—at the time when they are first put into use. In this connection it should be noted, however, that again there appears to be a tendency for foreign countries to broaden their laws along these lines, at least two countries having enacted recent laws with this object in view.

A characteristic of most foreign weights and measures laws is the provision for the approval of type of commercial apparatus by the national weights and measures authorities before such apparatus may be imported or sold. The systems of type approval in effect in different countries differ as to details, but the principle of national approval of type appears to have become well established.

In the majority of foreign countries the actual testing of commercial apparatus is carried on by representatives of the national government, all weights and measures control being concentrated in the hands of the central government. In a number of countries, however, the routine testing of commercial apparatus by the central authorities is limited to certain classes of apparatus, usually of a more or less scientific character or of a kind demanding specialized equipment or considerable experience or skill on the part of the inspectors for their proper examination; other classes of apparatus are tested by representatives of the local governments, working, however, under the detailed regulations of the central authority and, in some instances, subject to still closer control by reason of requirements to the effect that the qualifications of local officers must meet with the approval of the central office before such officers may be appointed.

There follows a brief outline of the weights and measures organizations of a few typical foreign countries:

Argentina.—The supervision of weights and measures matters is vested in the National Office of Weights and Measures (Oficina Nacional de Pesas y Medidas) of the Ministry of Agriculture (Ministerio de Agricultura) (Buenos Aires). All weighing and measuring instruments must be approved as to type, verified, and sealed by the Federal authorities before exposure for sale. Municipal inspectors carry on the periodic retesting of these instruments in the localities where they are used commercially, this work being regulated by the Federal authorities.

Austria.—The entire control of weights and measures matters is vested in the Bureau of Standards and Surveys (Bundesamt für Eich-und Vermessungswesen) of the Ministry of Commerce and Trade (Bundesministerium für Handel und Verkehr) (Vienna). Approval of type before sale is mandatory. One hundred and twenty-six standardization offices are maintained throughout the country. There is a total personnel of about 150, of whom 110 are technically trained.

Belgium.—The entire control of weights and measures matters is vested in the Technical Service of Weights and Measures (Service Technique des poids et mesures) of the Ministry of Industry, Labor, and Social Welfare (Ministère de l'Industrie, du Travail et de la Prévoyance Sociale) (Brussels). Approval of type before sale is mandatory. For purposes of testing commercial apparatus, the country is divided into 17 testing districts. There is a total personnel of about 30.

Canada.—The entire control of weights and measures matters is vested in the Weights and Measures Standards Branch of the Department of Trade and Commerce (Ottawa). Approval of type before sale is mandatory. For purposes of testing commercial apparatus, the country is divided into 18 districts. There is a total personnel of about 140.

Czechoslovakia.—The entire control of weights and measures matters is vested in the Central Inspection Board (Československý ústředni inspektorát pro státni službu cejchovni) of the Ministry of Public Works (Ministerstva verejnych praci) (Prague). Approval of type before sale is mandatory. For purposes of testing commercial apparatus, 151 field inspection offices, 30 branch offices, and 26 barrel-testing offices are maintained. There is a total personnel of about 240.

France.—The entire control of weights and measures matters is vested in the Bureau of Commercial and Industrial Affairs (Direction des Affairs commerciales et industrielles) of the Ministry of Commerce and Industry (Ministère du Commerce et de l'Industrie) (Paris). Type approval before sale is mandatory. For pur-

poses of testing commercial apparatus, the country is divided into 6 districts in which are located 295 verification offices. There is a total personnel of about 350.

Great Britain.—The supervision of weights and measures matters is vested in the Standards Department of the Board of Trade (London). Approval of type before sale is mandatory. The testing of commercial weighing and measuring apparatus is carried on by local inspectors, of which there are about 575; in addition, there are about 110 inspectors of gas meters. The work of the local inspectors is carried on under the regulations of the Board of Trade.

Japan.—The supervision of weights and measures matters is vested in the Central Bureau of Weights and Measures of the Department of Commerce and Industry (Tokyo). The Central Bureau carries on all tests of class A apparatus, which includes steel tapes, finely graduated linear measures, graduated glassware, analytical balances, small weights, water and gas meters, pressure gauges, etc. Class B apparatus, including ordinary commercial devices not included in class A, are tested by the inspection bureaus of the several local governments under the supervision and regulations of the Central Bureau. There is a total field personnel of about 200.

Mexico.—The entire control of weights and measures matters is vested in the Department of Weights and Measures (Departmento de Pesas y Medidas) of the Ministry of Industry, Commerce, and Labor (Secretaria de Industria, Comercio y Trabajo) (Mexico City). Instruments not conforming to existing regulations may be submitted for type approval. For purposes of testing commercial apparatus, 1 verification office of the first order and 31 verification offices of the second order are maintained. There is a total personnel of about 250 engaged in weights and measures activities.

Netherlands.—The entire control of weights and measures matters is vested in the Service of Weights and Measures of the Ministry of Labor, Commerce, and Industry (The Hague). For purposes of testing commercial apparatus, 12 district bureaus of verification are maintained throughout the country. There is a total field personnel of about 30.

Norway.—The entire control of weights and measures matters is vested in the Director of Weights and Measures (Justervesenet) of the Department of Commerce (Oslo). Approval of type before sale is mandatory. For purposes of testing commercial apparatus, 9 verification offices are maintained throughout the country.

Sweden.—The entire control of weights and measures matters is vested in the Royal Mint and Standards Department (Kungl. mynt- och justeringsverket) (Stockholm). Approval of type before sale

is mandatory in the case of certain classes of devices. All precision instruments are tested by the Standards Department. For purposes of testing commercial apparatus, the country is divided into 29 districts.

Switzerland.—The supervision of weights and measures matters is vested in the Bureau of Weights and Measures (Amt für Mass und Gewicht) of the Department of Finance (Eidg. Finanzdepartement) (Bern). Water and gas meters are tested by employees of the meter companies under the regulations of the National Bureau. Other devices are tested by weights and measures officers of the several Cantons under the regulations of the National Bureau. There are 24 testing stations for water meters, 10 testing stations for gas meters, and 129 standardization stations for other devices.

Union of South Africa.—The control of weights and measures matters is vested in the Superintendent of Assize (Pretoria), with the exception of gas, water, and electric meters, which are tested by officials of the municipalities. In the case of all weighing and measuring devices except meters, approval of type before sale is mandatory. There is a total field personnel of about 40, assisted in carrying on inspection work by members of the police force.

RECENT DEVELOPMENTS ABROAD

Through correspondence with foreign weights and measures offices, certain facts of interest have come to the attention of the bureau, as follows:

Austria.—The use of gasoline-measuring pumps and of balances is increasing, 845 of the former and 13,843 of the latter having been tested in 1927. Since Janury 1, 1927, the testing of clinical thermometers has been required, and in the first ensuing 6-month period 171,249 clinicals were certified.

Canada.—A great increase in the number of gasoline-measuring devices is noted. Regulations have been established recently for the calibration of vehicle tanks used in the wholesale distribution of gasoline and oil and for the establishment of standardized bottles for the retail sale of motor oil.

China.—The standardization of commercial weighing and measuring devices is now being given serious study by the Technical Bureau of the Ministry of Industry, Commerce, and Labor, with the view of providing adequate control of these devices through a corps of trained inspectors. A system of standards has already been offically approved, and the construction of copies of these for use in the testing of commercial equipment is now in progress.

Great Britain.—On January 1, 1928, the sale of food (weights and measures) act, 1926, became fully effective; this act definitely pro-

hibits the giving of short weight, measure, or count in the sale of foods and prescribes in detail the method of sale of a variety of commodities. The Standards Department is now preparing regulations for liquid-measuring devices used for liquid fuels and lubricating oils, and for milk, under authority granted by the weights and measures (amendment) act, 1926. Regulations for milk-bottle measures for milk are also being prepared.

Japan.—The first weights and measures law dates from the year 702 A. D. From about 1876 on, frequent changes have been made in the laws; there was a general revision in 1909, with amendments in 1916, 1920, 1921, 1924, 1925, and 1928. Standardization of platform weighing machines, steelyards, and gas meters has recently been receiving considerable attention.

Mexico.—A law passed in 1926 gives the Federal Department of Weights and Measures certain supervision over the manufacture of apparatus within the Republic, and under this law regulations containing detailed manufacturing specifications will be issued. Under a presidential order the department has recently assumed charge of the inspection and verification of fixed depositories for the storage of crude petroleum and its derivatives.

Norway.—It is noted that the work of weights and measures supervision has steadily increased during recent years.

Union of South Africa.—The control exercised over the sale of goods by weight or measure has recently been extended to intoxicating liquor, which when sold for consumption on licensed premises must be dispensed in tested glasses of standard sizes. Standard weights, lengths, and gauges for fencing wire, iron fencing standards, and droppers have recently been established by law.

II. STANDARDIZING THE TROPICAL YEAR—THE CALENDAR

By Charles F. Marvin, *Chief, United States Weather Bureau*

HISTORICAL

Devising a suitable calendar was probably one, possibly the first, of the problems of standardization undertaken by primitive man. Throughout all subsequent ages, even down to the present day, change after change has had to be made in every model to better adapt the calendar to human needs. Undoubtedly, at the start man perceived no greater interval of time than the day of light followed by the night of darkness. Then followed the count of 29 or 30 days constituting the lunar month. A long time must have elapsed before the year, with its heat and cold, high and low sun, and the growth and maturity of food crops, was discerned with any approximate relation to the day and the lunar month. It is, indeed, entirely proper to say that the change in Russia in 1917 from the old Julian to the Gregorian calendar, as also the adoption of modern reckoning by the Greek orthodox churches in 1923, and the still more recent adjustments of the Mohammedan Friday holiday to coincide with the Christian Sunday simply show that the present generations of humanity are still contributing to calendar evolution and are striving to attain a universal standard not yet reached.

The history of calendar standardization is absolutely lost in the remotest antiquity, but its study is most alluring and fascinating.

Romulus.—The calendar now in use by nearly all humanity is a direct lineal descendant from the calendar Romulus gave to his new city of Rome, elaborated by him no doubt from cruder and still more ancient patterns in use by neighboring tribes.

Tracing very briefly the history of the present calendar will facilitate reaching a better understanding of the nature of the problem of "standardizing the tropical year," which in technical terms comprises the whole problem of making a suitable calendar for the continuous measurement of the passage of time for the indefinite past and future.

The familiar but yet anomalous names, September, October, November, and December, take us back to the time of Romulus, when

the year had 10 numbered and undoubtedly lunar months of 29 or 30 days each. Among all primitive people the springtime and the return of the growing season—the vernal equinox—was the favorite beginning of their year, and history indicates that the new Roman calendar started with the equinox near the 25th day of the first month.

Just when is hardly known, but at some very early time the names of Roman gods or other deities began to replace the numbers designating months, so that March, April, May, and June, for the first 4 months were in use when Rome was founded, but the remaining 6 of the original 10 retained their number designations up to the times of the Cæsars.

Numa Pompilius.—A year of 10 months, or about 300 days, could not possibly keep in step with the tropical year of 365¼ days, and it is possible, but not definitely known, that Romulus may have inserted supplementary months in order to better round out the year. However, it is definitely known that after the death of Romulus his successor, Numa Pompilius, permanently added two new months to the Roman year—February, to end the year, and January, named after the two-faced god Janus, to be the first month. Notwithstanding that the true length of the solar year was accurately known to the Egyptians for at least 1,000 years before the founding of Rome, we can not suppose the early Romans had more than a very crude knowledge of this astronomical constant. Numa, however, introduced what we now commonly call a leap year. His common year contained 12 lunar months of alternately 29 and 31 days. Because odd numbers were regarded as lucky, an extra day was added, causing the year to contain 355 days. To keep his calendar in step with the solar year, Numa caused to be inserted every second year an intercalary month of alternately 22 and 23 days between the 23d and 24th of February. The average length of Numa's luni-solar calendar year was, therefore, 366¼ days.

Decemvirs.—Some 300 years later—that is, about 452 B. C.—the Decemvirs found the Roman reckoning out of step with the agricultural year and changed the position of February to make it follow January. This change by the Decemvirs, as also the addition of two months by Numa, were undoubtedly for the major purpose of restoring the time of the vernal equinox to its favorite place, about the 25th of the month of March. The Decemvirs also tried to perfect Numa's leap-year rule in a way to make the average length of the calendar year 365¼ days. The rule, however, was not only inadequate and difficult to practice but allowed a discretionary power of the pontiffs, which in the course of the next 400 years fell into great abuse and introduced serious calendar confusion.

In passing it may be noted that, by Numa's calendar, December became the eleventh month and, by that of the Decemvirs, the twelfth month, as it still remains. Thus, for more than 2,300 years humanity has complacently contented itself with a sequence of the last four months of the year inconsistent with their numbered names. When the movement now in progress to improve the calendar becomes effective, we are about to see these same months become the tenth, eleventh, twelfth, and thirteenth months of the year. How fitting it is to zealously preserve these mute witnesses of the inexorable transformations evolution effects.

Julius Cæsar.—By the ignorant management, as well as the abuses, of the pontiffs the Roman calendar got into great confusion by the time of Julius Cæsar, and the vernal equinox had advanced far into the summer months. To restore the equinox to the 25th day of March, the year 47 B. C. was made to contain a total of 445 days, and the first Julian year began with January 1, 46 B. C. Cæsar definitely abolished the lunar feature of the old Roman calendar, making the new one purely solar in character; that is, disregarding the moon, the common year contained 365 days, an extra day being added to February every fourth year to nearly equal the actual length of the tropical years. Julius assigned 31 days to alternate months beginning with January and 30 days to the intermediate months, except that in common years February received but 29 days and 30 days in leap years. At this time 6 of the original 10 months were still named by their Latin numbers. To honor Julius, however, Quintilis with its 31 days was changed to July. Catering to the pride of Augustus, the name of the month Sextilis was similarly changed to August less than 50 years later. However, Augustus's month must have as many days (31) as July, so a day was added from February, but this upset the number of days in the seasons, so the 31st of September was added to October and the 31st of November was added to December.

Thus, we learn of the trifling reasons for the lawless sequence in the lengths of the months and seasons of the present calendar, but which nevertheless inspired some poet to pen our familiar verse:

Thirty days hath September,
April, June, and November,
All the rest have thirty-one,
Except the second month alone,
Which has but twenty-eight, in fine,
Till leap year gives it twenty-nine.

Easter and the Week.—With the spread of Christianity two new and important factors were injected in calendar construction. When the Emperor Constantine embraced Christianity the week of six days of work and a seventh of rest was legalized, and for the first

time took its place in pagan calendar subunits. A few years later the great ecumenical council of Nicea, 325 A. D., definitely fixed the date of Easter in its relation to the date of the vernal equinox, which, by the error of the Julian leap-year rule, had already retrograded from March 25, its favorite date among the Romans, to March 21, its actual date at the time of the council.

Meton, Luni-Solar Calendars.—Digressing for a moment from consideration of the Roman calendar, it must be noted that a little while after the time when the Decemvirs were trying to correct the faults of Numa's luni-solar calendar the Athenian astronomer, Meton, announced his discovery (432 B. C.) that 235 lunations occur in a period of almost exactly 19 tropical years. This Metonic cycle has ever since been the basis of various luni-solar calendars, such as that of the Jews and the ecclesiastical calendars of many of the Christian churches. However, the completely incommensurate relations between the solar year and the lunar month defy reconciliation and the best luni-solar calendars that can be devised are characterized by annual fluctuations in the date of the equinox which amount to fully 28 days as a maximum.

Gregory.—Cæsar's leap-year rule intercalates too many leap years, and in 1582 Pope Gregory corrected the error of reckoning by striking out 10 days, thus restoring the equinox to its date at the time of the Council of Nicea, viz, March 21. To preserve this date he introduced the Gregorian leap-year rule, which omits three of the quadrennial leap years in 400 years.

As previously stated, people now living recently witnessed Russia, the Greek churches, and others permanently abandon the old Julian calendar in favor of the Gregorian, and the process of calendar evolution is still going on.

The Vernal Equinox.—Almost without exception, the major purpose of every calendar change alluded to in the foregoing brief historical review was to restore and stabilize the place in the calendar of the date of the vernal equinox; in other words, to keep the calendar accurately and for all time in step with the tropical year. The changes made by Gregory, and his leap-year rule, were to restore and hold the date of the equinox at the 21st of March, but we are still having too many leap years, and the normal date of the equinox is now more nearly the 20th than the 21st of March. However, the world-wide popular interest which has been aroused in recent years to improve the calendar does not concern itself in the least with the old question of fixing the date of the equinox. All attention is now centered on the best arrangement of the 365 days in subgroups of weeks, months, seasons, etc., with a disposition of leap-year day. The status of this popular question is discussed on another page.

THEORY OF A FIXED SOLAR CALENDAR

The Leap-Year Rule.—The foregoing brief history of the present world calendar clearly indicates that the progressive and enlightened portions of humanity will not indefinitely tolerate a calendar in which the seasons shift even slowly from one date to another. In other words, whatever date may be deemed to be the best one for the vernal equinox, it must remain the same for all time, or sooner or later the calendar must be changed.

Curiously enough, while calendar reformers throughout all history have by implication striven to fix the date of the vernal equinox, no authority at any time has specifically defined what that date should be. In the ancient Mosaic solar calendar the vernal equinox was designed to fall on or very near the first day of the first month. Numa, the Decemvirs, and Cæsar by implication favored March 25 of the Roman Calendar. Gregory, influenced by the chance conditions prevailing in 325 A. D., altered the calendar so that the equinox occurred on March 21. As a question of pure standardization, one date for the equinox is about as good as another, but the mighty impress upon human feeling and thought by religion and nearly 2,000 years of Christian living have now incidentally, but nevertheless inexorably, fixed the 21st of March as the proper, if not the only, practicable date for the vernal equinox. Hence, if the people of the twentieth century are to standardize the calendar along modern scientific lines, it seems that Article I of any convention for such a purpose in effect should be:

> The date of the vernal equinox shall hereafter continuously be as nearly as possible Greenwich noon on the 21st day of March.

To satisfy this perrequisite we must employ the correct leap-year rule. As previously mentioned, we are still having too many leap years even under Gregory's rule, which omits three of the quadrennial leap years in 400 years.

Furthermore, while all Europe and the Americas, as well as Eastern nations, have adopted the Gregorian calendar, it is but very little known that the Greek orthodox churches have tentatively adopted, not the Gregorian leap-year rule, but a slightly more accurate one, pending some future time when all nations may be able to unite in the adoption of the best possible leap-year rule. The way is open, therefore, for some new rule which the world at large may approve. The rule of the Greek churches omits three and one-half quadrennial leap years in 450 years, or, in whole numbers, seven leap years in 900 years. The full rule of the Eastern churches is: "Every year divisible by 4 is a leap year, except that only those centuries remain leap years whose century numbers, divided by 9,

yield a remainder of 2 or 6." The two calendars will agree until the year 2800, but will then differ by one day until 2900, after which they will remain in agreement until 3200. The conflict and confusion of the two rules will increase with lapse of time and ultimately become large and permanent.

Tropical Year Growing Shorter.—Prior to the nineteenth century the length of the tropical year was always regarded by calendar reformers as strictly constant. Near the close of the nineteenth century, however, mathematical astronomers found that the very long-time effects of the other members of the solar system on the inclination and the eccentricity of the earth's orbit cause the length of the year to vary in a slow, periodic manner, within small limits. At the present time, and for a number of centuries to come, the length of the tropical year, from Newcomb's equation,[1] is as follows:

$$L=365^{d}+f-bt \qquad (1)$$

in which f and b are small constants, with the following values: $f=0.24231545$, $b=0.0000000614$. The time, t, must be counted in years from the beginning of the Christian era. The effect of this variation on calendar accuracy was first discussed by the writer in Popular Astronomy for May, 1923.

The length of a calendar year can be written

$$L_c=365^{d}+f_c$$

in which f_c is a fraction of a day determined by the rule for leap years.

By the Gregorian rule

$$f_c=\tfrac{1}{4}-\frac{3}{400}=0.2425$$

The average error in reckoning by a given rule after one year will be

$$L_c-L=f_c-f+bt$$

It is easy to show that the accumulated error after n years becomes

$$E=(f_c-f)\,n+\frac{bn^2}{2}+c \qquad (2)$$

If the civil and solar reckonings start in accord at any given epoch, the constant of integration c becomes zero.

Equation (2) represents a parabola, the curvature of which depends upon the value of the astronomical constant b and is wholly

[1] The year will not grow shorter for all future time, as seems to be implied by equation (1), which is simply a first approximation to the present rate of secular change (about 0.53 second per century). The perturbing forces are periodic, and the year will lengthen in the distant future.

beyond human control. Therefore it follows that the error curves for all leap-year rules are identical in form and differ only in their positions with reference to the coordinate axes.

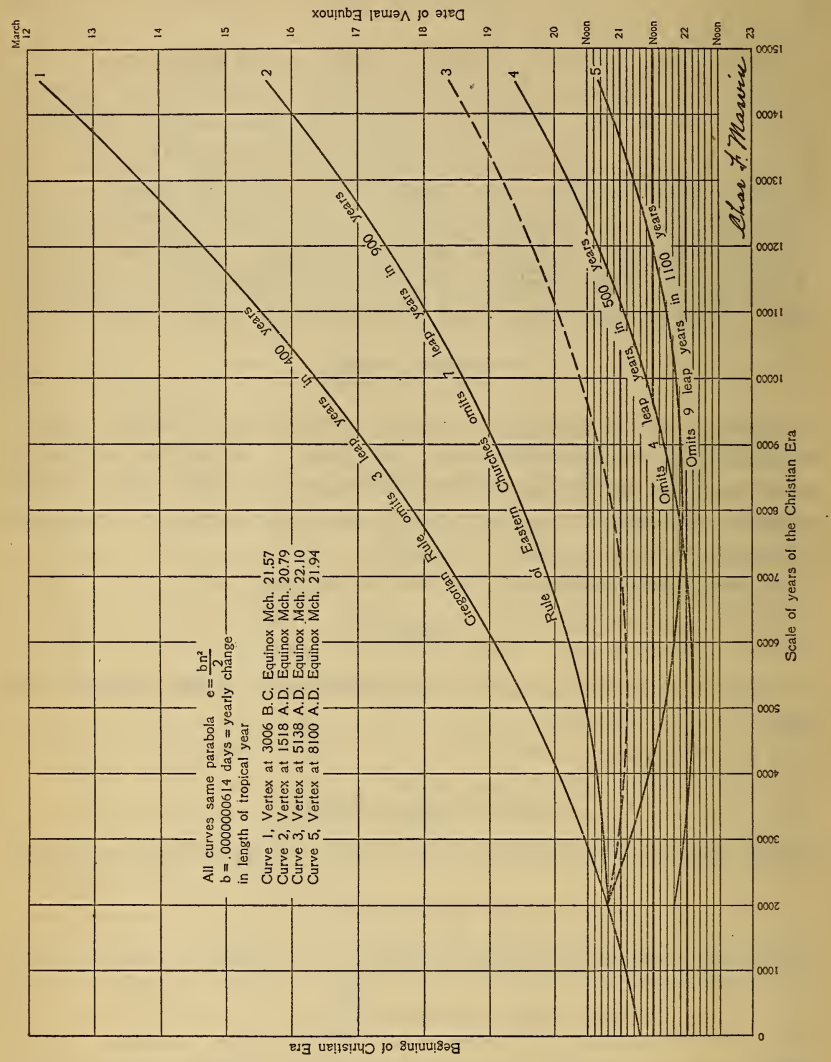

FIG. 1.—*Dates of the vernal equinox under several leap-year rules. The shaded portion represents a band of tolerance which comprises unavoidable calendar errors within ± 1 day centered on noon of March 21*

To fix the equinox, an average value of f_c must be found which will make E in equation (2) a minimum over a long period of time. Since E is a variable by equation (2), the best value of f_c is one which, when the rule goes into effect, makes the calendar year

shorter than the solar year. The date of the equinox then advances slowly for a few thousand years until the continued shortening of the solar year causes the two to become of equal length for a time, after which, due to the further shortening of the solar year, the calendar year becomes increasingly too long and the date of the equinox retrogrades indefinitely, unless the solar year lengthens within the lifetime of the rule or the rule itself is changed.

The diagram clearly indicates that rules 3, 4, and 5 satisfy the above conditions, whereas by the Gregorian and Eastern church rule the calendar year is already longer than the solar year. These rules have passed their useful lifetime and should be changed.

Both rules 3 and 4 omit 4 leap years in 500 years and are supposed to become operative by the year 2000, which is a century leap year by all the rules. No. 4 presupposes that by world agreement, or otherwise, one leap year is suppressed at some arbitrary time; for example, the leap year next after the adoption of any new calendar.

If humanity is ready to tolerate some complexity in the leap-year rule to secure prolonged accuracy, rule 5, which resembles but is much more accurate than the rule of the Eastern churches, is the best. It omits 9 quadrennial leap years in 1,100 years; that is, every year divisible by 4 is a leap year, except that only those centuries remain leap years whose century numbers divided by 11 yield remainders of 3 or 9. This rule omits, alternately, 4 leap years in 500 years, then 5 leap years in 600 years.

There is, of course, a limit upon the accuracy of the astronomical data underlying the calculation of these results, and rules 3 or 4 may be accepted as probably the best available, because of their simplicity and accuracy. Long before the useful life of either is ended astronomers will give us revised values of the constant b, and the leap-year rule can be adjusted where necessary to fit the small secular changes in the earth's orbit and year. No single leap-year rule can suffice perpetually.

III. INTERNATIONAL STANDARDIZING AGENCIES

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES

(From a Memorandum Received From the Director)

The International Bureau of Weights and Measures has during the last few years devoted particular attention to the thermal expansion of the prototype meters. This was formerly measured by the Fizeau method and by that of the comparator, and for want of a better procedure the mean of the results furnished by the two methods was taken as representing the expansion of the international prototype meter. Furthermore, all of the prototypes distributed in 1889 were compared with the international prototype at eight temperatures within the range 0 to 38° C. There was deduced from these experiments, for each platinum-iridium prototype, an expansion formula with the particular condition that a uniform value was taken for the quadratic term on the justifiable ground that this term could not be determined with sufficient accuracy to establish with certainty the differences found. Since 1920, very careful measurements have been made to verify the earlier results.

In the first place, previously, the points were distributed almost uniformly over the temperature interval covered by the experiments, and a quadratic formula was then fitted to the experimental values by the method of least squares. More recently a different procedure has been followed. As soon as it is proved that a quadratic formula is sufficient, it is useless to stake it out point by point; it is preferable to determine with precision three points at approximately equidistant temperatures. Thus, at the present time we customarily select 0, 18, and 36°, at which we have made many observations under the best conditions.

Since 1888 the apparatus, as well as the methods of comparison, have been perfected, and we have arrived at a most important conclusion, namely, that all the bars derived from the same melt of platinum exhibit the same expansion. This has been proved certainly to a tenth of the divergences previously found. The problem of the expansion of the prototype meter is thus simplified, because one may substitute for it any bar from the same melt.

In the recent experiments the divergence between the Fizeau apparatus and the comparator has been reduced to a quarter of that previously found, but this divergence appears still to be of a magni-

tude such that the results obtained can not be expected to stand for many years. The experiments are still in progress.

The bureau has, since 1919, compared 24 prototype meters, in groups, with two working standards of the international bureau. Most of these national prototypes were found to have the same calculated length at 0° referred to the international prototype as in 1888–89 within the errors of observation. Some (Germany, France, Hungary, Italy) showed variations somewhat larger, for which explanations could not in all cases be given. One had suffered an accident which would explain the change. As to the three others, nothing in their history affords an explanation of the change. One possessed a poorly defined graduation mark; for the others, only hypotheses can be offered.

It should not be forgotten that the comparisons of 1887–1889 were not made by the same observers as those of 1919–1927. Now, the length of the prototypes is defined by the distance between two graduation lines intersected by two longitudinal lines 0.2 mm apart, and it is the mean position of each graduation line which serves as fiducial point. In 1887 it was not yet known how to trace perfectly regular lines, and it is possible that the present observers have not estimated the mean position in the same way as the former observers did. This would explain the larger divergences found. It should be further noted that an objective of the comparator which did not give perfectly distinct images, was recently replaced.

It should be mentioned also that, in recent years, an element of symmetry has been introduced which had been previously neglected. If the cross hairs of the microscope are not rigorously equidistant at the left and at the right, the rulings may indicate a length very slightly different. Since the existence of this divergence has been established all observations have been made in duplicate, first with the observer in the usual position with respect to the comparator and then with the observer on the other side.

It is interesting to announce that the Serbian prototype which followed the entire retreat of the army from Belgrade to Corfu, and which has manifestly been subjected to unusual treatment, has been found to have, within 0.23 μ, the length assigned to it in 1889.

Passing from prototypes to precision length scales, one may note that during the 12 months ending June 30, 1928, the bureau determined the thermal expansion of 25 bars or metallurgical specimens, and the length and thermal expansion of six scales including a study of their graduation errors.

In the domain of length measurements, geodetic wires continue to require much attention. Their comparison upon the mural base is made under field conditions of support, tension, etc. Most of the

wires used for base measurements are returned to the bureau from the field; these, if they have been handled with care, are found to have the original length within approximately 1/500,000.

In 1913 the International Committee decided that the bureau should study a group of four wires and send them for control purposes successively to various laboratories which possess the necesary standardization equipment. The question was taken up again in 1927 after we had reconstructed our base upon new principles. The wires have been studied and sent to Teddington (the British National Physical Laboratory) and returned to the bureau. A very slight divergence was found, the cause of which is being sought.

During the year the bureau has studied the expansion of two lots of wires and determined the length of 71 wires of 24 m length, 3 wires of 8 m, and 9 tapes mostly of 4 m.

End standards, or industrial end gauges, have also been the subject of numerous researches. These latter are for the most part of the Johansson system and possess, in consequence, plane ends and are of a most accurate construction. We measure them by interference methods, having thus verified 172 ranging in length from 1 to 100 mm.

Interference methods for the determination of quartz standards have been developed and applied to pieces as long as 100 mm. The difficulty of obtaining perfectly transparent quartz, without flaw, has prevented as yet the construction of sets of these standards. When this problem is solved the international bureau will measure a certain number of standards of like construction, send them to various laboratories equipped to make similar measurements, and thus see, by the concordance or divergence of the results, whether the wave lengths agreed upon (cadium or krypton) will really serve as standards of length.

Few standards of mass have been verified, but, on the other hand, a study has been undertaken with a view to gaining a better knowledge of them. In particular, a platinum-iridium kilogram has been exposed for more than a year to a current of air maintained at 100° C. No appreciable change in the mass has been found.

Nichrome standards were constructed at the bureau many years ago, but tests made from time to time show that these decrease gradually in mass, doubtless from a slow evolution of gas. For example, a kilogram in particular belonging to P. Chappius has lost in a period of six years about 0.5 mg.

Nichrome standards were preheated in vacuum to drive off the gas. Standards thus treated have proved to be very constant at first, but at the end of a few years they likewise show an appreciable loss. It

seems that, immediately after heating, the gases near the surface are eliminated, but that, little by little, the gases located deeper in the metal diffuse out and, in their turn, are lost. Apart from this, nichrome weights possess excellent qualities; the metal is pleasing in appearance, takes an excellent polish, and is usually free from blowholes. Endeavor is being made to obtain it free from gas. If these experiments succeed, an excellent material will be available, relatively inexpensive and particularly suited to the making of precision weights.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

(Secretariat general, 49 Rue des Mathurins, Paris, France)

The Committee on Physico-Chemical Standards has prepared a number of pure chemicals which are supplied in samples of varying size at cost to scientific investigators. A depot for the distribution of these samples has been established at the Bureau of Standards under the direction of Dr. G. E. F. Lundell, to whom inquiries for information may be addressed.

The Committee on Thermochemical Data defined the thermochemical standard of combustion calorimetry as follows: The value 6,319 calories$_{15°}$, now accepted for the heat of combustion of benzoic acid, corresponds to the isothermal heat of combustion of 1 g of benzoic acid, weighed in vacuum and burned at 20° C. For experiments carried out at other temperatures, the committee proposed the following values:

°C	Calories, 15°	°C	Calories, 15°
0	6,323.3	18	6,319.4
15	6,320.1	19	6,319.2
16	6,319.9	20	6,319.0
17	6,319.6	21	6,318.8

The Committee on Thermochemical Data also defined the constant of chemical equilibrium as a function of absolute concentration, as follows:

$$K=\frac{(B_1)^{n_1}(B_2)^{n_2}}{(A_1)^{m_1}(A_2)^{m_2}}$$

corresponding to the reaction.

$$m_1A_1+m_2A_2\cdots\leftrightarrows n_1B_1+n_2B_2$$

The Committee on Bromatology called attention to an error in the old edition of Lewkowitsch's Oils, Fats, and Waxes, repeated in the French translation of Bontous, with respect to the directions for carrying out the Wijs test.

INTERNATIONAL COMMISSION ON ILLUMINATION

(Teddington, England)

The International Commission on Illumination held its seventh session at Saranac Inn, N. Y., September 24 to 28, 1928. Representatives from 11 nations were present at the meeting, which was held under the presidency of C. C. Paterson, of England. Dr. J. W. T. Walsh, of Great Britain, is honorary secretary and A. Filliol, of Switzerland, honorary treasurer.

The purpose of the commission is—

To provide an international forum for all matters relating to the science and art of illumination; to promote by all appropriate means the study of such matters; to provide for the interchange of information between different countries; to agree upon and to publish international recommendations.

The official reports of meetings and all official recommendations are issued in the French language.

More than 50 reports and technical papers grouped under 15 technical committees were presented at the Saranac Inn sessions. The following is a brief summary of the most important decisions and recommendations:

Vocabulary.—The vocabulary of photometry and illumination shall consist in general of two classes of terms, (1) terms adopted and defined by a decision of the commission and (2) terms whose designation or name and definition have not yet been formally accepted by the commission but which have been proposed by the several national committees. In the text of the vocabulary terms of this (2) class shall be accompanied by a note stating their unofficial character. A preliminary report giving terms in English, French, and German will be published.

Definitions and Symbols.—The Committee on Definitions and Symbols considered the advisability of adopting a system of photometric units based on the cgs system, but no decision was reached. Definitions of density of luminous flux, hemispherical flux, radiance, and quantity of light were adopted.

Factory and School Lighting.—The commission retains the code, as adopted in Geneva in 1924, as a model for legal purposes and proposes that this code be hereafter designated as the I. C. I. Code. Minimum values in the code shall be adjusted as progress in the technique of illumination progresses. The plane upon which illumination shall be measured shall be that plane of practical working surface upon which illumination is least.

Automobile Headlights.—A fundamental requirement for the alleviation of existing difficulties due to glare, insufficient illumination, and their allied effects is so to arrange the construction details and tolerances that all focusing devices can be eliminated.

Heterochromatic Photometry.—The commission notes with satisfaction the work in progress at the national laboratories for establishing a satisfactory basis for stepping from one color to another in the unit of candlepower. It recommends active prosecution of work in the method foreshadowed at Bellagio, which eliminates empirical features by the calculation of relative luminosities, using spectrophotometric data and the visibility factors accepted by the commission in Geneva, 1924. It expresses the hope that this work may speedily result in the establishment of a standard method for heterochromatic comparisons suitable for adoption by the I. C. I.

Street Lighting.—It is recommended, in order to facilitate international comparisons of street-lighting installations, that essential characteristics are (1) the average horizontal illumination on the carriageway; (2) the minimum horizontal illumination on the carriageway; (3) the power used in watts or the hourly consumption of gas, as well as the emitted flux in lumens—these quantities to refer to unit of surface area and unit of length of the carriageway.

The plane of reference in each case is to be the surface of the street.

The Committee on Street Lighting was requested by the commission to study further the possibility of arriving at an agreement as to the plane on which measurements of street illuminations are to be made; to study types of photometers suitable for such measurements; to study glare and to suggest a practical test for defining and measuring the degree of glare and visibility in street lighting; to collect data.

Colored Signal Glasses.—The commission recommends that, for purposes of definitions, signal lights consist of two elements—the light source and the light filter. The source is best defined in terms of its color temperature, the filter by its spectral transmission, and the resultant effect, the light flux, is most suitably defined in terms of the Young-Helmholtz color theory, but agreement on exact values is held in abeyance. It is recommended that, for general purposes, data be computed on the basis of a light source at a color temperature of 2,360° K. and that, for the present, sensation curve values as given in the colorimetry report (J. Opt. Soc. Am., vol. 6, p. 549, 1922) be used and the visibility data as adopted in Geneva, 1924.

Diffusing Materials.—The committee recommended definitions to the Committee on Definitions and Symbols (see above) for regular, diffuse, and total transmission and reflection factors.

Light-Flux Distribution.—The committee will actively collect data from the different countries as to the classification of lighting equip-

ment and fittings used for general purposes in the respective countries and will then issue this material in a form suitable for comparison and discussion, with a view to finally reaching an international understanding on methods employed for defining light distribution of a fitting and the characteristics which influence light distribution.

Daylight.—It was agreed that the value of daylight illumination at any point in an interior shall be expressed either by the horizontal illumination prevailing when the exterior illumination due to the unobstructed hemisphere is 5,000 lux, or by the roof ratio, which is the ratio between the two values mentioned above.

Cinema Lighting.—The various national committees will submit to the Committee on Cinema Lighting data collected in their respective countries, such as values of screen illumination, reflecting properties of screens, auditorium illumination, corridor illumination, and national specifications that may be used or in preparation.

Glare.—A tentative definition of glare was agreed upon as a working basis from which an internationally acceptable definition may be later worked out. Research is desirable on the following topics: (*a*) Relative effect on vision of surface area and brightness of a source; (*b*) relation between angle of cut-off and glare in factory lighting; (*c*) glaring effects in interior fittings in relation to surface brightness and angular distances; (*d*) application of available data on glare to the automobile-headlighting problem; (*e*) quantitative estimation of glare.

Aerial Navigation Lighting.—The following subjects are recommended for immediate study: (*a*) Characteristics of mist and fog and their effect on range of visibility of lights of various spectral qualities; (*b*) standardization of identification markings for routes, cities, and towns; (*c*) specification of the color of obstruction, boundary, and approach lights.

Colorimetry.—The investigations to be conducted are based on the following generally accepted statements: (*a*) An accepted nomenclature is fundamental; (*b*) a standard daylight for colorimetric measurements should be agreed upon as soon as possible.

Experimental work as suggested on (1) a redetermination of the three excitation functions (sensation curves) on the basis of the Young-Helmholtz theory of color vision, (2) determination of psychophysical sensibility to change of wave length, and (3) the determination on a psychophysical basis of the standard for white light.

The next meeting of the commission will be held in England in 1931.

NEW INTERNATIONAL ASSOCIATION FOR THE TESTING OF MATERIALS

The first meeting of this newly formed international body, the importance of which was discussed at the 1927 meeting of the International Congress for Testing Materials at Amsterdam, will be held in 1931. The activities of the new association will include international cooperation in regard to all matters connected with the testing of materials. W. H. Fulweiler, United Gas Improvement Co., Philadelphia, Pa., is the American member of the permanent committee, and the secretary is Dr. M. Ros, Loenhardstrasse, 27, Zurich, Switzerland.

INTERNATIONAL CRITICAL TABLES[1]

(Editor in Chief, Dr. E. W. Washburn, Washington, D. C.)

During 1928 two additional volumes of the International Critical Tables have been published. Volume III (444+xiv pp.) covered density, thermal expansion, compressibility, vapor pressures, boiling points, adsorption, gas solubilities, and mutual solubilities of liquids.

Volume IV (481+viii pp.) covered triple points, transition points, freezing points, solubilities, phase relations for condensed systems, osmotic pressure, surface tension, and properties of surfaces. It was accompanied by an index covering the first four volumes.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Report of Standardization.[2]—The work of the International Electrotechnical Commission is classified in 18 divisions, for each of which an advisory committee is appointed. These divisions are as follows:

1. Nomenclature.
2. Rating of electrical machinery.
3. Symbols.
4. Steam turbines.
5. Aluminum.
6. Lamp sockets and caps.
7. Charging plugs for automobiles.
8. Standard pressures for transmission, distribution, and insulators (and related subjects).
9. Electric traction equipment.
10. Insulating oils.

[1] Published for the National Research Council by the McGraw-Hill Book Co. (Inc.), 370 Seventh Avenue, New York, N. Y.

[2] Standardization activities summarized for the Standards Yearbook for 1929, by C. H. Sharp, president United States National Committee of the International Electrotechnical Commission.

11. Rules and regulations for overhead transmission lines.
12. Radio communications.
13. Measuring instruments.
14. Rating of rivers.
15. Terminal markings.
16. Hydraulic turbines.
17. Switches and circuit breakers.
18. Electrical installations on ships.

Correspondingly, the United States national committee has appointed groups of advisers for these various subjects. It is the function of these advisers to examine various propositions coming before this national committee, with the purpose of ascertaining as best they may their bearing both nationally and internationally and the attitude toward them of all the national interests affected thereby. The action of the national committee is based on the reports of the advisers. In order to avoid duplication of work and to have the most direct and effective tie in with national standardization, it is the practice of the national committee to include among its advisers the personnel of any sectional committee of the American Standards Association which covers the same technical field. Therefore, in many cases the advisers of the national committee and sectional committee of the A. S. A. are identical in membership.

Internationally, the work of the commission during the past year was marked by the plenary meeting in Italy in September, 1927. The results of the meetings of the advisory committees at Bellagio may be summarized as follows:

Nomenclature.—Meeting under the secretariat of the United States national committee, the advisory committee discussed at the instance of the Italian committee the question of the proper designation of magnetic units. It was shown that, through an error in printing of the proceedings of the International Electrical Congress in 1900, the term "gauss" is frequently used in reference to a magnetic field instead of to magnetic induction or field density, for which it was originally proposed. It was decided to appoint a subcommittee to investigate this question and to report at a future meeting. The chairman of the subcommittee is Dr. A. E. Kennelly.

The subcommittee on vocabulary reported a very complete system of classification of terms. This subcommittee has met since the Bellagio meeting and is proceeding rapidly with an international vocabulary which should prove to be very useful in electrotechnics and power generation and distribution. The work of the advisory committee is being conducted by Dr. C. O. Mailloux.

Rating of Electrical Machinery.—This committee reported its practical completion of the revision of the rules for the rating of electrical machinery. This publication is now before the national com-

mittees of the commission for acceptance or rejection. The United State national committee, through its advisors, is ascertaining the views of the important electrical bodies in this country on this question. Proposals in addition to the material at present included in the rules, such as standard methods of stating efficiencies and standards for the measurements of test voltage in dielectric tests, were presented to the national committees for their consideration.

Symbols.—Further progress is being made in the matter of graphical symbols for electrical quantities, and this committee is proceeding with the symbols for telephony and telegraphy and also heat and thermodynamics.

Prime Movers.—Under the secretariat of the United States national committee, the Committee on Hydraulic Turbines revised slightly and passed on for confirmation the agreements on this subject which it had reached at the New York meeting. There exists through this action an international code covering definitions and methods of test for hydraulic turbines.

The Committee on Steam Turbines made a start on the preparation of a test code based on the British and the United States codes. The work initiated at Bellagio has since been carried much further through a meeting held in The Hague in May of this year at which the United States was represented by three delegates. There is a prospect of the formulation in the relatively near future of a comprehensive test code for steam turbines. The meetings were conducted by Dr. W. F. Durand.

Lamp Sockets and Caps.—Progress toward the standardization of Edison screw lamp bases has been made by this committee, and it was decided to refer to the International Lamp Makers Organization the question of dimensions of small bayonet caps, with a view to their standardization.

Voltages.—The list of standard voltages was reviewed and no change made. This committee adopted for presentation to the national committees certain rules for high-tension tests of porcelain insulators and also of insulators of all types and all material.

Electric Traction Equipment.—This committee proposed standards for dielectric tests, for temperature-rise limits, and for methods of temperature measurements of traction motors. Commutation tests were agreed to, and the questions of overload tests and special tests were referred to the national committees. On the recommendation of the committee its name was changed to Advisory Committee on Electric Traction Equipment, with a corresponding widening of its scope.

Insulating Oils.—This committee was unable to go further in the matter of standard artificial aging test on insulating oils, as the

investigation into the four methods selected at New York for doing this was not as yet ready for report. Much useful progress has been made on other aspects of the subject.

Regulations for Overhead Lines.—This committee determined to draw up in the near future a skeleton code covering all the requirements which should be dealt with in any regulations for overhead transmission lines. This draft will be based on the replies to questionnaires sent out by the secretariat of the committee.

Radio Communication.—Agreement was reached upon standards for vacuum-tube bases, one being the European type, which represents a compromise of the existing types of bases as made and used in Europe. The European bases show relatively small differences. The American type of base was also standardized in accordance with the latest American standard. The American type and European type do not permit of any compromise through small variations in dimensions.

Measuring Instruments.—It was decided that the work of this committee should at the outset be directed toward preparing a code for acceptance tests of new alternating-current watt-hour meters. The United States representative submitted the Code for Electricity Meters as representing a suitable basis for such an international code. The committee expects to have another meeting within a year, at which definite progress may be made.

Rating of Rivers.—Under the secretariat of the United States national committee, this committee arrived at a number of important decisions for rating of rivers and referred the matter back to the national committees for further study.

Terminal Markings.—The common principles of European systems on markings were adopted as a base for the international proposal. The system so proposed is not in accordance with common American usage.

Plenary Session.—The final plenary session of the 1927 meeting of the International Electrotechnical Commission was held at Rome. It was decided to hold the next plenary meeting in the three Scandinavian countries—Denmark, Sweden, and Norway—in 1930.

INTERNATIONAL FIXED-CALENDAR LEAGUE

In the Standards Yearbook for 1928 a brief account was given of the proposal by the International-Fixed Calendar League, which was presented before the League of Nations and to this country. Since the United States Government policy did not permit official participation, a National Committee on Calendar Simplification was formed by George Eastman on suggestion by the Secretary of State. An

account [3] of the more recent proposals and the personnel of the committees is given below. A discussion [3] of the problem of Standardizing the Tropical Year is given elsewhere in a special chapter in this yearbook.

SIMPLIFYING THE CALENDAR [3]

Modern Proposals.—Calendar reforms originally agitated by one or more individuals, then by societies and unions, finally came under official consideration of a special subcommittee of inquiry into the reform of the calendar, of the League of Nations. Nearly 200 differing proposals were analyzed, many rejected as too radical or inadvisable, and the remainder put into one of two classes. It is noteworthy that proposals which have been made over and over again to shift the beginning of the year to the winter solstice or other date were among those rejected.

Reserving A to designate the present calendar, class B divides the year of 12 months into quarters having 30, 30, and 31 day months, with year day and leap day as blank days or not, according to whether the principle of blank days proves acceptable.

Class C consists of 13 equal months of exactly 28 days each. In this plan all months are exact multiples of the 7-day week and begin on the same week day, as do also all years if the principle of the blank days is adopted.

No change of the calendar, breaking as it does the continuity of statistics and reckoning of all kinds, is worth while unless it brings important benefits to humanity, business, and social affairs; consequently the choice of any new arrangement of the days, weeks, months, and seasons of the year must be carefully studied.

The undisputed defects of the present calendar are (1) the unequal lengths of the months; (2) incessant changes of day names for the same dates in the following months; (3) changing dates for Easter drift, school terms, court sessions, holidays, etc.

From the scientific point of view the subunits—days, weeks, months, etc.—must all stand in multiple relations and be as nearly as possible aliquot parts of the year.

The Blank-Day Principle.—The week of seven days having become one of the most important subunits of the year, which comprises exactly 52 such weeks, plus one day in common and two days in leap years, it is obvious that the calendar year can be made perpetual in the sense that each year will begin on the same, preferably the first, day of the week, provided the one or two surplus days are left blank; that is, not given any week-day name. For example, call the 365th day at the end of the year "Year day" and let it be observed as a double Sunday or holiday. *It has recently been shown that this dis-*

[3] Prepared by Dr. C. F. Marvin, chief United States Weather Bureau.

posal of the extra day is entirely consistent with the original Mosaic calendar of the Israelites at the time of the Exodus. In a similar way, the intercalary day in leap years will be designated "Leap day" and also be a holiday, preferably in midsummer.

The fixing of Easter is an ecclesiastical question which has become intimately associated with the improvement of the civil calendar and is being earnestly considered by the churches interested.

Standard month under plan C

ALL MONTHS LIKE FEBRUARY, WITH DAY-NAMES FIXED TO DATES						
Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	[1]28

[1] Year day, Dec. 29. Leap day, June 29. A mid month "Sol" after June. Easter Sunday, Apr. 8. Christmas on Monday.

Progress in 1928.—The report of the subcommittee was made June 17, 1926, after about three years' study of the question. On the basis of this report the League of Nations, during September of 1927, addressed letters to all nations suggesting the formation of so-called national committees which should encourage a methodical examination of the question by public opinion in the various countries, the consensus of view being later communicated to the league for further consideration.

The Government of the United States was not in a position to participate officially in the organization of such a national committee, but, knowing the interest which had already been shown in the improvement of the calendar by George Eastman, the Secretary of State suggested that he form a committee similar to the one created in 1925 for the purpose of collaborating with the Committee on Intellectual Cooperation of the League of Nations.

This idea was promptly made effective by Mr. Eastman, who enlisted in the membership of the committee a number of influential persons engaged in important work in both civil and Federal affairs, representing industry, commerce, finance, science, women, education, agriculture, labor, the press, and other activities.

A preliminary organization meeting of a majority of the members was held in Washington on April 23, followed on July 9 by a meeting of the full committee, which confirmed the actions taken at the preliminary meeting and appointed important subcommittees charged with accomplishing the objects of the national committee in their respective fields.

The present members of the National Committee on Calendar Simplification and the chairmen of the special subcommittees are as follows:

The National Committee

George Eastman (chairman), Eastman Kodak Co.
Dr. C. F. Marvin (vice chairman), Chief United States Weather Bureau, Department of Agriculture.
Dr. G. K. Burgess, Director Bureau of Standards, Department of Commerce.
Haley Fiske, president Metropolitan Life Insurance Co.
A. H. Harris, chairman of the executive committee, New York Central Railroad Co.
Dr. Max O. Lorenz, Interstate Commerce Commission.
Adolph S. Ochs, publisher, New York Times.
Mary Roberts Rinehart.
Dr. Fred E. Wright, National Academy of Sciences.
Silas H. Strawn, American Bar Association.
William Green, president American Federation of Labor.
Gerard Swope, president General Electric Co.
George E. Roberts, vice president National City Bank of New York.
David E. Finley, special assistant to the Secretary, Treasury Department.
Dr. Valeria H. Parker, president National Council of Women.
Mrs. John D. Sherman, General Federation of Women's Clubs.
Prof. W. S. Eichelberger, Director Nautical Almanac, Naval Observatory, Navy Department.
Benjamin F. Affleck, president Universal Portland Cement Co.
Dr. C. W. Warburton, Director of Extension Work, Department of Agriculture.
Ethelbert Stewart, Commissioner of Labor Statistics, Department of Labor.
Mary Anderson, Chief Women's Bureau, Department of Labor.
Dr. John J. Tigert, Commissioner of Education, Department of the Interior.
O. N. Solbert (secretary).

Special Subcommittees
(Name of chairman only given; 102 members)

Industry and commerce, George Eastman.
Finance, George E. Roberts.
Transportation and communication, A. H. Harris.
Science, engineering, and technology, George K. Burgess.
Labor, William Green.
Agriculture, C. W. Warburton.
Education, Dr. John J. Tigert.
Journalism and publishing, Adolph S. Ochs.
Women's interest, Mrs. J. D. Sherman.
Law, Silas H. Strawn.

While the United States was the first nation to form its committee, other nations have the matter under serious consideration, and increasing public and official interest is being awakened on the question of calendar improvement throughout the world, as indicated by the following category of events:

September 27, 1927. Letter from League of Nations to Secretary of State suggesting formation of national committee for simplification of calendar.
January 4, 1928. Letter by the Secretary of State to George Eastman, favoring the formation by the latter of a national committee for the United States.

February 18, 1928. The Pan American Congress of 21 nations at Habana unanimously resolved that there be appointed in each country a national committee to consider the proposed simplification of the calendar and to prepare for an international conference intrusted with proposing specific measures for the reform of the calendar.

April 23, 1928. National Academy of the United States adopted a resolution favoring the improvement of the calendar.

April 23, 1928. Preliminary meeting of the United States committee with Dr. Robert Haas, of the League of Nations, guest of honor.

June, 1928. The International Labour Conference at Geneva, by resolution "expresses the hope that in giving effect to the request of the secretariat of the League of Nations, and in accordance with the instructions of the governing body, the International Labor Office will proceed to a very full consultation of the trade-union organizations in the different countries."

July, 1928. The International Federation of League of Nations Societies resolved to "invite the League of Nations Societies to urge the Governments of their respective countries to take immediate steps to expedite the convening of the League of Nations, of an international conference, intrusted with proposing specific measures for the reforms of the calendar."

July 9, 1928. Full organization meeting of the United States national committee. In the months following this meeting the full organization of the subcommittees was pressed forward and committee work gotten under way.

August, 1928. Parliament of Great Britain passed bill for the provisional fixing of Easter on the next Sunday after the second Saturday of April, if approved by authorities of the Church of England and other Christian churches.

December 4, 1928. The Hon. Stephen G. Porter, chairman of the House Committee on Foreign Affairs, introduced the following resolution: "That the President is respectfully requested to propose, on behalf of the United States, to the nations of the world the calling of an international conference for the simplification of the calendar, or to accept an invitation on behalf of the United States to participate in such a conference upon the proposal of some other nation or group of nations."

December 31, 1928. The formation of national committees in foreign countries is under consideration, especially in Canada, Great Britain, Holland, Germany, France, and Italy.

It is expected the national committees will express in the near future the public views of their communities on the preferred plan, which will be made effective throughout the world by convening some suitable international congress to decide upon the essential details and date of becoming effective, which the champions of the movement hope may be in 1933, because that year begins normally on Sunday.

INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION[4]

The various actions pertaining to standards, standard instruments, and nomenclature taken by the International Geodetic and Geophysical Union at its third general assembly held in Prague, September, 1927, are indicated on pages 20 to 24 of the Standards Yearbook, 1928. The various international committees appointed to consider

[4] Note furnished by J. A. Fleming, general secretary of the American Geophysical Union.

these matters will report at the fourth general assembly of the union, which is to be held at Stockholm, Sweden, August 18 to 25, 1930.

Since the publication of Standards Yearbook, 1928, the transactions of and resolutions adopted by the general assembly of the union and of its sections have been published in detail as follows (references to the secretary of the union or section concerned, with his address, following each of the titles are given for the information of those who may wish to secure copies of these publications):

Troisième assemblée générale réunie a Prague due 3 au 10 Septembre, 1927 (Sir Henry Lyon, secretary general of the Union, c/o Science Museum, South Kensington, London, S. W. 7, England).

Rapports nationaux sur les travaux exécutés dans les différents pays établis a l'occasion de la troisième assemblée générale, Prague, 29 Aout–10 Septembre, 1927 (Gen. G. Perrier, secretary of section of geodesy, 78, rue d'Anjou, Paris 8e, France).

The transactions for the section of seismology are not yet published (Prof. E. Rothé, secretary of section of seismology, 38, Boulevard d'Anvers, Strasbourg, Bas-Rhin, France).

Procès-verbaux des séances de la section de Météorologie de la troisième assemblé générale, Prague, Septembre, 1927 (Capt. Ph. Wehrlé, secretary of section of meteorology, 176, rue de l'Université, Paris 7e, France).

The transactions for the section of terrestrial magnetism and electricity are not yet published (Dr. Ch. Maurain, secretary of section of terrestrial magnetism and electricity, 83, rue Denfert-Rochéreau, Paris 14e, France).

Réunion plénière de la Section d'Océanographie, Prague, September, 1927 (Prof. G. Magrini, secretary of section of oceanography, Casella postale 489, Rome, Italy).

The transactions for the section of volcanology are not yet published (Prof. A. Malladra, secretary of section of volcanology, R. Osservatorio Vesuviano, Resina, Napoli, Italy; Prof. Gaetano Platania, secretary of section of volcanology, R. Università, Catania, Italy).

Réunion plénière de la section d'hydrologie scientifique, Prague, Septembre, 1927 (Prof. G. Magrini, secretary of section of scientific hydrology, Casella postale 489, Roma, Italy).

General G. Perrier has published a general account of the transactions of the Prague assembly under the title "La coopération internationale en géodésie et en géophysique" (a reprint of 120 pages from "Annuaire pour l'an 1928 publié par le Bureau des Longitudes").

During the ninth annual meeting of the American section of the international body, namely the American Geophysical Union, in Washington, April 26 and 27, 1928, various reports and papers relating to actions at the Prague assembly and to standards, standard instruments, and nomenclature were considered and discussed. Among these subjects may be mentioned:

General meeting of the union. The scope and general rulings concerning the proposed publication of bulletins on geophysical methods, instruments, results, etc., under the auspices of the division of physical sciences of the National Research Council.

Meeting of section of geodesy. Reports of progress in geodetic work in Mexico, Canada, and the United States, and a symposium on the figure of the earth as derived by triangulation, gravity, torsion-balance, and astronomical methods.

Joint meeting of sections of seismology, geodesy, and terrestrial magnetism and electricity. Symposium on geophysical methods as applied in the study of geological structure, including among its six papers one on the relation of the magnetic work of the United States Coast and Geodetic Survey to geophysical prospecting methods.

Joint meeting of sections of meteorology and oceanography. Symposium on interrelations between the sea and the atmosphere, and the effect of these relations on weather or climate, including papers on problems related to solar radiation, to surface-water temperature, and to atmospheric circulation, the papers being concerned among other things with the measurements and standards of solar radiation and of ocean surface-water temperature.

Meeting of section of volcanology. Five papers relating to volcanic activity, volcanological publications, and volcano research.

The transactions of this meeting are in the course of publication. As soon as published, copies may be secured from the general secretary of the American Geophysical Union (Thirty-sixth Street and Broad Branch Road, Washington, D. C.).

The various sections of the American Geophysical Union are taking steps through committees, in realizing the actions pertaining to standards, standard instruments, and nomenclature taken at the Prague assembly. A revised list of seismological stations and seismologists to be published by the National Research Council is now under way. It is proposed to keep this list current hereafter by the publication of an annual supplement.

Section of Geodesy.[5]—The section of geodesy met with other sections of the International Geodetic and Geophysical Union at a conference held in Prague, Czechoslovakia, during the latter part of August and early in September, 1927. As usual, the section of geodesy held sessions for several days prior to the formal opening of the union which took place on September 4. The preliminary sessions of the section were made necessary by the very large agenda which the section of geodesy always have before it.

Reports were presented showing notable progress made in a number of countries, both on the practical and on the theoretical phases of geodesy. A report on the geodetic work of the United States was presented by an officer of the Coast and Geodetic Survey. That organization is in charge of the Federal geodetic work, and necessarily is the leader in this branch of science for the United States.

There were a number of subjects considered by the Prague conference which deal with the standards or specifications for different classes of geodetic operations designed to coordinate the work of the different nations. As is well known, there are a number of prob-

[5] Contributed by the president of the section, Dr. William Bowie.

lems in geodetic work which are world-wide in their scope. The principal one of these is the determination of the figure of the earth, which is generally recognized as a spheroid, which most nearly conforms to the sea level or geoid surface. The figure of the earth is determined by triangulation and by astronomic determinations of latitude and longitude at a number of triangulation stations. It is evident that, in order that this piece of research may be conducted in the most efficient manner, the triangulation and astronomical work of contiguous countries should be comparable in accuracy.

The committee on standardization of the section of geodesy presented preliminary reports on the specifications for triangulation of the first or highest order and for leveling of the highest order. Preliminary drafts of these specifications were submitted to the section, and authority was given to the chairman of the committee to prepare the final drafts, which were then to be submitted to the whole committee for adoption.

The section of geodesy charged the Committee on Gravity with the task of securing information regarding the determination of national base gravity stations from the fundamental station at Potsdam, Germany. As is well known, the difference in the value of gravity at two stations can be determined with great accuracy by the half-second invariable pendulum. This apparatus has been used very extensively in establishing base stations for the several nations, but there is some doubt as to whether all of the base stations have been adequately connected with the station at Potsdam. After this committee makes its report it is expected that recommendations will be made to the next conference of the section of geodesy, which will be held in 1930, looking toward strengthening the establishment of the base stations and, possibly, the determination of the differences between each two of a number of national base stations other than the Potsdam one. In this way a network of gravity differences would be available which could be adjusted by the method of least squares.

The secretary of the section of geodesy, Gen. G. Perrier, reported that tables had been prepared for the computation of geographic positions on the Hayford spheroid, which was the one adopted by the section at its Madrid meeting in 1924. The section of geodesy recommended that spheroid for use in all scientific investigations and also for surveys, maps, and charts in those countries which have not already adopted a spheroid for such use or, having adopted one of the older spheroids, might wish to change to the one that has the strongest values for the equatorial radius and the flattening of the Equator.

In the report from the United States the outstanding feature was the discussion of the method used in the adjustment of the 13,000

miles of arcs of triangulation in the western half of the United States, and also the statement that the adjustment had been completed.

An interesting statement was made at the beginning of the conference by one of the delegates from the United States regarding the design and use of the Bilby steel triangulation tower. The formal report of the Coast and Geodetic Survey had been sent to the printer before the tower had been tested in the field. The Bilby steel tower replaces the wooden tower formerly used, and, since it is demountable and can easily be transported across country, the cost of signal building on triangulation has been reduced to about one-third of what the cost would be if the triangulation parties still used the wooden towers. The Bilby tower can be used at many stations and will probably last a number of years, since any injured members of the tower can easily be replaced.

The formal report of the Coast and Geodetic Survey, made to the Prague meeting, contained an item dealing with the adjustment of the first-order leveling net of the United States which shows that mean sea level on the Pacific coast of the United States is approximately 2 feet higher than mean sea level on the Gulf and Atlantic coasts. This adjustment also showed that mean sea level slopes upward toward the north. For instance, Portland, Me., is about 1 foot above St. Augustine, Fla., and Seattle, Wash., is 0.85 foot above San Diego, Calif.

It is of interest to know that, for North America, the triangulation of Alaska, Canada, the United States, and Mexico is all being computed on the same spheroid and based on the same initial point, which is called Meades Ranch, located in central Kansas. It is also interesting to know that the gravity base stations of Ottawa, Canada, Washington, D. C., and Mexico City have all been connected by observations with the half-second pendulum. It is expected that the first-order level nets of Canada and of the United States will be adjusted into a single net during the coming year. This coordination of work in North America has been carried on by the officials of the geodetic organizations of the three countries, but this coordination has been indirectly due to the meeting of the delegates from the countries concerned at the conferences of the now extinct International Geodetic Association and its successor, since the war, the Section of Geodesy of the International Geodetic and Geophysical Union.

INTERNATIONAL ASTRONOMICAL UNION

The third session of the International Astronomical Union was held in Leiden, Holland, July 5 to 13, 1928. Twenty-eight countries were represented, of which 24 were members of the Union. Rumania was added to the list.

Several committees deal with standardization of nomenclature. The Committee on Physical Observations of the Planets completed the catalogue of names for the markings on the planet Mars. The Committee on Lunar Nomenclature has finished the catalogue of markings on the moon. The Committee on Solar Physics agreed upon the selection of the areas of the calcium flocculi as an index of solar activity to supplement relative sun-spot numbers.

The Committee on Standard Wave Lengths and Solar-Spectrum Tables adopted a new system of secondary standards of wave lengths derived from the iron arc specified by the international union. The table is made up of wave-length values on which at least three independent observers agree. The standards comprise several hundred wave lengths ranging from 3,370.878 to 6,750.156 Ångstroms, and the average error is not more than one unit in the last place of the decimals.

A set of solar-spectrum standards was adopted based upon the comparison of the wave lengths corresponding to the Fraunhofer lines in the sun with the primary standards. This table of standards comprises about 400 values from 3,592.027 to 7,122.206 Angstroms, with an error of not more than one unit in the last decimal place. This is the first comprehensive set of solar-spectrum standards on the international scale of wave lengths. The union recommended the extension of these systems of standards to longer and to shorter wave lengths.

SEVENTH INTERNATIONAL CONGRESS OF PHOTOGRAPHY [6]

On July 9, 1928, the seventh International Congress of Photography met in London. Arrangements were made under the auspices of the Royal Photographic Society. The work was divided into three sections, of which the first dealt with scientific and technical questions, including (*a*) theoretical aspects of photography, (*b*) photographic practice, and (*c*) scientific applications of photography, and (*d*) industrial and other special applications of photography, including cinematography, color photography, and photoengraving processes.

It was hoped that final agreement might be reached with respect to the standardization of sensitometric measurements. The American committee proposed a definite standard of photographic light intensity based upon the work at the Bureau of Standards and, after discussion, passed the following resolution to take effect when ratified by the national committees:

This meeting of the seventh international congress recommends to the national committees that the photographic unit of intensity for the sensitometry of nega-

[6] Tolerance in thickness shall be ±0.05 mm.

tive materials shall be defined as the intensity of a source of radiation having a luminous intensity of one international candle, and produced by a grey body at a colour temperature of 2,360° K, together with a selectively absorbing filter made up as follows: Two solutions compounded according to the following formula, the complete filter to consist of a 1-cm[7] layer of each solution contained in a double cell made by using three plates of borosilicate crown glass (refractive index, *D* line=1.51) 2.5 mm thick.

Solution A

Copper sulphate ($CuSO_4,5H_2O$)	g[7]	3.707
Mannite $C_6H_8(OH)_6$	g[7]	3.707
Pyridine (C_5H_5N)	c. c	30.0
Water (distilled) to make	c. c	1,000

Solution B

Cobalt ammonium sulphate $CoSO_4,(NH_4)_2SO_4, 6H_2O$)	g[7]	26.827
Copper sulphate ($CuSO_4, 5H_2O$)	g[7]	27.180
Sulphuric acid (sp. gr. 1.835)	c. c	10.0
Water (distilled) to make	c. c	1,000

It is recommended that the foregoing resolution shall come into force as a decision of this seventh international congress if and when ratified by the national committees represented at this congress.

INTERNATIONAL RADIOTELEGRAPH CONVENTION

International Technical Consulting Committee on Radio Communications.—The International Radio Convention which went into effect January 1, 1929, set up an International Technical Consulting Committee on Radio Communications for the purpose of studying technical and related questions pertaining to these communications.

Its composition, activities, and operations are defined in the general regulations annexed to the convention, as follows:

1. The International Technical Consulting Committee on Radio Communication, established by the convention, shall be charged with the study of technical and allied questions which relate to international radio communication and which shall have been submitted to it by the participating administrations or private enterprises. Its function shall be limited to giving advice on questions which it will have studied. It shall transmit this advice to the International Bureau of the Telegraph Union at Berne, Switzerland, with a view to its being communicated to the administrations and private enterprises concerned.

2. This committee shall be formed, for each meeting, of experts of the administrations and authorized private radio operating companies who wish to participate in its work and who undertake to contribute, in equal parts, to the common expenses of the contemplated meeting. The personal expenses of the experts shall be borne by the administration or private enterprise which has appointed them.

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[7] For practical purposes an accuracy to the second place of decimals is probably sufficient.

The experts of such authorized private enterprises shall participate in the work, with the right to deliberate but not to vote. When, however, a country is not represented by an administration, the experts of the authorized private enterprises of that country shall have a right, as a whole and regardless of their number, to a single vote.

3. The administration of the Netherlands shall be charged with organizing the first meeting of the International Technical Consulting Committee on Radio Communication and with drawing up the program of work for this meeting.

4. The administrations which shall have been represented at a meeting of the committee shall agree on the designation of the administration which shall call the following meeting. Questions to be studied by the committee shall be sent to the administration organizing the next meeting and that administration shall determine the date and program of the meeting.

5. In principle, the meetings of the International Technical Consulting Committee on Radio Communication shall take place every two years.

Allocation of Frequencies by International Radio Conference of Washington, 1927.—The International Radio Convention which went into effect January 1, 1929, allocated the entire radio spectrum from 10 to 60,000 kc. This allocation was made to services and not to individual stations or administrations. It is the function of the administrations to assign the definite frequencies to stations. All assignments are to be designated by their frequency in kilocycles per second, the wave length when given to be secondary and approximate.

The allocation follows:

Frequencies in kilocycles per second (kc/s)	Approximate wave lengths in meters	Services
10– 100	30,000 –3,000	Fixed services.
100– 110	3,000 –2,725	Fixed services and mobile services.
110– 125	2,725 –2,400	Mobile services.
125– [1] 150	[1] 2,400 –2,000	Maritime mobile services open to public correspondence exclusively.
150– 160	2,000 –1,875	Mobile services.
160– 194	1,875 –1,550	(a) Broadcasting. (b) Fixed services. (c) Mobile services. The conditions for use of this band are subject to the following regional arrangements: All regions where broadcasting stations now exist working on frequencies below 300 kc/s (above 1,000 m). } broadcasting. Other regions { Fixed services. / Mobile services. Regional arrangements will respect the rights of other regions in this band.
194– 285	1,550 –1,050	(a) Mobile services. (b) Fixed service. (c) Broadcasting. The conditions for use of this band are subject to the following regional arrangements: Europe { (a) Air mobile service exclusively. / (b) Air fixed services exclusively. / (c) Within the band 250–285 kc/s (1,200–1,050 m). Fixed service not open to public correspondence. / (d) Broadcasting within the band 194–224 kc/s (1,550–1,340 m). Other regions { (a) Mobile services except commercial ship stations. / (b) Fixes air services exclusively. / (c) Fixed services not open to public correspondence.

[1] The wave of 143 kc/s (2,100 m) is the calling wave for mobile stations using long continuous waves.

Frequencies in kilocycles per second (kc/s)	Approximate wave lengths in meters	Services
285– 315	1,050 – 950	Radiobeacons.
315– [2] 350	950 – [2] 850	Air mobile services exclusively.
350– 360	850 – 830	Mobile services not open to public correspondence.
360– 390	830 – 770	(*a*) Radio compass service. (*b*) Mobile services, on condition that they do not interfere with radio compass service.
390– 460	770 – 650	Mobile services.
460– 485	650 – 620	Mobile services (except damped waves and radiotelephony).
485– [3] 515	620 – [3] 580	Mobile services (distress, call, etc.).
515– 550	580 – 545	Mobile services not open to public correspondence (except damped waves and radiotelephony).
550–[4] 1,300	545 – [4] 230	Broadcasting.
1,300– 1,500	230 – 200	(*a*) Broadcasting. (*b*) Maritime mobile services, waves of 1,365 kc/s (220 m) exclusively.
1,500– 1,715	200 – 175	Mobile services.
1,715– 2,000	175 – 150	Mobile services. Fixed services. Amateurs.
2,000– 2,250	150 – 133	Mobile services and fixed services.
2,250– 2,750	133 – 109	Mobile services.
2,750– 2,850	109 – 105	Fixed services.
2,850– 3,500	105 – 85	Mobile services and fixed services.
3,500– 4,000	85 – 75	Mobile services. Fixed services. Amateurs.
4,000– 5,500	75 – 54	Mobile services and fixed services.
5,500– 5,700	54 – 52.7	Mobile services.
5,700– 6,000	52.7 – 50	Fixed services.
6,000– 6,150	50 – 48.8	Broadcasting.
6,150– 6,675	48.8 – 45	Mobile services.
6,675– 7,000	45 – 42.8	Fixed services.
7,000– 7,300	42.8 – 41	Amateurs.
7,300– 8,200	41 – 36.6	Fixed services.
8,200– 8,550	36.6 – 35.1	Mobile services.
8,550– 8,900	35.1 – 33.7	Mobile services and fixed services.
8,900– 9,500	33.7 – 31.6	Fixed services.
9,500– 9,600	31.6 – 31.2	Broadcasting.
9,600–11,000	31.2 – 27.3	Fixed services.
11,000–11,400	27.3 – 26.3	Mobile services.
11,400–11,700	26.3 – 25.6	Fixed services.
11,700–11,900	25.6 – 25.2	Broadcasting.
11,900–12,300	25.2 – 24.4	Fixed services.
12,300–12,825	24.4 – 23.4	Mobile services.
12,825–13,350	23.4 – 22.4	Mobile services and fixed services.
13,350–14,000	22.4 – 21.4	Fixed services.
14,000–14,400	21.4 – 20.8	Amateurs.
14,400–15,100	20.8 – 19.85	Fixed services.
15,100–15,350	19.85– 19.55	Broadcasting.
15,350–16,400	19.55– 18.3	Fixed services.
16,400–17,100	18.3 – 17.5	Mobile services.
17,100–17,750	17.5 – 16.9	Mobile services and fixed services.
17,750–17,800	16.9 – 16.85	Broadcasting.
17,800–21,450	16.85– 14	Fixed services.
21,450–21,550	14 – 13.9	Broadcasting.
21,550–22,300	13.9 – 13.45	Mobile services.
22,300–23,000	13.45– 13.1	Mobile services and fixed services.
23,000–28,000	13.1 – 10.7	Not reserved.
28,000–30,000	10.7 – 10	Amateurs and experimental.
30,000–56,000	10 – 5.35	Not reserved.
56,000–60,000	5.35– 5	Amateurs and experimental.
Above 60,000	Below 5	Not reserved.

[2] The wave of 333 kc/s (900 m) is the international calling wave for air services.
[3] The wave of 500 kc/s (600 m) is the international calling and distress wave. It may be used for other purposes on condition that it will not interfere with call signals and distress signals.
[4] Mobile services may use the band 550 to 1,300 kc/s (545–230 m) on condition that this will not cause interference with the services of a country which uses this band exclusively for broadcasting.

NOTE.—It is recognized that short waves (frequencies from 6,000 to 23,000 kc/s, approximately; wave lengths from 50 to 13 m, approximately) are very efficient for long-distance communications. It is recommended that, as a general rule, this band of waves be reserved for this purpose in services between fixed points.

INTERNATIONAL COOPERATION IN STANDARDIZATION[8]

In April, 1926, a conference of representatives of 18 national standardizing bodies was held in New York City. This conference undertook to lay the basis of a general international organization for cooperation in industrial and engineering standardization matters. A draft constitution for such an organization was drawn up which would be called the "International Standards Association" (I. S. A.) An international committee of seven was appointed to confer with the International Electrotechnical Commission in regard to bringing about a unified organization before submission to the national bodies for final ratification.

The committee of seven, appointed by the New York conference, met in London in September, 1926, with the Committee of Action of the International Electrotechnical Commission. It was not found possible to reach complete agreement, and on request of the American delegate (chairman of the A. E. S. C.) the matter was postponed for a year. However, temporary arrangements were made for continuing international cooperation in the general field of standardization, which cooperation had been under way since 1921. To this effect, a temporary central office was established in London with the financial support of the different national standardizing bodies, this office being in charge of C. B. le Maistre, secretary of the British Engineering Standards Association, and Mr. Huber-Ruf, technical secretary of the temporary office, the work being done under the supervision of Sir Archibald Denny, chairman of the committee of seven and of the British Engineering Standards Association.

A second meeting of the committee of seven was held in London in November, 1927. All members except the representative of the United States were present. The following five recommendations were unanimously agreed to for submission to the several national standardizing bodies:

1. That the International Standards Association be established immediately, provided the funds necessary, in accordance with the schedule of contributions already circulated with the statutes, be forthcoming for the period of the three years, 1928, 1929, and 1930.

2. That the foundation of the International Standards Association date from the New York conference, April, 1926, and be in accordance with the statutes and by-laws, already circulated.

3. That it be established in a completely independent position, the central office being, for the present, in London.

4. That the committee of seven act as the first council under the constitution. (See statute 8 and by-law 2.)

5. That Sir Richard Glazebrook be elected the first president of the International Standards Association, discharging for the present

[8] Prepared by John Gaillard, of the American Standards Association.

the duties of general secretary, the appointment of the latter being a question to be dealt with by the plenary assembly.

To promote close relations with the International Electrotechnical Commission, the committee appointed representatives to a joint committee "to put into definite form a scheme of collaboration best suited to fulfill the requirements of the situation."

To continue the work, the committee requested Mr. Huber-Ruf to act as secretary.

It will, perhaps, be interesting to mention also the proposal which was made at Bellagio to form a "comité d'entente" in which the following international organizations are taking part, and in connection with which the International Electrotechnical Commission has been invited to act as convener: International Illumination Commission; World Power Conference; International Conference on High-Tension Lines; International Consultative Committee on Long-Distance Telephony; International Union of Tramways, Local Railways, and Public Motor Transport; International Union of Producers and Distributors of Electrical Energy; and International Electrotechnical Commission.

The responses to the request for formal organization were favorable on the part of the majority of the national standardizing bodies, but the British body declined to participate. This decision of the British was accompanied by their announcement to suspend, as of March 31, 1928, the London international office.

The German and Swiss national standardizing bodies then proposed that, in order to prevent discontinuity in the international work, Mr. Huber-Ruf remain in his function as technical secretary in charge of a central office, this office now to be located in Zurich, Switzerland. This proposal has already received (status on September 1, 1928) the support of Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Holland (with tentative reservations), Hungary, Italy, Norway, Russia, Sweden, and Switzerland; the decisions of Australia, Canada, Great Britain, Japan, Poland, and United States are still pending.

Activities of the Central Office.—The program of the work, as started in London and now continued in Zurich, comprises at the present time 12 items, as follows:

1. (*a*) and (*b*) Screw threads and bolts and nuts (inch dimensions). Secretariat: Great Britain. No list of inquiries to the other bodies has as yet been circulated. (*c*) Widths across flats. Secretariat: Sweden. In March, 1928, a circular letter was sent out concerning a French proposal for the standardization of widths across flats for bolts and nuts.

2. Screw threads and bolts and nuts (metric dimensions). Secretariat: Switzerland. In October, 1927, a conference was held in

Berlin and was attended by representatives from Austria, Czechoslovakia, France, Germany, Poland, Sweden, and Switzerland. A report on the results of the discussions dealing with coarse and fine metric thread, including the questions of crest clearance and manufacturing tolerances, was circulated to all bodies by the secretariat in May, 1928.

3. Limits for fits (limit gauges), Secretariat: Germany. After collection of data in the different countries, the secretariat worked out a report, supplemented by a set of about 130 drawings and tables, which was sent to all national bodies in July, 1928. The report deals with a comparison of the different national systems of fits now in existence, discussing such items as reference temperature, basic hole or basic shaft, bilateral or unilateral system, grades and classes of fits, the laws on which the systems are based, wear of gauges, and symbols for the designation of fits. It is shown that in many cases the differences between similar fits in different systems are quite small and might probably be straightened out for the sake of international uniformity.

4. Ball Bearings. Secretariat: Sweden. A conference attended by representatives from Czechoslovakia, Great Britain, Germany, Russia, Sweden, and Switzerland was held at Stockholm in October, 1927. A report dealing with radial and thrust ball bearings, radial roller bearings, adapter-sleeve bearings, manufacturing tolerances, and nomenclature was sent out to the national bodies in January, 1928.

5. (*a*) Pipe lines. Secretariat: Switzerland. An inquiry has been sent out by the secretariat, and the replies are now being digested. (*b*) Gas and water fittings. A conference on screwed iron fittings was held in November, 1927, in Zurich, Switzerland, and attended by representatives from Belgium, Czechoslovakia, Germany, France, Great Britain, Poland, Sweden, and Switzerland. A report on this conference was sent out containing resolutions concerning proposals formulated by the conference on which the opinion of the national bodies is requested. The report is illustrated by numerous diagrams.

6. Paper sizes. Secretariat: Germany. An inquiry has been sent out, replies to which show the existence of a far-reaching uniformity in the sizes of business letters and standard sheets in the several European countries. An international proposal is being worked out.

7. Rivets. Secretariat: Holland. This work is in course of development.

8. Ships' elements. Secretariat: Holland. An inquiry was sent out and a digest of the replies and resulting proposals was circulated to the national bodies participating, viz, France, Germany, Great Britain, Holland, Italy, Norway, and Sweden.

9. (*a*) The classification of technical subjects, with special view to the standardization work, was undertaken by the secretary of the general office and circulated in French, German, and English to the national bodies for their criticism. The replies are now being digested by the technical committee dealing with this matter. (*b*) Catalogues of standards and translations. The secretary of the central office collected the catalogues of standards issued by the several national bodies and sent to each of the latter a complete set of such catalogues. With a view to standardization of terminology used in the discussion of the technical subjects, the secretary is working on a scheme of standard designations in the three languages. (*c*) Progress reports have also been sent out by the secretary of the central office. (d) Conversion tables for inch-millimeter dimensions. An inquiry on this subject has been circulated, the results of which are now being digested in the central office.

10. Drawings. Secretariat: Switzerland. An inquiry has been circulated, but pressure of other work on the international program has prevented progress of this matter. The countries participating in this work are Czechoslovakia, France, Germany, Italy, Poland, Sweden, and Switzerland.

11. Test pressures for the acceptance of new stationary steam boilers. Secretariat: Czechoslovakia. The work of this committee has been started by the circulation of data to the national bodies. The countries cooperating in this project are, so far, Austria, Czechoslovakia, France, Germany, Hungary, Italy, Poland, and Sweden.

12. Soil pipe. Secretariat: Czechoslovakia. This work has just been started, and a proposed program was circulated by the secretariat in July, 1928.

Miscellaneous. In addition to the activities on the 12 projects outlined above, information was collected by the central office from the national bodies on the following technical subjects: Sieves, machine tools, standardization of agricultural products, mathematical symbols, contact wires, narrow-gauge track equipment and rails for mining purposes, conversion tables for pressures and temperatures, cost-price systems, shafting keys, shafting and shafting ends for power transmission, engine couplings, machine and transmission pulleys, grinding wheels, abrasive paper and cloth, cast iron, cast steel, copper, and other materials and alloys, automotive standards, machine elements (handles, levers, handwheels), rules and regulations for steam boilers, combustion motors, pumps, ventilators, and compressors, aeronautical questions, sprinkler systems, reference temperature for measuring instruments, commercial zinc, office furniture, cocks for pressure gauges, commercial window glass, squares for spindles, etc., standard diameters, casing for drilling tools.

IV. NATIONAL STANDARDIZING AGENCIES

(Governmental)

NATIONAL BUREAU OF STANDARDS

(Washington, D. C., United States of America)

[See Section V]

The National Bureau of Standards has its principal headquarters in Washington and branches in six other cities. Of its staff of 913 in all, 370 are scientific and technical workers. There are 18 buildings, a library of 32,433 volumes, and 132,213 tests were completed during the past fiscal year (1927–28). The director is George K. Burgess. For further details of activities in standards and standardization, see Chapter V of this Yearbook.

NATIONAL PHYSICAL LABORATORY[1]

(Teddington, England)

Provision has been made for beginning a new building devoted to physics. The Air Ministry have received proposals for the installation of a variable-density wind tunnel at the laboratory, for securing full-scale data of considerable accuracy, obtainable otherwise only by lengthy tests on machines in free flight. It is hoped that the construction will begin during the current year, the preliminary investigation to determine the best form of tunnel having been completed.

A power plant and million-volt transformers have been installed in the High-Voltage Building, and research is under way on the program outlined by the high-tension subcommittee. During the year much work has been carried out developing methods of experiment and measurement at high voltages, and reports on various problems of distribution of power at such voltages have been submitted to the electricity commissioners.

International Standards.—The specifications for an international scale of temperature from −190 to 2,500° C. and upward, drawn up by the National Physical Laboratory, the Physikalisch-Technische Reichsanstalt, and the National Bureau of Standards, were submitted to the Seventh General International Conference on Weights

[1] For details, see Report of the National Physical Laboratory, which contains a complete list of papers published. Vol. XX of the Collected Researches contains the papers on optics and photometry; Vol. XXI, those on the standard mutual inductance.

and Measures held at Sevres, and decisions were made regarding several questions of importance. The specifications were accepted provisionally, subject to alterations of detail deemed necessary by the Thermometric Conference of 1928. Cooperative work in the above-named laboratories is being continued.

The same conference accepted measurements of length in terms of wave lengths of light as equivalent to measurements in terms of the international meter, using the red cadmium line as the standard. The National Physical Laboratory has for some years been carrying on experimental work with a view to the adoption of a wave-length of light as the primary standard of length, the apparatus for this purpose being partly completed.

During the past year, in connection with the program of international coordination of electrical measurements, the laboratory has made comparisons of the international ohm with the Laboratoire Central d'Electricité and the Bureau of Standards, and of the international volt with the Bureau of Standards, satisfactory agreement having been obtained in each case. International comparisons have also been made of radio-frequency standards. Piezoelectric oscillators have been circulated to the various national laboratories on the initiative of the Bureau of Standards, showing a mean variation of all measurements not more than 3 parts in 100,000. International comparisons of photometric standards are also in progress.

Australian Standards.—The laboratory has, upon request from the Council for Scientific and Industrial Research of the Commonwealth of Australia, cooperated with the board of trade in formulating the proposals for establishing and maintaining as the legal standards of the Commonwealth the standards in use in Great Britain. A representative from Australia has studied the methods employed in the laboratory. A comprehensive report has been submitted to the Commonwealth authorities, setting forth the proposals and the standards and apparatus required. To maintain agreement with the standards of Great Britain it is expected that the National Physical Laboratory will undertake the initial and periodical reverification of the Australian standards.

Schneider Cup.—The Air Council acknowledged the "valuable contribution to the success" of the British seaplanes in the contests for the Schneider cup, made possible in part as a result of the wind-tunnel work of the aerodynamics department covering two years.

Total Solar Eclipse.—In the cooperative work in observing the solar eclipse distinct effects were noted showing reduced absorption of wireless waves by the Heaviside layer even though the path of the waves was at no point in total darkness. During obscuration at totality the normal right properties of the Heaviside layer were

temporarily restored. Measurements of the illumination of a horizontal surface due to skylight alone showed a minimum illumination during the eclipse equal to 0.18 foot candles.

Roads Research.—A full-scale apparatus has been designed and constructed for experiments on skidding, the actual experiments during the year having been carried on with the small-scale model. The new apparatus permits tests under various conditions of speed, load, and braking force on the wheel. The effects of wheel dimension on road destruction have been investigated by the use of a special trailer fitted with different sizes of wheel. The horizontal and vertical vibrations of the ground caused by the trailer moving at various speeds over road hollows were measured, and the drawbar pull and spring deflection of the trailer were also recorded. A horizontal vibration recorder was also developed for the work, and an extensive plan of research on concrete roads is in progress.

Industrial X-Ray Analysis.—The X-ray patterns of the tungsten steels are under investigation, with the object of correlating the presence of certain groups of lines with magnetic properties. Studies are also in progress to discover the effect of cold-working on the orientation of the crystals of which the metals are composed.

Physics Department.—The thermal conductivities of water, glycerine, aniline, and various oils have been determined over a range of temperatures, and work on the thermal and electrical conductivities of single crystals of aluminum has been completed. Preliminary values of the heat of combustion of carbon monoxide have been obtained, and work with gas of higher purity is planned, as well as on other gases over a range of temperatures and pressures. A method for measuring flame temperatures by the reversal of spectrum lines was studied and applied to determining the temperature of a carbon monoxide flame burning in oxygen. Preliminary determinations of the melting point of palladium were obtained which agree closely with that proposed for international acceptance at the General Conference on Weights and Measures at Sevres. Steady progress has been made with the study of the wet and dry bulb hygrometer and the dew-point hygrometer at temperatures between 40 and 100° C., to secure data for a set of tables to be used with the wet and dry bulb hygrometer up to 100° C. A publication is being prepared describing the results of an extensive investigation of typical distant-reading temperature-measuring outfits for use in connection with cold storage. Instruments have also been devised for the measurement and control of humidity in cold stores. The work on the relationship between X-ray absorption and wave length has been continued by making determinations of the absolute absorption of homogeneous radiation in copper, silver, and platinum.

Appreciable advances have been made in the factors controlling sound transmission of various materials, notably as to the effect of the vibration of the partition. The stationary-wave method of measuring the absorption coefficient of small specimens has been studied and apparatus for the purpose constructed. Apparatus has been installed for an absolute measurement of sound intensity.

The new universal lens interferometer has been used to investigate optical systems, and a paper on its theory was published. The methods for making measurements in the ultra-violet and of wave lengths in the infra-red are being developed and research on the measurement of color carried on.

A bridge method for direct measurement of mutual conductances of thermionic valves has been devised, and the methods of measuring relative phase and ratio of amplitude of input and output voltages of amplifying systems have been improved. The vertical-force magnetometer has been completed. The methods of magnetic testing of materials have been improved and interesting results obtained on the effect of mechanical and heat treatment of the material.

A research has been completed on the redetermination of the effect of acidity of the electrolyte on the voltage of standard Weston cells.

The electrotechnics division has improved methods and equipment for work at high voltages in connection with the new high-voltage laboratory. A report on corona discharge on high-voltage lines has been made to the electricity commissioners. Improvements have been made in the design of standard resistances, and a number of resistances, including one rated at 7,500 amperes, have been constructed. The use of current transformers employing the magnetic properties of "permalloy" has permitted the development of new methods for the measurement of power in circuits carrying large alternating currents.

Work on photo-electric and heterochromatic photometry has continued. The "maintenance of standards" work included international comparisons and a study of the effect of geometrical form of photometric integrators on measurements of mean spherical candlepower. The reflection characteristics of road surfaces have been studied, and a standard surface of known reflecting factor has been established. An account of the work on the lighting of picture galleries has been published.

In wireless, the directional research has included a study of the rotating-beacon transmitter and its utility to marine navigation. Progress has been made on the properties of aerials, antenna systems, and apparatus.

Besides the maintenance of the standards of length and mass, a number of line and end standards were verified, and the metric

standards of mass of the board of trade and the laboratory were redetermined, showing their high stability and that their values are satisfactorily known. In connection with interferometry, the relation between the optical, geometrical, and mechanical lengths of a standard steel end gauge was investigated, and the results on the contact of flat surfaces have been published. Contact rusting of steel surfaces has led to a theory of dry solid friction based on molecular attractions and repulsions. Practical methods have been devised for measuring the diameters of fine quartz suspension fibers used in scientific instruments. A diffraction grating ruling engine has been completed, and trial rulings have been made. A new combined barostat and vacuum chamber for the direct testing of mercurial barometers has been put into use, and a portable secondary standard barometer of novel design has been constructed. In volumetric work the differences between results by gravimetric and by volumetric methods have been studied, and the effect of surface tension on hydrometer readings is being studied.

In the research on pivots and jewels the relations between frictional torque and load have been determined in terms of the radii of curvature and elastic constants of the pivot and jewel which enable radii suitable for any particular purpose to be calculated.

A relative determination of the value of gravity yielded a result in agreement within 1 part in 1,000,000 with the value 991.194 cm/sec ^{2} hitherto assumed. The new value was derived from pendulum experiments at Teddington and Greenwich and depends on the absolute determinations at Potsdam over a number of years.

Research on hardness testing to interpret hardness tests by examining the relation between indentation tests and tensile strain was continued. An explanation of the mechanism of deformation of single crystals of metal has been formulated after an experimental investigation.

A research on springs for motor vehicles has led to the conclusion that on the surface of unmachined spring leaves there is a layer of material which causes a marked reduction in the endurance of the leaves as compared with the same material in the form of machined test pieces. To accelerate this work a new machine has been designed and constructed. The behavior of seven standard spring steels was compared and experiments made on road vehicles.

In the high-temperature work on materials, a report has been published on "creep" tests on 0.51 per cent carbon steel and 0.53 per cent carbon cast steel. New alloys are being sought for use at high temperatures, alloys of nickel and chromium being investigated. Results on the strain and temperature hardening of Armco under stress up to 390° C. are ready for publication; results on the possibility of

reducing the sizes of bright nuts is in press; and a report on the causes of failure of wrought-iron chains has been published.

The method of integrating the wind pressure on structures has been further developed, and measurements have been made of the vertical and horizontal vibration of ground and buildings due to various causes. Observations of the periodic movement of the buildings of the Tower of London and tests in connection with the preservation of St. Paul's Cathedral are under way.

A study has been made of the constitution of the light alloys, and work is in progress on the undercooling of aluminum alloys, on the permanence of dimensions of various alloys under heat treatment, and on artificial aging. Metallic beryllium has been deposited from the vapor of the iodide in the hope of producing it in a purer and more ductile form.

Studies relating to the preparation, properties, and X-ray structure of pure iron, chromium, and manganese have been made, and the work on the latter two metals has been published.

X-ray analysis has also been used in studying the atomic arrangement of certain solid solutions and to elucidate the structure of alpha and beta manganese. The research on deformation of metals and alloys has been extended to include the behavior of duplex alloys, especially of eutectic or eutectoid bodies. The surface tension of liquid metals has been measured for bismuth, zinc, cadmium, and antimony over wide ranges of temperature, and lead-tin alloys have been included. Other studies made include the magnetic phenomena in metals and alloys and the development of methods of spectrographic analysis and work on special refractories.

A research on iron-phosphorus system has been completed and further progress made on iron-manganese, iron-chromium, iron-silicon, and iron-berryllium. Publication of the results on the effects of impurities on copper has been approved. The investigation on pressure die casting is in progress, and work on special brasses is completed. The work on dental alloys has been extended.

The improved chemical methods in metallurgical analysis have been developed and the estimation of oxygen in pure metals and alloys studied.

Advance has been made on the theory and practice of flying, and in the study of wing flutter, both experimental and theoretical. Preventives of flutter were found, and it is now possible to predict the critical flutter speeds and frequencies of the model under various conditions and compare these with the observed values.

Experimental studies have been made of the value of the Handley Page slot in improving low-speed control. Apparatus is under construction for imitating a complete spin in a wind tunnel, and the

conditions of the dangerous "flat spin" have been investigated. A difficult research on the convection of heat from an airfoil is about complete and will soon be published. The Cierva "autogyro" has been examined and a theory of the machine developed. Several new and interesting features of fluid motion behind various forms of bodies of high resistance have been found. Two models in air and water have been experimentally studied to aid designers in improving the over-all efficiency of their machines. Research on air propellers include observations on a screw in free air for comparison with wind-tunnel tests, and tests of an American air screw to check the validity of the theoretical correction allowed for tunnel interference. A small arm about 4 feet in diameter has been constructed for calibrating the standard pitotstatic tube at speeds ranging from about 20 feet per second downward. In view of the greater steadiness of air flow resulting from the presence of a honeycomb wall, such a wall has been erected in the 7-foot tunnel room.

Seventy-one ships' models were tested in the William Froude national tank in 1927 as compared with 63 in 1926 and 36 in 1925. In the research on the influence of waves on the resistance, propulsion, and pitching of ships, a paper has been prepared giving the data collected in five ships on Atlantic voyages. Experiments on high-speed liners were made in the spring of 1928. In the research on maneuvering, the estimated rudder-turning moments derived from the modern data have been compared with the values measured on a twin-screw ship and on a single-screw ship. A paper has been published on the analysis of screw-propeller efficiency results from models and ships. Thrust measurements on propellers of three ships indicate that actual frictional resistance exceeds that estimated from the model. Models of barges were towed in various "trains" behind a self-propelled tug and the barge forms studied, and a form was developed requiring a towrope force about two-thirds that required for the standard type under the same conditions. Research on the calculation of the wave resistance of three-dimensional forms is progressing, and a second paper on the subject has been published during the year.

PHYSIKALISCH-TECHNISCHE REICHSANSTALT

(Charlottenburg, Germany)

Laboratory of the President.—Glow discharges in the inert gases have been investigated, to which have been added some atoms of aluminum, zinc, cadmium, magnesium, or copper whose arc and first-spark spectra are known over a wide range. The excitation of the

spectra of these foreign atoms is determined by the transformation voltages of the inert gases. The spectra of the atoms indicated are produced in helium by 19.73 volts, in neon by 16.6 volts, and in argon by 11.5 volts. The excitation concerns the neutral atom and, besides, in the positive glow and especially in the negative glow the simple charged ion of the foreign atom.

The luminous phenomena are in consequence of their light intensity applicable to the series analysis, especially of the first-spark spectra. The first-spark spectra of mercury Hg II has been investigated. The term analysis of Carroll in reference to the lowest energy doublets 1^2S–2^2P, 2^2P–2^2S, 2^2P–3^2D was confirmed. The first term 3^2D–4^2F for these, on the other hand, consists of lines 5,677.15 (10), 5,595.34 (1), 5,425.25 (8), and gives an inverted ^2F term. The $D-$, $F-$, and $G-$ term sequences were obtained, from which the values of the terms themselves are established. The ionization potential amounts to 18.672 volts, corresponding to a value of 151,281 cm^{-1} of the lowest ^2S term.

Laboratory for Radioactivity.—The investigations on atom disintegration were continued with stronger polonium preparations and improved research arrangements. The results are in agreement with those of Rutherford and Chadwick and extend theirs in several points. On a series of elements the $K-$ and $L-$ radiation under the influence of alpha-ray bombardments were observed. The excitation conditions for these were carefully studied. It was established that potassium, in addition to the known beta radiation, emits also a hard gamma radiation. The investigations concerning high-altitude radiation of cosmic origin were continued. Tests of radium preparations, radioactive ores, spring waters, etc., increased considerably.

Chemical Laboratory.—From 250 kg of Norwegian minerals—for example, Gadolinite, Kolumbite, and Alvite—about 30 mg of metallic rhenium were first separated. This amount permitted a thorough investigation of those properties which are important from the analytical chemistry standpoint, so that with the financial aid of the firm of Siemens & Halske a gram of the new element was produced from about 3 tons of the minerals.

The Röntgen spectrum of the complete L series of rhenium was photographed and measured.

Seventy-one different kinds of glass were tested as to their reaction to water, both of the surface and of the interior. From an investigation of a large number of unannealed samples of tubing (three hours in boiling-water bath), the following classification according to surface test is recommended:

Hydrolytic classes	Yield of alkali (as Na_2O) in mg/1,000 per square decimeter
1. Water-resistant glass	0 to 50
2. Resistant glasses	50 to 100
3. Harder apparatus glasses	150 to 400
4. Softer apparatus glasses	400 to 1,600
5. Defective apparatus glasses	Over 1,600

Laboratory for Precision Instruments and Acoustics.—The testing included, as heretofore, lead screws, standard threads, calibration rings, micrometers, timepieces, chronographs, etc. A Zeiss pitch tester was procured, also several sets of end gauges. The side-measuring equipment of the laboratory was further improved, and the agreement of the thread measurements according to the various customary methods was brought into narrower limits. For the measurement of tapier-pipe threads up to 700 mm diameter, the apparatus was in part purchased and in part constructed.

The acoustical activities in kind and scope were restricted essentially to the testing of concert-pitch and frequency forks, as well as of forks for musical-tone sequence. The retesting of a concert-pitch fork standardized some 39 years ago in the Reichsanstalt gave, in spite of outwardly apparent wear, still within ± 0.1 vibration of the true vibration frequency. The question of stabilizing of the international concert pitch is delayed because the discussion of this matter at present is being handled by a people's commission.

Cryogenic Laboratory.—The newly built cryogenic laboratory, the machines and laboratories space of which were set up and put in service during 1927, is specially designed for work at the lowest temperatures, such as can be obtained with liquid hydogen and liquid helium. Besides these, liquid air, liquid nitrogen, and liquid oxygen are produced. The helium liquefying plant gives 0.5 liter of liquid helium in 10 minutes and permits temperatures down to 1.2° absolute to be attained. The helium used is obtained in part through separation of a neon-helium mixture from the Linde Co. and in part through purification of helium which the Auer Co. produces by heating Monazite sand to redness. The measurements with aid of liquid helium relate principally to the electrical resistivity and superconductivity of metals as well as to the specific heat of gaseous helium, which is important from the theory of gas degeneration.

Laboratory for Electrical Atomic Research.—Measurements were made on the concentration of atomic hydrogen in the glow discharge whereby at least 90 per cent atoms were found. Further investigations were undertaken on the magnetic susceptibility of gases.

Photochemical Laboratory.—The effect of X rays on photographic plates was investigated in regard to the energy transformation. The

reaction mechanism in connection with the photochemical introduction of halogens in carbohydrates was studied. By means of an X-ray spectrograph of high dispersion many analyses of minerals, alloys, and preparations were carried out. The same apparatus served for photographing the full L series of the new element rhenium.

Principal Workshop.—In the laboratory were constructed, among other things, a variable ionization standard, the mechanical parts of an interference apparatus for the testing of plates, an adjustable rotating sector with five separate adjustable sectors, an air-cooled nickel temperature oven for metal investigations, several tuning-fork standards, several precision condensers of various types, a bolometer, a siren, an apparatus for the measurement of oil films, and a number of standard separation rings.

Division of Weights and Measures.—The division has performed the regular activities assigned to it by the weights and measures law. This is the determination and maintenance of the standards of the division and the supervision of the standards of the testing authorities, the preparation of those regulations for the testing of measuring apparatus which find their expression in decrees and public notices, the admission of new measuring apparatus to test, the testing of measuring apparatus for the building up of metrological science and technology in industry, the preparation of statistics of testing, and the administration of weights and measures ordinances. The outline of a proposed law concerning the testing of flasks was worked out. The preparation of a new edition of test regulations was started; the schedule of test fees was examined with the aim of lowering certain groups of them.

In the laboratory for length measurements there were carried out in great numbers tests and certifications (over 700) for science and technology of line scales, parallel end gauges, spherical end gauges, measuring tapes, and on other apparatus designed for accurate measurement. The preliminary work for providing the test offices with meter bars and tape measures at the standard temperature of 20° were so far advanced that henceforth usable measuring devices of this sort can be produced for the testing authorities. Machines for the measuring of the length of fabric and the length of wire for the retail trade were admitted tentatively; an investigation was made on a leather-measuring machine as to the influence of stretch of the measured goods (especially thin leather) on the indicated measurements.

For use in the interferometric measurement of end gauges the following four krypton lines were selected and measured:

	μ	
Red krypton line	0.64563241	
Yellow krypton line	0.58709463	
Yellow-green krypton line	0.56495924	(principal standard)
Violet krypton line	0.45023790	(measured relative to the first three lines)

These wave lengths are valid at 760 mm air pressure, 20° C., and 10 mm water vapor pressure. Further, the fine structures of the krypton lines were investigated. For determining the ratio of the meter to the yellow-green krypton line a large interference comparator was built. The final measurements with this will be taken up shortly.

In the field of trade scales the sections pertaining to the inspection ordinance and instructions were revised; also the directions concerning loose-weight scales, pendulum scales, and beam scales were extended. Requirements for standard apparatus used in testing of track scales and of crane scales were fixed. New test methods were developed especially for testing the flexure of the levers and platform supports of large scales. In the field of scales for special purposes (automatic scales, scales for putting up equal packages) the test regulations were suited to the needs of commerce. Many requests for admitting new types of scales for calibration were handled in a regular procedure. A general investigation of the properties of varieties of steel used for knife-edges and sockets and of their requirements is in progress. Standardization in the construction of balances was continued.

Further, there were precision tests of numerous analytical weights, and a series of foreign grain testers were brought into agreement with the German primary standard.

Hydrometers were tested, not only for German authorities and firms but also for foreign ones, notably for the Hungarian testing authorities. The testing instructions were revised carrying with it the unification of hydrometer scales. In cooperation with leading groups of the industry standardization was furthered with the object of raising the average quality of apparatus not admitted for test.

Work in the line of test regulations for gas meters, measuring apparatus for liquids, barrels, and flasks related chiefly to high-capacity gas meters and wet gas meters. Besides, a large number of special constructions and new types of gas meters were admitted for test.

The extension of existing regulations for measuring apparatus for liquids, principally for mineral oils, was continued. As heretofore, of greatest importance are the system and construction tests of newly admitted apparatus for benzene and other mineral oils and the preparation of the necessary special instructions for the admission

to test of such measuring devices. The increasing use of metal barrels for beer shipments has increased the routine tests of inspectable barrels. A special law is in preparation for a comprehensive regulation of trade where flask contents are given according to volume.

Division of Electricity and Magnetism.—The resistivity of copper and iron crystals, as well as of drawn iron wire, was measured in the temperature range from 1.3 to 273° absolute. A method was worked out for determining the elastic constants of metals by means of free torsion and transverse vibrations which produce alternate currents, whose frequencies are measured by amplification through superposition on the vibrations of a standard frequency oscillator.

The resistivity, the temperature coefficient, and the thermoelectromotive force of pure cobalt and of Monel metal were determined. Further, through resistivity measurements over a great range of temperature, it was shown that no transformation points exists in aluminum and bismuth.

The vocal quality of sinusoidal sound waves was investigated by means of a photo-electric arrangement in connection with a superposed standard frequency oscillator.

The international frequency measurements with piezooscillators and resonators were carried forward with good results. For amplification of deflections, especially of galvanometers, an apparatus depending upon the bolometer principle was constructed. The secondary losses in nonsynchronous moters were submitted to a careful investigation not only for moters with slip-ring armatures, but also for motors with squirrel-cage armatures.

The compressed-gas condenser developed in the high-voltage laboratory for the highest voltages was improved by means of a new electrostatic guard arrangement and has already been used with success up to 300 kv for dielectric-loss measurement.

A yoke method for the absolute measurement of magnetic steel bars of large cross section, as also a method for measuring the magnetic transformation point (Curie point) with very small field strengths, was worked out. The measurements for deciding the question of the applicability of Poynting's law for materials with hysteresis were advanced. Measurements of the initial permeability of binary and ternary iron-nickel alloys were continued, and further a simultaneous magnetic and metallographic investigation of the so-called Heussler alloys of Al, Cu, and Mn was carried out.

The investigations of magnetostriction were continued on varieties of iron, steel, nickel, cobalt, the alloys of these metals, as also iron-aluminum, iron-silicon, iron-manganese, nickel-copper, nickel-tungsten, and bismuth.

A comparison measurement of the German X-ray dosage unit (Behnken) with the American unit defined in like manner was undertaken by a representative of the Reichsanstalt in America. The agreement, on the average 3 per cent, was satisfactory. From theoretical considerations, as also through tests, it was shown that standardizing of X-ray dosage meters with radium in the manner proposed by Solomon does not give definite results. It was further shown how the method should be modified in order to obtain definite results.

An electrical registering indicator was developed for the torsion dynamometer with air-friction protection developed at the Reichsanshalt. The investigation already begun on oil and bearings was continued with special reference to the range of partial lubrication which lies between the angular velocity of zero and that of the minimum friction.

The testing activity of the division increased, especially in the following fields: Standard cells, phase angle of condensers, condensers and condenser bushings for high voltage, small transformers and relays, as also magnetic investigations of iron, cast iron, and magnet steel.

Division of Heat and Pressure.—The measurements of compressibility of various gases up to pressure of 200 atmospheres begun in the past year were completed and their theoretical consequences evaluated. Later, in connection with some unexpected observational results, further observations of the compressibilities of these gases at pressures between 1.2 and 1.5 atmospheres were begun.

At the request of technical interests with the support of the "Notgemeinschaft der Deutschen Wissenschaft," the temperatures of oxyacetylene flames were measured. The temperature of the hottest part of the flame was found to be 3,100° with reference to the establishment of the legal temperature scale and to international agreement in temperature measurements. Further temperature measurements in the range 650 to 1,100°, as also between −210 and −253°, were completed. Noteworthy success was attained in finding conditions under which the precision of measurements between 650 and 1,100° can be appreciably increased. Accurate measurements of the heats of fusion of the metals have been undertaken.

An investigation of the density of various hydrocarbons at the temperature of liquid hydrogen has made possible interesting conclusions in regard to the relation between densities of mixtures and the densities of their components.

The thermal expansion of bars of various metals, glass, and porcelain were carried down to the temperature of liquid hydrogen and found in good agreement with the requirements of theory.

The thermal conductivity of ice, which is of importance to the refrigeration industry, has been determined between −10 and −120°. This turned out to be four times that of water. The thermal expansion of ice was also investigated down to −220°.

The view so generally accepted in technology that under otherwise similar conditions less heat is transferred to the surface of a tube by superheated steam than by saturated steam was experimentally proved to be incorrect.

After reduction of the comprehensive experimental data obtained in the preceding year on the flow of large volumes of gas, the first reliable relation between the coefficient of flow and the Reynolds number which characterizes the flow was obtained.

The necessary fundamental measurements for extending the range of exact pressure measurements from 1,000 to 2,000 kg/cm² were carried out. In the field of humidity measurements, in order to make it possible to produce standard humidities the vapor pressure of a number of sulphuric acid-water mixtures was determined.

During the year 1927 there were tested 640,558 clinical thermometers, 7,232 other mercury thermometers, 241 instruments for electrical and optical temperature measurements, 478 instruments for pressure measurement, 883 instruments for testing petroleum products, and 98 miscellaneous articles.

Division of Optics.—For facilitating the testing of larger thick plates for parallelism by means of the Haidinger interference rings in reflected light a new interference apparatus has been built, by which also the diameter of one ring can be measured in a simple manner with sufficient accuracy. By means of this simple instrument in polarized light the strains in glass can be quantitatively determined by the magnitude of the double refraction. At present systematic investigations are under way of the characteristics of mirrors of Krupp steel, as also of the excellence of stock steel balls; that is, as to the agreement of the diameters of the different balls of all kinds as well as the sphericity of the individual balls, among which balls of German, American, Swedish, English, and French makers were tested.

For the refraction of quarts between 0.4 and 2.4 μ the constants of the Ketteler equation were determined. Current testing was concerned with saccharimeter quartz plates, polarization apparatus, echelon grating, as well as the widest diversity of optical parts for clarity, strain, planeness, and parallelism.

The investigation of the fine structure of $H\alpha$ was continued. Exposures with two combined silvered Lummer-Gehrcke plates showed differences in the fine structure both normal and across the electrical field of the positive column of the discharge tube. At very small pressures and correspondingly small fields the difference disappears;

also the subordinate components show changes, depending on field direction and field strength. The effect of silvering one side of the Lummer-Gehrcke plates was further investigated. Improvement of the reflection coefficient, also, in the blue part of the spectrum resulted.

With reference to the radiation constant sigma, a slightly higher value was found than the present theoretically most probable one. As regards the rational unit of light intensity, it was attempted to base closed cavity ("black body") light unit on the absolute measurement of total radiation. Work on the Warburg light unit comprised the improvement of the double monochromator, as also the successful development of an electrometric registration method, which permits the very small photo-electrical currents of 10^{-12} amperes, produced by the minute spectral intensities, to be compared with an accuracy of 0.1 per cent, and in like manner is applicable to precision measurements of phosphorescence and ionization processes. Concurrently therewith an equipment was developed for registration of the spherical distribution of light directly in polar coordinates.

Following the official metal-leaf exhibit at Milan, Munich (Deutsches Museum), and at the Berlin Materials Exhibition for scientific and technical purposes, the use of very thin metal films has greatly increased. Many kinds of metal film were produced for the investigation of radioactive materials, cathode rays, X rays, highly sensitive membranes, thermophone films, for acoustical devices, magneto-optical purposes, bimetallic devices, high-voltage and transformer protecting apparatus, and chemical research. There were newly developed the thinnest plane mirror membranes which approximated in planeness the best glass mirrors. In the construction of new micro-thermo elements the development of a new type which exceeds in sensitivity by about four times the vacuum thermoelements of like setting time was successful.

As in the preceding year, a variety of objects for the optical industry were investigated, namely, standard lamps, mirrors, filters, field glasses, objectives, polarization apparatus, quartz plates, and various glass samples, the latter in part for their transparency for infra-red and ultra-violet and in part for their refracting power for light of various wave lengths.

LABORATOIRE D'ESSAIS MECANIQUES, PHYSIQUES, CHIMIQUES ET DE MACHINES

(Paris, France)

The Laboratoire d'Essais Mecaniques, Physiques, Chimiques et de Machines, of the Conservatoire National des Arts et Metiers, is at the present time attached to the Ministry of Public Instruction and of

the Fine Arts (Direction of Technical Education). It is the national testing laboratory of France and is directed by M. J. F. Cellerier.

Technical questions of importance are submitted to a special commission called the technical commission, composed of 28 members selected from scientists and engineers best qualified and presided over by M. Emile Picard, permanent secretary of the Academy of Sciences.

The Laboratoire d'Essais had, in December, 1927, a staff of 193 persons. The diversity of work has led to the formation of five distinct divisions: (1) Physics and the calibration of measuring instruments, (2) metals, (3) structural materials, (4) contrivances, and (5) chemistry.

During the calendar year 1927, 4,072 requests for testing were received, each involving a number of determinations. These comprised 561 physical tests and calibration of instruments, 1,178 tests of metals, 769 tests of materials, 274 tests of machines, and 1,291 chemical tests. The receipts derived from testing comprise receipts direct to the laboratory, 670,533 francs, in 1927; and receipts through the Ministry of Finance, comprising fees for legal calibration of alcoholometers, densimeters, and clinical thermometers, amounting to 1,221,041 francs. The total receipts for work of the laboratory were 1,891,574 francs; expenses for supplies and equipment, as well as personnel, 2,738,016 francs.

Physical Tests and Calibration of Instruments.—Physical tests comprise (*a*) physical tests involving measurements of pressures, thermal constants, optics, metrology, etc. (except electrical tests reserved for the Laboratoire Central d'Electricité), and (*b*) the calibration of measuring instruments—alcoholometers, thermometers, including ebullioscopes, etc.

To the equipment for physical tests, properly so called, have been added a graduated gasometer bell jar of 150 liters capacity designed to collect gases especially from the distillation of combustible materials; an adjusting device, with special manometer, for testing pressures of safety valves of fire extinguishers; a series of densimetric standards for liquids; a portable illuminometer for measuring illumination; equipment for the study of sounds with amplifier tubes and a thermal galvanometer; a special installation for the radioscopic and radiographic study of paintings; an apparatus for measuring the thermal conductivity of refractory materials at high temperatures (up to 1,400° C.); and a machine for measuring the surface of plane and pliable materials, such as pasteboard, cloth, leather, etc.

The technical researches and special tests comprised—

(*a*) The study of a new calorimetric apparatus for determining the coefficient of conductivity of materials intended to heat steam reser-

voirs. The temperatures of the hot face of the samples tested should be about 300° C. only, in order to approximate service conditions. In the apparatus now used in the laboratory the temperature of the hot face of the sample does not exceed 80°.

(*b*) Continuation of the study of sounds produced by warning-signal apparatus, notably automobile horns of various makes.

(*c*) Continuation of the study of pigments, notably those used in oil paintings. These studies have been pursued with the new apparatus recently acquired by the laboratory, upon authentic and retouched paintings.

The equipment for calibrating measuring instruments has been augmented by a certain number of standard instruments and of various devices intended notably to facilitate testing of clinical thermometers in greater numbers than in 1926, as well as thermometers accompanying Luchaire and Luynes-Bordas apparatus.

In 1927 there went into effect ministerial instructions concerning the legal calibration (*a*) of Luchaire apparatus for determining flash points of petroleum and of lubricating oils, (*b*) Luynes-Bordas apparatus for the fractional distillation of heavy combustible mineral oils resulting from the distillation of petroleum, (*c*) thermometers accompanying these.

To the metal-testing equipment was added a small Chevefy dynamometer, equipped with a small graduated rule, for measuring the stretch of rubber and sewing thread; a Chauvin and Arnoux micrometer, for the study of the variations of resistivity in alloys; a set of microscope oculars for a new metallographic bench; and a lighting arrangement for impressions permitting the variation of the angle of incidence of the light in sclerometric tests.

Among technical researches and special tests may be cited a study of the impurities of oils made on a micrographic bench aided by a special lighting arrangement; the application of compounds sensitive to traces of reducing gases to establish a scale of sensibility permitting the evaluation of the impurity contents of samples of metals; the examination of rocks in thin sections obtained by new rapid methods; the determination of the depth of case, as a function of time, of pieces carburized in cyanide of potasssium, by macroscopic examination followed by a microscopic examination of their structure; the micrographic study of large specimens of tungsten, obtained by means of electric-arc fusion in various reducing media, perfected by the study of the influence of alternate thermal and mechanical treatments upon the porosity of the test samples; the examination of duplicate hypereutectoids of steels subjected to various thermal treatments; tests of variations in scratch hardness of metallic coatings as a function of the thickness of the protective

coating and of the hardness of the underlying metal; the study of variations of scratch hardness of artificial gems as a function of their chemical composition and of the method of fusion; micrographs of metallic pieces welded electrically or by chemical means; macrographs of springs broken in service and of pieces of malleable iron; the tensile tests of the strength of special brasses and of nonferrous metals at high and low temperatures.

Tests of Structural Materials.—The equipment for testing structural materials has been increased by (1) a Monnin impact-machine pendulum for testing the resistance of wood to rupture under tangential shock, (2) a small-jaw crusher for crushing stones and hard rocks.

Among the special tests may be mentioned tests upon different magnesia and zinc aggregates for floors without joints; tests of a large number of solid insulating products; experiments upon a special product before being used as a coating to render cement reservoirs impermeable to mineral or heavy oil derivatives (gasoline, petroleum, gas oil, mazout).

Testing of Appliances.—The equipment for testing appliances has been augmented by a gas-heated boiler for tests of hot-water radiators, and the complete installation of an outfit in the laboratory for the test of hot water or steam radiators; various measuring apparatus for testing radiators, such as recording thermometers, etc.; and apparatus for the control of electrical measurements.

An apparatus for determining the coefficient of friction of a curious group for one apparatus to handle has been devised.

In response to numerous requests, methods have been developed for testing heat insulators at temperatures above 300°; an apparatus is in construction.

Chemical Tests.—To the equipment for chemical testing have been added a platinum crucible, a Courtonne incinerating furnace for tests of combustibles, a MacNaught apparatus for testing lubricating oils, a complete outfit for measuring the pH by the potentiometric method, and a Maillard-Dantzer photocolorimeter for the optical analysis of colors.

The researches included a study of the determination of the degree of aging of wood by the pH, establishing a method permitting the evaluation of the dosage of mortars and clays in cement or hydraulic lime which has been approved recently by the technical commission and solves satisfactorily a problem pending for a long time among architects and experts.

Partial Transfer of Activities Into the Suburbs of Paris.—Since its foundation in 1901, the activity of the Laboratorie d'Essais has grown steadily. The number and importance of its tests have

augmented without cessation. Its divers activities are at present closely crowded in the allotted space of the Conservatoire National des Arts et Metiers, which accommodates also the celebrated Musée des Arts et Metiers and numerous professorships.

To permit this establishment to develop as it should, an effort has been made, as for the great foreign national laboratories, to move its various laboratories into the suburbs. With this object, large tracts have been acquired in Colombes, near Paris. Modern chemical laboratories, which are already built there, have been furnished and will house chemical testing during 1928. Plans are made for the successive installation on these tracts of the other laboratories as fast as the budget permits.

LABORATOIRE CENTRAL D'ELECTRICITE

(Paris, France)

The Laboratoire Central D'Electricité during the period since the last Standard Yearbook was issued has grown by the addition of two new buildings, making six in all; and by the addition of 1,100 square meters (11,840 square feet), making 3,000 square meters floor space. The staff has remained the same, and the number of tests for the period have been 1,889.

Accommodations for the study of the electrical units are almost completed, and these researches may be taken up before the end of 1928. The new installation for high-voltage testing is likewise completed. The laboratory at present is in position to make tests at 350,000 volts, either on insulators subjected to artificial rain or on insulators immersed in oil.

In space adjoining the rooms reserved for tests at high voltage there has been installed a Dufour Cathode-ray oscillograph intended to record rapidly varying transitory phenomena.

Among the principal researches carried out during the period are (1) the study of an apparatus intended for measuring high voltages, (2) the perfecting of a new method for the study of magnetic properties of sheet iron at high frequencies, (3) the perfecting of apparatus for the study of diffusing properties of bodies, (4) researches relative to heterochromatic photometry pursued in collaboration with M. Fabry, (5) the continuation of the studies pursued in collaboration with the Paris Gas Co. for the realization of the unit of brightness based upon the properties of the black body, (6) the preservation of the standards of the electrical units. At the September (1927) session of the International Commission of Weights and Measures there was communicated a report by the Central Bureau of Weights and Measures of the Russian Republic, giving a comparison of the electromotive forces of standard cells of the dif-

ferent national laboratories. Taking into account the fact that all the cells of the Laboratoire Central are constructed with mercurous sulphate prepared by alternating-current electrolysis and that they, therefore, give an electromotive force higher by 5 hundred-thousandths of a volt, one finds by applying this correction that the mean electromotive force of the standard cells serving as a base at the Laboratoire Central is lower by 13 microvolts than the cells of the National Physical Laboratory and 6 microvolts below those of the Bureau of Standards.

NATIONAL STANDARDIZING BODIES

In carrying on their standardizing activities the national standards committees or associations in the 20 countries in which such organizations are now functioning follow with more or less modification the method of cooperation developed by the first standardizing body created—the British. The national body does not initiate standardization, but acts only if and when it finds that the groups concerned are desirous of having the work undertaken. In fact, it is only on the request of a representative technical or trade organization, or a Government department, that the association acts, and, even then, before appointing a committee to study any subject it authorizes the holding of a representative conference of all concerned in order to be certain that there is a consensus of opinion favorable to such work being carried out and that it is to fulfill a recognized want. The matter is fully ventilated at such conference, and it is on its report, if favorable, that the association takes definite action by the appointment of what is called a sectional or departmental committee. The sectional committee in some cases represents a whole industry; at other times it is representative of materials.

The national bodies keep in touch with each other by correspondence, exchanging information in regard to new projects, draft standards, and general tendencies in the national work in the respective countries. The information interchanged is arranged in regular form on uniform blanks, all by agreement between the officers of the various bodies. All approved standards are interchanged as a matter of routine, and each national standardizing body acts as a sales agent for the approved standards of the other bodies. The information supplied by the foreign national bodies to the American Standards Association has been used as the basis for the sketches given below.

In the order of their organization the national bodies are as follows: Great Britain, 1901; Holland, 1916; Germany, 1917; United States of America, 1918; Switzerland, 1918; France, 1918 (reorganized in 1926); Belgium, 1919; Canada, 1919; Austria, 1920; Italy,

1921; Japan, 1921; Hungary, 1921; Australia, 1922; Sweden, 1922; Czechoslovakia, 1922; Norway, 1923; Poland, 1924; Finland, 1924; Russia, 1925; and Denmark, 1926.

Brief outlines of the activities and accomplishments of the standards committees or associations in the various countries are given below in alphabetical order, with the exception of those of the American Standards Association, which are presented in Chapter VIII.

Australia.—Australian Commonwealth Engineering Standards Association, W. R. Hebblewhite, general secretary, Macleay House, 16 College Street, Sydney, New South Wales.

During the six years of its existence, up to July 1, 1928, this association published a total of 121 specifications. It now has 127 additional specifications under preparation. Participating in its standardization activities are about 1,200 individuals, members of more than 250 sectional committees and subcommittees.

A summary of the specifications-making activities of the association is given in the accompanying table.

Industrial groups	Published	Approved for issue	In hand	Total
Civil engineering	4		38	42
Mechanical engineering		3	19	22
Electrical engineering	50	2	39	91
Transportation	28			28
Chemical industry	39		8	47
Mining			18	18
Total	121	5	122	248

Before a specification approved by the association can be designated as an Australian standard it must pass through a "tentative" period of 12 months. Recommendations received as a result of its use during this period are given consideration when the specification is advanced to the "standard" stage.

Austria.—Österreichischer Normenausschuss für Industrie und Gewerbe ("O. N. I. G."), Dr. Jaro Tomaides, secretary, Lothringerstrasse 12, Vienna III, Austria.

Since its organization in 1920 as the central agency for standardization in Austria, the Austrian standards committee has prepared 411 standards and specifications, 300 of which have been approved and promulgated. Before being adopted as standard the findings of its subjects committees are given publicity in the periodical "Sparwirtschaft" to invite criticisms.

Standardization activities are classed in six major groups. An indication of the status of the activities in these groups in 1928 is given in the following table.

	Completed	Printed for criticism	Under way	Total
General standardization (Hauspalt, Büroweson)	5		32	37
Building trades	29	44	24	97
Chemical industry	2	13	13	28
Electrical industry	47	4	39	90
Mechanical industry	212	47	40	299
Transportation	5	3	9	17
Total	300	111	157	568

Belgium.—Association Belge de Standardisation, Gustave L. Gérard, general secretary, Max Reichert, secretary, 33 rue Ducale, Brussels, Belgium.

In the accompanying table there is given a summary of the standardization projects undertaken by the Belgian Standards Association since its organization in 1919 and of the standards completed to July 1, 1928.

	Total	Completed
A. Civil engineering	12	3
B. Mechanical engineering	28	18
C. Electrical engineering (Belgian Electrochemical Commission)	17	17
H. Metallurgy	2	1
K. Chemical industry	2	0
M. Mining	1	0
P. Paper industry	1	1
Z. Miscellaneous	3	0
Total	66	40

In addition to the standards indicated in the table, the association has issued 11 publications dealing with general standardization topics. Much attention is being paid by the association to standards and specifications in not only the main engineering and chemical fields, but also to the standardization of the sizes of papers, of technical drawings and documents, of commercial forms, and of packings for export.

Special efforts are exerted by the association officers to induce the members of the association to bring the publications to the attention of the bodies they represent and to encourage the adoption of the standards by the Government departments and public utilities.

Funds are obtained from the Government departments to defray part of the costs of the standardization work in which they are interested. Other expenses of the association, including those for publications and the maintenance of the general office staff of the secretary, are covered by contributions from the bodies represented on the main committee having charge of the standardization programs and from associate members at rates of assessment established at each annual meeting in March.

Canada.—Canadian Engineering Standards Committee, B. Stuart McKenzie, secretary, 178 Queen Street, Ottawa, Canada.

This association acts in an advisory capacity to the British Engineering Standards Association, which, with the British Board of Trade, suggested its organization in 1917 during the World War. Although it follows as closely as practicable the B. E. S. A. standards, its specifications are so drafted as to operate for the best interests of Canadian industry. On account of established business interests, it is found advisable in many cases to follow other standards which have been generally adopted in Canada.

Many of the C. E. S. A. specifications have been adopted by the Dominion Government. It has formulated 23 specifications and has work under way on 24 additional specifications, as shown in the accompanying table.

	Standardization projects			Standardization projects	
	Total	Complete		Total	Complete
A. Civil engineering	19	8	G. Ferrous metals	4	1
B. Mechanical engineering	8	3	M. Mining machinery	1	1
C. Electrical engineering	11	8			
D. Automotive work	3	2	Total	47	23
E. Railway work	1	1			

Czechoslovakia.—Ceskoslovenská Normalisacní Spolecnost, B. Rosenbaum, director, Prague V, Parizska 28, Czechoslovakia.

The standardization of various forms of screw threads was undertaken by this organization in 1924. Additional projects in the mechanical engineering field were inaugurated in 1925, including bolts and nuts; rivets and pins; angle irons; structural steel; cross sections of ribbon, sheet, round, and square iron; and car wheels and tracks. In 1925 standard paper sizes were established. Work on a number of transmission problems was undertaken in 1926.

Up to November, 1927, a total of 25 standards had been adopted, 48 additional standards were in various stages of progress, and 12 more projects were under immediate consideration.

In 1928 the organization issued the following standards: Rails for colliery and field railways, specifications for soft and hard solders, specifications for delivery and testing of steel products, and specifications for steel castings.

Standards of this organization are published in both Czech and German. The association has adopted an official trade-mark for goods manufactured in accordance with its specifications.

Additional information concerning the activities and accomplishments of this organization for the year 1928 is not available.

Denmark.—Den danske Standardiseringskommission, H. E. Glahn, secretary, Industribygningen, Copenhagen B, Denmark.

About one-half of the expenses of the Danish standards committee are borne by the Government, which provided for such expenses when the committee was formally organized in 1926. Of its 22 members, all of which are appointed by the Ministry for Industry, Trade and Shipping, six represent Government departments and the others technical, industrial, and trade bodies.

Since its establishment the committee has approved four Danish standards: Standard diameters (a kind of preferred numbers applying to diameters of shafting, rods, pins, etc.), steel-wire ropes (6 by 19 and 6 by 37 wires), standard reference temperature. About 30 standards are under consideration or have been sent out for public criticism.

Finland.—Finland's Standardiseringskommission, A. Willberg, secretary, Mikaelsgatan 19, Helsingfors, Finland.

In the membership of the central standardization committee of Finland are official representatives of the interested Government departments and various trade associations, technical societies, and engineering colleges.

In the four years of its activities up to September, 1928, the committees had approved 128 standards which are now in use in Finland, and it has under consideration for approval 64 other standards.

The number of approved standards and those under way for each group under which they are classified is given in the following table:

Industrial groups	Approved	Under way	Industrial groups	Approved	Under way
A. General standards		4	N. Agriculture		3
B. Mechanical engineering	120	37	P. Paper	3	2
C. Electrical engineering		9	Z. Miscellaneous	5	5
H. Materials		2			
K. Chemistry		2	Total	128	64

France.—Association Française de Normalisation, R. Girardeau, general secretary, 25 Boulevard Malesherbes, Paris, France.

From 1918 to 1924 standardization work in France was conducted by the Permanent Commission of Standardization, which functioned under the French Minister of Commerce. Its primary purpose was to establish standards for use of the Government. The commission became inactive for several years, and in 1926 the national organizations representing various industries formed the French Standards Association.

Included in its membership is the Mechanical Standardization Committee, which originally functioned as one of the standards-

making bodies of the former Permanent Commission of Standardization. Through this committee the French Standards Association revised and published in 1928 27 dimensional standards relating to screw threads, bolts, nuts, screws, rivets, washers, and cotter pins. Information concerning other French national standardization work for the year 1928 is not available.

Germany.—Reichskuratorium für Wirtschaftlichkeit (R. K. W.) (National Bureau of Economic Improvement), H. Hinnenthal, managing director, 58/59 Luisenstrasse, Berlin N. W. 6, Germany; Reichsausschuss für Leiferbedingungen (R. A. L.) beim R. K. W. (National Committee on Specifications of the R. K. W.), Engineer Gröschler, manager, 58/59 Luisenstrasse, Berlin N. W. 6, Germany; Ausschuss für Wirtschaftliche Fertigung (A. W. F.) beim R. K. W. (Committee for Economic Production of the R. K. W.), Engineer Setzerman, manager, 58/59 Luisenstrasse, Berlin N. W. 6, Germany; Ausschuss für Wirtschaftliche Verwaltung (A. W. V.) beim R. K. W. (Committee on Economical Management of the R. K. W.), Engineer Groschler, manager, 58/59 Luisenstrasse, Berlin N. W. 6, Germany; Deutscher Normenausschuss (D. N. A.) (German Standards Association), Dr. Engineer Hellmich, managing and presiding member, 47 Dorotheenstrasse, Berlin N. W. 7, Germany.

German standardizing activities are carried on by various bodies whose work can all be classed as a part of the "Rationalization" movement. "Rationalization" is to be interpreted as the acquisition and employment of every means which will be conducive to the economic advancement of the country, including standardization of materials and finished products, standard specifications and test methods, improved methods of production and transportation, scientific management, improved office and accounting practice, etc.

The promotion of rationalization is focused mainly in the Reichskuratorium für Wirtschaftlichkeit (R. K. W.) and its three subsidiaries, the Reichsausschuss für Lieferbedingungen (R. A. L.), the Ausschuss für Wirtschaftliche Fertigung (A. W. F.), and the Ausschuss für Wirtschaftliche Verwaltung (A. W. V.), and in a fifth body, the Deutscher Normenausschuss (D. N. A.). This latter body also carries on some of its work under the regulations of the R. K. W.

The Reichskuratorium für Wirtschaftlichkeit (R. K. W.) (National Bureau for Economic Improvement) was first organized in 1921 as the Reichskuratorium für Wirtschaftlichkeit in Industrie und Handwerk, and in 1925 the terms "in Industrie und Handwerk" were dropped. For brevity it is designated as the R. K. W. It has as its main object the promotion of "rationalization" in industry, business, agriculture, household economy, etc. Since 1925 it has

received support through regular grant of funds by the German Government. The Government exercises no direct influence over the disposal of these funds, but places the responsibility for their proper use on the shoulders of the business organizations and corporations from which the membership of the R. K. W. is drawn. The R. K. W. is composed of a directorate, made up of leaders from various classes of business, a finance committee, and the member associations. Its activities are mostly economic. Proposals to have work done are submitted to the directorate and finance committee, who determine whether or not the particular proposition is a rationalization problem whose solution would lead to general economic improvement and be useful in commercial practice. Upon approval, the amount of Government funds that may be allotted and the distribution of these funds among the different parts of the work are determined by the finance committee. The R. K. W. has no direct connection with the actual carrying through of any rationalization proposition. Those business bodies and trade associations which do carry on this work through the R. K. W. are allowed the utmost freedom in the prosecution of the projects but carry the responsibility for their proper completion and are required to report progress to the R. K. W.

The R. K. W. has published 13 pamphlets, referring to different phases of rationalization, 8 of them pertaining to work of its subsidiary committees. It has 11 publications in the course of preparation, of which 10 represent the work of the subsidiaries. It publishes two papers—one, the R. K. W.-Nachrichten, gives information monthly concerning the work being done by the R. K. W., and the other, the Presse-Nachrichten, gives the comments of the press on rationalization every two weeks.

The Reichsausschuss für Lieferbedingungen (R. A. L.) beim R. K. W. (National Committee on Specifications of the R. K. W.), give the short designation of R. A. L., was established in 1925 as a suborganization of the R. K. W. It corresponds roughly to the Federal Specifications Board in the United States. It deals with the preparation of specifications, methods of test, content fixation, dimensions, etc., for raw materials, semifinished and finished products, and commodities. Its work covers the whole of economic life excepting engineering machinery and materials which are, in general, embraced in the work of the Deutscher Normenausschuss (D. N. A.) (German Standards Association). It accomplishes its work through the medium of representatives chosen from producers, wholesalers, retailers, trade, and consumer organizations. When the specifications are considered worthy of promulgation as standards they are given a D. I. N.-R. A. L. designation and number.

This organization has issued specifications and methods of test, and has others in the course of preparation, as follows:

Specifications for—	Issued	In preparation	Specifications for—	Issued	In preparation
Paint materials	6	1	Leather	1	2
Asbestos	1	1	Lime	1	1
Fuels		1	Foods		2
Office supplies		2	Paper		1
Brushes		1	Soap	1	1
Fodder		1	Textiles	13	4
Foundry practice		1	Tools		1
Wood		1	Miscellaneous		1
Ceramic products		1	Total	23	23

The Ausschuss für Wirtschaftliche Fertigung (A. W. F.) beim R. K. W. (Committee for Economic Production of the R. K. W.) was first established in 1918 as a committee of the Society of German Engineers. Later it became a part of the R. K. W., and was given the above designation. Its work is carried on through subcommittees chosen from the various fields of its activities. It deals with improvement in methods of practice that are more or less common to various industries and which directly affect the cost of the product. Subjects dealt with include the rational planning of work; power transmission, such as group or single drive; transportation, including use of new types of vehicles and routing of material, packing regulations, and regulation of work to give a constant unimpeded flow (Fliessarbeit).

This organization has published pamphlets and leaflets and has others in the course of preparation, as follows:

	Issued	In preparation
Motion study	Leaflets and pictures	6
Handwork	1	1
Work planning	1 pamphlet, 3 magazine articles	3
Spray casting	1	
Punching practice	26 leaflets	[1]
Fluidity of work	1	1
Transmission of energy	4 pamphlets, 5 leaflets	4
Tempering		2
Hauling practice	6 pamphlets, 5 leaflets	3
Packing practice	3	
Wood industry		2
Machine work [2]	16 tables	
Forge practice [2]	1	
Other problems (miscellaneous)	14	1

[1] Several leaflets.
[2] Published since this organization was made a part of the R. K. W.

A newspaper, the "A. W. F. Mitteilungen," appears monthly, giving the news of this organization.

The Ausschuss für Wirtschaftliche Verwaltung (A. W. V.) beim R. K. W. (Committee on Economical Management of the R. K. W.) was established as a standing committee of the R. K. W. in 1925. It carries on its work through the medium of committees or associations representing the various industries and deals with the economies of management and distribution. Such subjects as improved accounting practice, use of bookkeeping machines, keeping of statistics on management, structure and interdependability of administrative forces, use of index numbers, standardization of letters, checks, etc., are treated.

This organization has issued publications and has others in the course of preparation, as follows:

	Issued	Work in progress		Issued	Work in progress
Office practice	3	3	Sales practice	6	
Work technique		1	Terminology	7	
Accounting practice	5	2	Business economy	1	2
Purchasing and warehouse practice		1	Bibliography	1	
Banking practice	2	4	Total	25	13

The special and sole purpose of the Deutscher Normenausschuss (D. N. A.) (German Standards Association) is the preparation and promulgation of German standards. Before the World War standardization was carried on to some extent through the medium of appointed committees. The Army gave added stimulus to standardization of materials during the war, and the Konigsliche Fabrikationsburo (Imperial bureau on manufactured products) was organized in 1917 to carry on this work. In order to separate the mechanical products from the other army needs there was founded the "Normalienausschuss für den Maschinenban" (Standardizing Committee for Machine Construction) in the same year. It was soon apparent that proper standardization required the cooperation of the whole of industry rather than one branch of the consuming division, and in December, 1917, the committee was reorganized as the "Normenausschuss der Deutschen Industrie" (Standards Association of the German Industry). In 1926 it was changed to Deutscher Normenausschuss (D. N. A.) (German Standards Association) due to the extension of its activities beyond industry alone.

The German Standards Association (D. N. A.) is a body similar in activity and structure to the American Standards Association in the United States. It is a federation of trade associations, technical

societies, and departments of the Government. Its standardization work is the result of voluntary cooperation of producers, consumers, and distributors, with the active assistance of Government departments and technical societies. It employs two basic methods of developing standards. According to one method proposed standards are developed by committees which are responsible to and report directly to the Standards Association; according to the other, the work is performed by autonomous committees appointed by representative industry groups. All of the standards are subject to approval by the Standards Reviewing Committee of the German Standards Association. Prior to approval they are given publicity for a short time to invite criticism. After approval, the proposed standard is given a D. I. N. designation and number and is published as a standard.

During the last 10 years about 2,200 standards have been issued by this organization and 700 more are in the course of preparation. The greater part of these are dimensional standards which have resulted in the elimination of excess sizes and varieties of numerous commodities. A list of these standards and the present status of current work may be found in the "Normblattverzeichnis" (Standards Catalogue), last issued in April, 1928. Standards are generally published in loose-leaf form, each published standard usually covering certain definite dimensions of a single device or commodity. The number of standards issued must be interpreted in the light of this fact when making comparison with the number issued in other countries.

Where the necessary financial support is not forthcoming from the industry or trade in which a given standardization activity is being carried on, the German Standards Association works under the auspices and support of the R. K. W. (Reichskuratorium für Wirtschaftlichkeit); otherwise it is entirely independent of the latter body.

About 1,800 standards issued by this organization may be classified as follows: General fundamental standards, 26; technical fundamental standards, 190; fittings, 20; auto industry, 9; building trades, 253; mining, 13; railway-car construction, 44; railway practice, 5; electrical engineering, 172; fire-fighting equipment, 17; rolled, drawn, and forged products, 40; foundry practice, 1; elevating machinery, 17; refrigeration, 1; motion technique, 7; power-driven equipment, 136; agriculture, 2; locomotive construction, 263; machine parts, 317; photography, 2; pipe, 58; machine and building materials, 29; transmission, 31; testing machines, 1; tools and gauges, 116; machine tools, 18.

Standards resulting from work with the R. K. W. are as follows:

	Issued	Work still in progress		Issued	Work still in progress
Textiles	6	5	Irrigation and drainage	2	1
Agricultural machinery	10	7	Small gas and water fittings		4
Household utensils	40	3	Piping	1	1
National building practice	9	8	Fittings	3	
Metal industry	2	2	Woodworking machinery	7	2

In addition, work is being prosecuted in the development of standards for trunks, preserving jars, iron freight containers and fastenings, surveying instruments, glass flasks, engineering drawing instruments, Stouffer lubricator, international standard of tolerances, thermometers, sewerage, oven parts, sewing machines, fireproof building material, screw tolerance, iron and steel garden tools, small fittings, and laboratory instruments.

The following books published as "Dinbücher" give a fuller treatment of standardization along certain lines: Dinbuch 2 on threads, Dinbuch 4 on tolerances, Dinbuch 6 on transmission (mechanical power), Dinbuch 8 on drawing standards, Dinbuch 11 on pins and keys.

Great Britain.—British Engineering Standards Association, C. le Maistre, C. B. E., secretary, 26 Victoria Street, Westminster, London, S. W. 1, England. Organized in 1901 as the Engineering Standards Committee by the Institution of Civil Engineers, Institution of Mechanical Engineers, Institution of Naval Architects, Iron and Steel Institute, and Institution of Electrical Engineers, this organization is the oldest national standardizing body in existence.

Under English law in 1918 the committee was incorporated as the British Engineering Standards Association, the constitution and articles of association being approved by the board of trade. A further reorganization is now in process, and the association is making application for what is known as a Royal Charter.

The primary object of this organization is to draw up British standard specifications for materials, machinery, or apparatus. It does not initiate standardization, but acts as the specific request of an authoritative body, such as a representative trade organization, a technical society, or a Government department, and to fill a recognized want.

The work of the association is financed by grants received from the Government, money derived from the sale of its publications, and by funds given by industry. However, the greater proportion of the financial burden is borne by industry itself. Manufacturers

throughout the country send their representatives to attend the meetings and not only contribute directly to the finances of the association, but in many cases prepare drawings and blue prints to assist the work of the technical committees. A conservative estimate of the monetary value of industry's contribution, both direct and indirect, amounts to about 40,000 pounds a year. The association is also supported by the British Indian Government and the colonial governments, as well as by the governments of the overseas dominions.

The association assists the Government in the preparation and coordination of Government specifications for materials, as the Government is desirous in the interests of national economy not only to widen their sources of supply, but to adopt as Government requirements what is best in present industrial practice.

In the electrical industry both national and international standardization has progressed to a greater extent than in the other industries. The B. E. S. A. sectional electrical committee is the British section of the International Electrotechnical Commission.

Great Britain is dependent largely on its export trade, and in order to assist industry the association has appointed local committees consisting of British engineers and traders in various trading centers of the world, more particularly in South Africa, India, the Argentine, Brazil, and Uruguay. In Australia and Canada the national standards organizations act as advisory committees to the B. E. S. A. Through these local committees some of the more important British standard specifications have been translated into French, Spanish, Italian, and Portuguese languages and have been widely disseminated.

The association has provided for the use by commercial firms of an official trade-mark, under conditions and regulations approved by the board of trade. A list of "licensees" authorized to employ the official mark is maintained and is open to public inspection.

The association has issued 335 specifications and reports covering general engineering standardization topics. Of these, 40 were issued either as new or revised specifications during the year 1928 (up to October), and 7 specifications are in the course of revision. In addition, the B. E. S. A. South African local committee has issued 5 standard specifications for use in South Africa.

The table below gives a summary of the number of specifications formulated, together with those being revised under each industrial group.

Industrial group	Specifications completed	Under revision	Industrial group	Specifications completed	Under revision
A. Civil engineering and building trades	27		G. Ferrous metallurgy	11	
B. Mechanical engineering	37		H. Nonferrous metallurgy	30	
C. Electrical engineering	63	3	K. Chemical industry	64	1
D. Automotive (automobile and aircraft)	47	2	M. Mining	8	
E. Transportation	18	1	O. Wood industry	1	
F. Naval architecture and marine engineering	15		Z. Miscellaneous	14	
			Total	335	7

Holland.—Hoofdcommissie voor de Normalisatie in Nederland, J. A. Teyinck, director, The Centraal Normalisatie Bureau, Koningskade 23, The Hague, Holland.

Organized in 1916, the general committee for standardization in the Netherlands is antedated by only one national standardizing body—the British Engineering Standards Association. Its funds are provided by voluntary contributions from departments of the national and local governments, chambers of commerce, various industries, and private firms interested in or participating in its activities.

Prior to being formally approved each proposed standard is published in several trade and technical journals, and consideration is given to criticisms brought forth by this publicity. After being approved the application of the standards is not mandatory, but voluntary in every case. So far as possible the committee makes use of the standards of other countries, and special emphasis is given to the furtherance of international standardization.

In 1928 the Centraal Normalisatie Bureau submitted to the American Marine Standards Committee proposals for international standard glass sizes for fixed lights and air ports, also for mooring bits. These proposals are now being considered by the committee on international standardization of shipbuilding details of the A. M. S. C.

As a result of a movement developed in the Dutch East Indies, upon the initiative of the Indian Section of the Royal Institute of Engineers, provision has been made for establishing a central Indian organization for standardization work. The duty of this organization will be to advise and to report to the general committee in the Netherlands, thus securing the support of Indian interests in the work in an organized way. Subjects that are of a special interest for the East Indies will be treated by the Indian organization, though issued by the general committee in the Netherlands. On questions of an international character, the general committee and the central Indian committee will cooperate as one entire body.

As shown in the accompanying table, the chairman of the general committee reported in July, 1928, that in the 11-year period since standardization work was begun in the Netherlands 276 projects have been completed and 104 had been published in tentative form.

Industrial groups	Approved standards	Tentative standards	Total
Drafting-room practice	44	15	59
Mechanical engineering	93	41	134
Electrical engineering	37	30	67
Marine engineering	52	15	67
Transportation	50	3	53
Total	276	104	380

Hungary.—Magyar Ipari Szabvanyosito Bizottsag, Ed. Gellert, secretary, Realtanoda u. 13–15, Budapest, IV, Hungary.

Although the constitution of the Hungarian Engineering Standards Committee was prepared by a committee appointed by the Hungarian Minister of Commerce, who appoints specially qualified individuals to serve on the council which reviews proposed standards before formally adopted, the standards committee has been functioning as an independent autonomous body since its creation in 1921.

For the purpose of keeping its standards in harmony with the best practice they are renewed at least once a year, and revisions are made if found desirable.

As shown in the accompanying table, the committee has completed 14 standardization projects and has 55 additional projects under way.

	Standardization projects	
	Total	Completed
A. Civil engineering and building industry	9	----------
B. Mechanical engineering	32	----------
C. Electrical engineering	11	11
D. Mining	6	----------
E. Drawing	6	----------
F. Miscellaneous	5	3
Total	69	14

Among the completed standards are 11 which were prepared by the Hungarian Electrotechnical Commission. The other three relate to the sizes of writing and drawing papers.

Italy.—Comitato Generale per l'Unificazione Nell' Industria Meccanica, I. Locatelli, general secretary, Foro Bonaparte 16, Milano, Italy.

At the suggestion of the National Association for Mechanical Industries, the general committee for standardization in the mechanical industry was organized in 1921. Its membership is composed of national associations in the mechanical industry, representatives of Government departments and public administrations, technical and scientific societies, and scientific and commercial men.

The function of the committee is to maintain closer cooperation with organizations and individuals interested in standardization and to approve standards which will be in harmony with technical, industrial, and commercial practice.

Although the work of the committee has been limited to standardization in the mechanical and metallurgical industries, it is now extending its work to include other branches of industry. This is being done without changing substantially its methods and procedure.

The chairmen of the technical committees form the central technical commission, whose duty it is to examine proposals submitted by the various technical committees organized by the general committee and, acting as a coordinating agency, submit the proposals to the general committee for approval or refer them to the technical committees for reconsideration.

Proposed standards approved by the central technical commission are published in the official organ, "L'Industria Meccanica," to elicit comments. Objections received are submitted for examination to the general committee, which is responsible for the final approval of standards.

Decisions of the general committee, the central technical commission, and the technical committees concerning standardization, in order to become effective, must be approved by a three-fourths vote of the members present and by at least two-thirds of the whole membership.

The general committee has approved and published 128 standards dealing with drafting-room practice, tolerances, screw threads, nuts and bolts, and keys. Several of these standards have become mandatory for Government departments and public administrations. It has also under way for final approval 39 other standards relating to metallic materials, machine parts, pipes, etc.

The general committee has appointed two special technical committees to conduct standardization work in the automotive and shipbuilding industries.

A summary of the standardization projects is shown in the following table:

	Standardization projects	
	Completed	Under way
Fundamental technical standards	29	7
Mechanical construction (elements and parts)	43	13
Drafting-room practice	13	
Metallurgical materials		3
Automotive construction		5
Naval construction		5
Electrical materials		2
Tools (mostly measuring)	43	3
Foundry practice		1
Total	128	39

Japan.—Japanese Engineering Standards Committee, H. Katsube, general secretary, care of Bureau of Industry, Department of Commerce and Industry, Tokyo, Japan.

This committee was organized in 1921 under the superintendence of the Minister of Commerce and Industry, who serves as its president. Other members of the committee are official appointees of Government departments. Although the committee functions as a governmental organization for preparing specifications for use primarily by the Government, steps are taken to obtain the suggestions of technical societies, trade associations, and manufacturing firms when the specifications are being prepared, and they are so printed and distributed as to encourage their use by the Japanese industries.

There have been organized four main working committees with 31 subcommittees, namely, metals, with 5 subcommittees; nonmetallic minerals, with 10 subcommittees; electrical machinery and instruments, with 8 subcommittees; and mechanical equipment and supplies, with 8 subcommittees. These committees and subcommittees have held 701 meetings and have undertaken the preparation of 115 standards, 70 of which have been approved as follows:

Industrial groups	Approved	Under way	Total
A. Civil engineering and building trades	8	3	11
B. Mechanical engineering	16	15	31
C. Electrical engineering	5	2	7
E. Transportation		1	1
F. Naval architecture and marine engineering	5	10	15
G. Ferrous metal	15	1	16
H. Nonferrous metal	14	7	21
K. Chemical industry	3	4	7
O. Wood industry	2		2
P. Pulp and paper industry		1	1
Z. Miscellaneous	2	1	3
Total	70	45	115

Norway.—Norges Industriforbunds Standardiseringskomité, Kaare Heiberg, secretary, Drammensveien 4, Oslo, Norway.

The Norwegian Standards Committee, which was organized in October, 1923, on the initiative of the "Norges Industriforbund"

(Federation of Norwegian Industries), consists of 35 members, representatives from Government departments and technical, industrial, and trade associations. The Government and the municipality of Oslo contribute nearly one-third of the financial support for the work, but otherwise the committee functions independent of State control. Its activities are in immediate charge of an engineer appointed by the committee. The various projects are handled by 34 sectional committees having a total membership of about 135. All draft proposals of the committees are published in the periodical Norges Industri.

Up to the end of August, 1928, standards had been approved for the following items: Standard sizes for paper, envelopes, and printed matter; matter planes, materials and advertisement, spaces for periodicals in standard paper size; rules for the execution of technical drawings (paper sizes, lines, letter and cipher types, methods of projecting, symbols for threads); screwed fittings for marine steam condensers; marine rigging screws, marine side lights; standard diameters; rivets for structural and marine purposes, pipe threads; limits and fits for mechanical engineering; cases for export of herrings and other sorts of fish; windows, window-doors, and ordinary doors for residences.

Work was in progress in 1928 on the following items: Building details, such as hardware, stairs, roofing, and bricks; standard building contract; tender inquiry and building specifications; screw threads, bolts, screws, pins, nuts, washers; keys and keyways; shaft diameters, couplings, bearings, pillows, block hangers, belts, and pulleys; pipe and fittings; ship hardware and fittings; specifications and tests for iron and steel; agricultural machinery and implements; packings for agricultural products, such as eggs, fruits, tomatoes, berries, butter, cheese; soil and waste pipes; sewage pipes and fittings; concrete pipes.

Poland.—Polski Komitet Normalizacyjny, A. Roginski, director, Ministerstwo, Przemyslu i Handlu, Elektoralna 2, Warszawa, Poland.

The Polish standardization committee was organized in 1924 by the Secretary of Commerce and Industry to prepare specifications for goods purchased by the State institutions and to assist in establishing manufacturing standards for the industries of Poland. About three-fourths of the expenses of the committee are borne by the Polish Government and one-fourth by industrial organizations.

Fifty-four individuals serve as members of the committee, being official appointees of the following agencies: Secretaries of War, Railroads, Public Works, Agriculture, Commerce and Industry, and Mails and Telegraphs; the Bureau of Measures, the Polytechnic

School of Warsaw, the Polytechnic School of Lemberg, the Academy of Mines, the Academy of Technical Sciences; the Central Association of Industry, Mines, Commerce, and Polish Finances; the Polish Association of the Metal Industry, the Association of the Chemical Industry, the Association of Polish Iron Foundries, the Association of the Textile Industry, the Professional Association of Constructors, the Association of the Mining and Metallurgical Industry of Upper Silesia, the Society of Mechanicians of the Association of Technicians at Warsaw, the Association of Polish Electrotechnicians and the Electrotechnical Committee, the Polish Chemical Society, and the Institute of Scientific Organization.

At the present time 17 committees, containing a total of about 460 persons representing more than 90 associations, firms, colleges, and bureaus, are working on standardization problems, as follows: Metallurgical products, piping, fire-fighting equipment, sanitary service, building materials, machine parts, gauges and tolerances, mechanical equipment, automobiles, boilers, chemical technology, aviation, textiles, leathers, milling, drainage systems, and miscellaneous. Since its organization in 1924 the committee has published 99 standards, largely dimensional. Work is now going forward on 76 standardization projects which can be classified approximately as shown in the accompanying table:

	Standardization projects		Standardization projects
Civil engineering	27	Textiles	5
Mechanical engineering	21	Automobiles	3
Metallurgy	7	Milling	1
Chemical industry	7		
Fuels and lubricants	5	Total	76

For the purpose of giving adequate publicity to proposed standards, reports of the work under way are printed in "Przeglad Techniczny," or Technical Review, in a special section entitled "Wiadomosci Polskiego Komitetu Normalizacyjnego," The Recent Doings of the Polish Committee of Standardization, and in the two technical reviews "Technika Cieplna," Technique of Heat, and "Mechanik Polski," The Polish Mechanician.

The opinions of the interested groups having been given consideration and harmonized by the committees in charge of the standardization projects, the proposed standards are approved by the standardization committee and published, usually in the form of titles of standards.

Russia.—Standards Committee, Council of Labor and Defense, Union of Socialist Soviet Republics, Z. A. Papernoff, secretary, Varvarka 12, Moscow, Union of Socialist Soviet Republics.

Little or no difficulty is encountered in introducing the standards developed by the Russian Standards Committee into the factories throughout the country, because all of the large industrial enterprises belong to the State. As an indication of the interest in the work of the standards committee shown by the industrial men and engineers may be cited the fact that more than 100,000 copies of the standards are sold per month. In addition to publishing its standards, the committee issues a series of pamphlets on standardization and a bulletin which appears regularly every two months.

Since its organization in 1925 the committee has approved and published 335 standards which can be classified somewhat as shown in the accompanying table:

	Standards published		Standards published
Mechanical engineering	75	Leather products	9
Chemical engineering	44	Paper products	9
Metallurgy	37	Rubber products	8
Food products, beverages, etc	29	Glass	5
Textiles	27	Soaps	5
Oils of all kinds	22	Paints	3
Wood products	14	Miscellaneous	24
Civil engineering and building trades	13		
Railway engineering	11	Total	335

In comparing the numbers given in the above table with those reported for other standardizing bodies sight must not be lost of the fact that each of the standards listed covers a relatively small part of what would be listed as a standardization project by certain other bodies. For example, four standards have been issued for castor oil, dealing with this oil for medicinal purposes, for aviation purpose, for technical purposes, and with requirements for packing and testing.

Work is going forward on more than 3,000 standardization items which are being developed by about 100 different committees.

Sweden.—Svenska Industriens Standardizeringskommission, Amos Kruse, general secretary, Malmtorgsgatan 10, Stockholm 16, Sweden.

Although organized in 1922 at the initiative of the Swedish Industrial Association and financed during the first year of its existence without Government aid, since 1924 the Swedish Industrial Standards Committee has been receiving funds from the Government, which now contributes at the rate of 52,000 crowns per year. Moreover, the Government appoints the chairman of the central committee which directs the work of standardization. Members of this committee represent four Government departments, the Swedish Industrial Association; the association of the mechanical, electrical, foundry, shipbuilding, and agricultural industries; the Academy of Science; and the chamber of commerce.

Up to July 1, 1928, the committee had approved a total of 207 standards and had 84 proposed standards in various stages of completion.

A summary of the standardization activities classed in 11 major groups, showing the status in each group, is given in the accompanying table:

Industrial groups	Approved	Under way	Revisions	Total
A. Civil engineering and building industry	2	5	3	10
B. Mechanical engineering	200	53	16	269
C. Electrical engineering	2	14	1	17
F. Shipbuilding		1		1
G. Ferrous metallurgy	1			1
K. Chemical industry		1		1
M. Mining		1		1
N. Agriculture	2	6		8
P. Pulp and paper industry			1	1
R. Glass and pottery		2		2
Z. Miscellaneous		1		1
Total	207	84	21	312

Switzerland.—Schweizerische Normalien-Vereinigung, H. Zollinger, secretary, Badstrasse 47, Baden, Switzerland.

The Swiss Standards Association, created in 1918, now represents the cooperative activities of about 30 national organizations engaged in various phases of standardization work. The standards bureau of the Swiss mechanical industries serves as a clearing house for these activities. Its publications are printed in both French and German.

Standards thus far issued cover such items as pipe sizes, pipe threads, pipe fittings, wood screws, machine screws, nuts, bolts, rivets, locks, drills, circular saws, pressure gauges, vacuum gauges, standard diameters, and a standard gauging system.

Considerable work has also been done on the standardization of drawings, building materials, numerous machine elements, thermometers, valves, hand tools, machine tools, pulleys, steel, iron, and other metals.

Information concerning the activities and accomplishments of this association for the year 1928 is not available.

United States of America.—American Standards Association, P. G. Agnew, secretary, 29 West Thirty-ninth Street, New York, N. Y. (See Chapter VII, p. 255.)

V. FEDERAL STANDARDIZING AGENCIES

(Executive Departments)

DEPARTMENT OF AGRICULTURE

BUREAU OF AGRICULTURAL ECONOMICS

Since the issue of the Standards Yearbook for 1928, standards have been issued as follows:

Canned foods:
- Canned corn.
- Canned peas.
- Canned tomatoes.

Cotton linters: For color.

Fruits and vegetables:
- Apricots.
- Garlic.
- Honeydew and honeyball melons.

Livestock:
- Slaughter cattle.
- Vealers and slaughter calves.

Meats:
- Fresh and frozen carcass beef.
- Calf and veal carcasses.

Poultry: Dressed and live.

The second standard container act was signed May 21, 1928. Under this law hampers, round-stave baskets, and splint or market baskets are to be used only in specified types and sizes. The Bureau of Agricultural Economics will administer this law, as it has the earlier standard container act.

BUREAU OF CHEMISTRY AND SOILS

A study of the proteins of the wheat kernel in the Bureau of Chemistry and Soils led to the suggestion of using new factors for calculating the percentage of protein in wheat and various parts of the wheat kernel from their nitrogen content. At the meeting of the Association of Official Agricultural Chemists in October, 1927, in the report of subcommittee C on recommendations of referees, the following recommendation was approved:

CEREAL FOODS—*Flour.*—(18) That the factors for the conversion of the percentages of nitrogen into terms of protein in wheat, wheat bran, wheat endosperm, and wheat embryo, as suggested by Jones (Cereal Chemistry, 1926, 3:194), be adopted.

Current Activities.—Among the subjects under present consideration are definitions and standards for ice cream, mayonnaise dressing, whole-wheat flour, whole wheat and graham bread, edible corn products, and the revision of such existing standards as may be required.

Accomplishments.—During the 12 months ending September 1, 1928, definitions and standards were promulgated for purified middlings (wheat), semolina, farina, pasteurized-blended cheese, emulsified cheese, and revised definitions issued for tea and for sage.

Service and regulatory announcements, food and drug No. 2, and supplements Nos. 1 and 2, issued December, 1927, which include the above definitions, and those previously adopted, are as follows:

ANIMAL PRODUCTS

MEATS AND THE PRINCIPAL MEAT PRODUCTS

Meats.—Flesh, meat, fresh meat, beef, veal, mutton, lamb, pork, venison.

Meat By-Products.—Prepared Meats: Prepared meat, cured meat, dry salt meat, corned meat, sweet pickled meat, dried meat, smoked meat, canned meat, hamburg steak, potted meat, sausage meat.

Meat Food Products.—Meat food products, meat loaf, pork sausage, brawn, headcheese, souse, scrapple.

Lard.—Lard, leaf lard, neutral lard.

MILK AND MILK PRODUCTS

Milks.—Milk, pasteurized milk, homogenized milk, skimmed milk, buttermilk, cultured buttermilk, goat's milk, ewe's milk, etc; evaporated milk, sweetened condensed milk, evaporated skimmed milk, sweetened condensed skimmed milk, dried milk, dried skimmed milk, malted milk.

Cream.—Cream, sweet cream, whipping cream, homogenized cream, evaporated cream, clotted cream.

Milk Fat or Butterfat.—Butter.

Cheese.—Cheese, cheddar cheese, American cheese, American cheddar cheese, whole milk cheese, partly skimmed milk cheese, skimmed milk cheese.

Whole Milk Cheese.—Cheddar cheese, American cheese, American cheddar cheese, stirred curd cheese, sweet curd cheese, pineapple cheese, limburger cheese, brick cheese, stilton cheese, gouda cheese, Neufchatel cheese, cream cheese, Roquefort cheese, gorgonzola cheese.

Whole Milk or Partly Skimmed Milk Cheese.—Edam cheese, Emmenthaler cheese, Swiss cheese, Camembert cheese, Brie cheese, Parmesan cheese.

Skimmed Milk Cheese.—Cottage cheese, schmierkase.

Whey Cheese.—Ricotta, Zieger, Primost, Mysost.

Ice Cream.—Ice cream, fruit ice cream, nut ice cream.

Miscellaneous Milk Products.—Whey.

VEGETABLE PRODUCTS

GRAIN PRODUCTS

Grains and Meals.—Grain, rice (*Oryza sativa* L.), brown rice, polished rice, meal, graham flour, maize meal, corn meal, Indian corn meal, oatmeal, flour, gluten flour, ground gluten, buckwheat flour, rye flour.

Breads.—Bread, wheat bread dough, white bread dough, wheat bread, white bread, milk bread, rye bread, raisin bread, brown bread, Boston brown bread.

Alimentary Pastes.—Alimentary pastes, plain alimentary pastes, egg alimentary pastes, noodles, egg noodles, water noodles, macaroni, spaghetti, vermicelli, semolina macaroni, semolina spaghetti, semolina vermicelli.

FRUIT AND VEGETABLES

Fruit and Fruit Products.[1]—Fruit, fresh fruit.

Citrus Fruits.—Grapefruit, pomelo (*Citrus grandis* Osbeck); orange (common, sweet, or round) (*C. sinensis* Osbeck).

Dried Fruit.—Sun dried, evaporated, and dehydrated.

Evaporated apples, cold-pack fruit, canned fruit, preserve, fruit preserve, jam, fruit jam.

Glucose fruit preserve, corn sirup fruit preserve, glucose fruit jam, corn sirup fruit jam.

Fruit butter, glucose fruit butter, corn sirup fruit butter.

Jelly, fruit jelly, glucose fruit jelly, corn sirup fruit jelly, citrus fruit marmalade.

Nut and Fruit Kernel Products.—Almond paste, kernel pastes.

Vegetables and Vegetable Products.—Vegetables, dried vegetables, canned vegetables, canned peas (*Pisun sativum*); canned pea varieties—early peas, sugar peas, sweet peas,; canned pea sizes; pickles, salt pickles, sweet pickles, sauerkraut, catchup (ketchup, catsup).

SUGARS AND RELATED SUBSTANCES

Sugar and Sugar Products.—Sugars.—Sugar, granulated, loaf, cut, milled, and powdered sugars; maple sugar, maple concrete; massecuite, melada, mush sugar and concrete.

Molasses and Refiners' Sirup.—Molasses, refiners' sirup, treacle.

Sirups.—Sirup, sugar-cane sirup, sorghum sirup, maple sirup, sugar sirup.

Glucose Products.—Starch sugar, glucose, mixing glucose, confectioner's glucose.

Candy.—Candy.

Honey.—Honey, comb honey, extracted honey, strained honey.

CONDIMENTS (OTHER THAN WINES, VINEGARS, AND SALT)

Spices.—Spices, allspice, pimento, anise, aniseed, bay leaves, capers, caraway, caraway seed, cardamom, cardamom seed, red pepper, Cayenne pepper, Cayenne, paprika, Hungarian paprika, rosenpaprika, rosapaprika, rose paprika, koenigspaprika, king's paprika, pimenton, pimento, Spanish paprika, celery seed, cinnamon, Ceylon cinnamon, Saigon cinnamon, cassia, ground cinnamon, ground cassia, cloves, coriander seed, cumin seed, curcuma, turmeric, dill seed, fennel seed, ginger, Jamaica ginger, limed ginger, bleached ginger, horse-radish, prepared horse-radish, mace, Macassar mace, Papua mace, marjoram, leaf marjoram, mustard seed, *Sinapis alba* (white mustard), *Brassica nigra* (black mustard), ground mustard seed, mustard meal, mustard cake, mustard flour, ground mustard, mustard, prepared mustard, nutmeg, Macassar nutmeg, Papua nutmeg, Male nutmeg, long nutmeg, paradise seed, grains of paradise, Guinea grains, melegueta pepper, parsley leaves, black pepper, ground black pepper, long pepper, white pepper, saffron, sage, savory, star aniseed, tarragon, thyme.

[1] Except fruit juices (fresh, sweet, and fermented) and vinegars.

Flavoring Extracts.—Flavoring extract, almond extract, oil of bitter almonds, anise extract, oil of anise, celery seed extract, oil of celery seed, cassia extract, oil of cassia, cinnamon extract, oil of cinnamon, clove extract, oil of cloves, ginger extract, lemon extract, oil of lemon, terpeneless extract of lemon, terpeneless oil of lemon, nutmeg extract, oil of nutmeg, orange extract, oil of orange, terpeneless extract of orange, terpeneless oil of orange, peppermint extract, peppermint, oil of peppermint, rose extract, attar of roses, savory extract, oil of savory, spearmint extract, spearmint, oil of spearmint, star anise extract, oil of star anise, sweet basil extract, sweet basil, basil, oil of sweet basil, sweet marjoram extract, oil of marjoram, thyme extract, oil of thyme, tonka extract, tonka bean, vanilla extract, vanilla bean, wintergreen extract, oil of wintergreen.

Edible Vegetable Oils and Fats.—Edible fats and edible oils, cacao butter, cocoa butter, coconut oil, copra oil, cochin oil, Ceylon oil, corn oil, maize oil, cottonseed oil, olive oil, sweet oil, palm kernel oil, peanut oil, arachis oil, earthnut oil, poppy seed oil, rapeseed oil, rape oil, colza oil, soy-bean oil, soy oil, Soja oil, sesame oil, gingilli oil, teel oil, benne oil, sunflower.

TEA, COFFEE, AND CACAO PRODUCTS

Tea.

Coffee, roasted coffee.

Cacao Products.—Cacao beans, cocoa beans, cacao nibs, cocoa nibs, chocolate, plain chocolate, bitter chocolate, chocolate liquor, chocolate paste, bitter chocolate coating, sweet chocolate, sweet chocolate coating, milk chocolate, sweet milk chocolate, cocoa, powdered cocoa, breakfast cocoa, sweet cocoa, sweetened cocoa, sweet milk cocoa, Dutch process chocolate, "alkalized chocolate," Dutch process cocoa, "alkalized cocoa."

BEVERAGES

Fruit Juices.—(Schedule to be prepared.)

Carbonated Beverages and Beverage Flavors.—Ginger ale, ginger-ale flavor, ginger ale concentrate, sarsparilla, sarsparilla flavor.

Wines.—Wine dry wine, fortified dry wine, sweet wine, fortified sweet wine, sparkling wine, modified wine, ameliorated wine, corrected wine.

Vinegar.—Vinegar, cider vinegar, apple vinegar, wine vinegar, grape vinegar, malt vinegar, sugar vinegar, glucose vinegar, spirit vinegar, distilled vinegar, grain vinegar.

Salt.—Table salt, dairy salt.

Baking Power.—Baking powder.

(Food and Drug No. 2, Supplement No. 1)

AMENDMENTS TO DEFINITIONS AND STANDARDS FOR FOOD PRODUCTS

The definition and standard for sage (S. R. A., F. D. No. 2, p. 15) and for tea (S. R. A., F. D. No. 2, p. 18) are hereby revised and amended to read as follows:

Sage.—47. Sage is the dried leaf of *Salvia officinalis* L. It contains not more than 12 per cent of stems (excluding petioles) and other foreign material.

Tea.—1. Tea is the tender leaves, leaf buds, and tender internodes of different varieties of *Thea sinensis* L., prepared and cured by recognized methods of manufacture. It conforms in variety and place of production to the name it

bears; contains not less than 4 per cent nor more than 7 per cent of ash; and meets the provisions of the act of Congress approved March 2, 1897, as amended, regulating the importation and inspection of tea.

Approved December 27, 1927.

W. M. JARDINE,
Secretary of Agriculture.

(Food and Drug No. 2, Supplement No. 2)

AMENDMENTS TO DEFINITIONS AND STANDARDS FOR FOOD PRODUCTS

The following definitions and standards for purified middlings, semolina, and farina (S. R. A., F. D. No. 2, p. 8) are hereby adopted:

VEGETABLE PRODUCTS

Grain Products

Grains and Meals.—12. Purified middlings is the clean, sound, granular product obtained in the commercial process of milling wheat and is that portion of the endosperm retained on 10 XX silk bolting cloth. It contains no more flour than is consistent with good commercial practice, nor more than 15 per cent of moisture.

13. Semolina is the purified middlings of durum wheat.

14. Farina is the purified middlings of hard wheat other than durum.

Approved June 27, 1928.

W. M. JARDINE,
Secretary of Agriculture.

The following definitions and standards for pasteurized cheese, pasteurized-blended cheese, and emulsified cheese, "process cheese" (S. R. A., F. D. No. 2, p. 7), are hereby adopted:

I. ANIMAL PRODUCTS

Milk and Milk Products

Cheese.—PASTEURIZED CHEESE AND EMULSIFIED CHEESE.—Pasteurized cheese, pasteurized-blended cheese, is the clean, sound, pasteurized product made by comminuting and mixing, with the aid of heat and water, one or more lots of cheese into a homogeneous, plastic mass. The name "pasteurized cheese," "pasteurized-blended cheese," unqualified, is understood to mean pasteurized Cheddar cheese, pasteurized-blended Cheddar cheese, and applies to a product which conforms to the standard for Cheddar cheese. Pasteurized cheese, pasteurized-blended cheese, bearing a varietal name, is made from cheese of the variety indicated by the name, and conforms to the limits for fat and moisture for cheese of that variety.

Emulsified cheese, "process cheese," is the modified cheese made by comminuting and mixing one or more lots of cheese into a homogeneos, plastic mass, with the aid of heat, with or without the addition of water, and with the incorporation of not more than 3 per cent of a suitable emulsifying agent. The name "emulsified cheese," "process cheese," unqualified, is understood to mean Cheddar cheese, pasteurized-blended Cheddar cheese, and applies to a product which contains not more than 40 per cent of water and, in the water-free sub-

stance, not less than 50 per cent of milk fat. Emulsified cheese, process cheese, qualified by a varietal name, is made from cheese of the variety indicated by the name and conforms to the limits for fat and moisture for cheese of that variety.

Approved July 21, 1928.

C. F. MARVIN,
Acting Secretary of Agriculture.

TEA STANDARDS

The United States Board of Tea Experts

Current Activities.—While it is true that the tea board serves for one year, and can be consulted at any time by the Secretary of Agriculture, normally its activities cease after the standards are selected and fixed by the secretary.

Accomplishments in 1928.—At the 1928 meeting the tea board selected seven standards, as follows:

Formosa Oolong (used for Foochow and Canton Ooling).
Congou.
Java (used for all fully fermented East India teas).
Gunpowder, green (used for all China green tea).
Japan.
Scented Orange Pekoe (used for capers).
Scented Canton.

PHYSICAL STANDARDS FOR TEA FOR THE NAVY, MARINE CORPS, AND DEPARTMENT OF JUSTICE

The supervising tea examiner at Washington and the New York tea examiner, both of this administration, constitute a committee that establishes standards of quality for the United States Navy which are used in purchasing all teas for issue purposes by the Navy at the Brooklyn Navy Yard and elsewhere in the United States.

The supervising tea examiner of this administration fixes tea standards for the United States Marine Corps and the Department of Justice, which standards are used in purchasing all teas for issue purposes for the Marine Corps and for all prisons under the Department of Justice.

COFFEE STANDARDS

Although the Food, Drug, and Insecticide Administration examines all bid samples and checks up on deliveries of practically all coffees purchased by the various departments of the Government, in only one case is a physical or objective standard established, and that is in the case of the Veterans' Bureau. The Veterans' Bureau has a definite physical standard to be used in purchasing all coffees for the various veterans' hospitals in the United States. The fixing of these standards and the testing of the samples are attended to by the food-control laboratory and the tea-control laboratory of this administration.

TEA-CONTAINER PROJECT

The tea-control laboratory of this administration is carrying on a research project testing out the keeping quality of tea in more than 100 types of tea containers.

STANDARDS FOR NAVAL STORES

The standards for rosin include the various grades of rosin, from highest to lowest, designated by the following letters, respectively: X, WW, WG, N, M, K, I, G, FF, F, E, D, and B, together with the designation "gum rosin" or "wood rosin," as the case may be. The standards for turpentine include "gum spirits of turpentine," "steam distilled wood turpentine," and "destructively distilled wood turpentine."

Current Activities.—At the present time the Food, Drug, and Insecticide Administration is studying the color composition of wood rosins and considering the desirability of standards for wood rosin separate and distinct from those for gum rosin. It is also working on permanent color types for turpentines.

STANDARD FOR FF ROSIN ESTABLISHED BY THE SECRETARY OF AGRICULTURE

The Secretary of Agriculture on December 31, 1927, established a new standard, effective April 1, 1928, for rosin redder in color than is covered by previous standards. The new grade is "FF rosin" and applies to rosin which, because of the redder color, can not be graded under the other United States standards. The standard for FF rosin is the type which has been prepared by the Secretary and designated "FF." The grade of the rosin shall also be determined by designating it as "gum rosin" or "wood rosin," as the case may be.

August 12, 1925.

AMENDMENT TO REGULATIONS FOR THE ENFORCEMENT OF THE NAVAL STORES ACT

Regulation 15 of the regulations for the enforcement of the naval stores act is hereby amended, effective August 15, 1925, by the addition of a new paragraph (*g*) to read as follows:

(*g*) A compound containing spirits of turpentine or rosin, or both, when sold for medicinal purposes is not deemed to be subject to the provisions of the naval stores act but is subject to the provisions of the Federal food and drugs act.

W. M. Jardine,
Secretary of Agriculture.

Washington, D. C., *August 3, 1925.*

February, 1926.

NOTICE OF ESTABLISHMENT AND PROMULGATION OF A STANDARD FOR OPAQUE ROSIN

Pursuant to the authority vested in the Secretary of Agrciulture by section 3 of the naval stores act, approved March 3, 1923 (42 Stat. 1436), and after three months' notice of the proposed standard having been given to the trade, as far as practicable, and due hearings and reasonable opportunity to be heard having been afforded those favoring or opposing the same, I, W. M. Jardine, do hereby establish, promulgate, and give public notice of the United States standard for opaque rosin, effective May 15, 1926.

UNITED STATES STANDARD FOR OPAQUE ROSIN

Opaque Rosin is rosin which because of its turbid, murky, or cloudy appearance, can not be graded under the other United States standards. The grade of such rosin shall be designated by the letters "OP," together with the designation "gum rosin" or "wood rosin," as the case may be.

In testimony whereof I have hereunto set my hand and caused the official seal of the Department of Agriculture to be affixed, in the District of Columbia, this 2d day of February, 1926.

W. M. Jardine,
Secretary of Agriculture.

FOOD, DRUG, AND INSECTICIDE ADMINISTRATION RULES ON ACCURACY OF HYPODERMIC TABLETS.

The degree of accuracy with which hypodermic tablets should comply with their declared compositions was outlined in a ruling under the Federal food and drugs act, issued October 22, 1925, by the Bureau of Chemistry, United States Department of Agriculture.

Within the last few years the Bureau of Chemistry, in the enforcement of the food and drugs act, has given particular attention to medicinal tablets, especially the more commonly used hypodermic tablets. The data thus collected show that most tablets on the market comply reasonably well with the compositions declared. A material number, however, were found to vary from the stated compositions by amounts in excess of what should be expected under properly controlled conditions of manufacture.

These preparations are of prime importance medicinally. They are manufactured from physiologically potent substances and constitute the chief dependence of the physician in emergencies. The physical characteristics of a hypodermic tablet usually furnish no information as to its quantitative composition. Physicians, druggists, and patients must rely upon the label. Serious consequences may follow any misstatement.

The Bureau of Chemistry will regard as adulterated or misbranded, or both, those hypodermic tablets which fail to comply with declared compositions to an extent greater than occurs in such tablets manufactured under properly controlled processes. In ascertaining the degree of accuracy practicable, careful consideration will be given to the conclusions of committees representing the drug-manufacturing industry which have studied this question thoroughly and have presented a comprehensive report to the Bureau of Chemistry. These committees have suggested the maximum variations, either above or below the labeled or claimed amounts (including all tolerances), which in their opinion should be permitted in tablets manufactured under properly controlled processes. They are as follows:

	Per cent
Atropine sulphate hypodermic tablets purporting to contain ¼ gr. or more	7.5
Atropine sulphate hypodermic tablets purporting to contain less than ¼ gr	9.0
Cocaine hydrochloride hypodermic tablets	9.0
Codeine sulphate hypodermic tablets	9.0
Morphine sulphate hypodermic tablets	7.5
Strychnine sulphate hypodermic tablets purporting to contain ¼ gr. or more	7.5
Strychnine sulphate hypodermic tablets purporting to contain less than ¼ gr	9.0
Strychnine nitrate hypodermic tablets purporting to contain ¼ gr. or more	7.5
Strychnine nitrate hypodermic tablets purporting to contain less than ¼ gr	9.0

METHODS OF ANALYSIS RECOMMENDED BY COMMITTEES REPRESENTING THE INDUSTRY

The committees representing the manufacturing industry have recommended methods of analysis of the products mentioned above. The details of these methods are too voluminous to reproduce here but are obtainable on application to the Food, Drug, and Insecticide Administration, Department of Agriculture, Washington, D. C.

OFFICE OF EXPERIMENT STATIONS

The American Society of Agricultural Engineers, through its Standardization Committee, adopted certain standards relating to farm machinery during the year, which were incidentally drawn to our attention for criticism. Information relating to these may be secured by communicating with the secretary of that society, Raymond Olney, St. Joseph, Mich.

FOREST SERVICE

Since the issue of the 1928 Standards Yearbook, the Forest Service has collaborated with the following activities:

American Chemical Society—ALPHA CELLULOSE COMMITTEE.—This subcommittee of the standard cellulose committee developed a standard method for the determination of alpha cellulose which was accepted by the standard cellulose committee. A number of the laboratory is chairman of this subcommittee.

Federal Specification Board—SHIPPING CONTAINER COMMITTEE.—Master specifications were prepared for wooden boxes, nailed and lock-corner construction, cleated plywood boxes, solid fiber and corrugated fiber boxes.

GLUE COMMITTEE.—This committee, of which a laboratory representative is chairman, has practically completed master specifications for animal glue which will be submitted to the board for approval. Preliminary work on specifications for casein and liquid glues has also been completed.

Technical Association of the Pulp and Paper Industry—PAPER BOARD COMMITTEE.—A member of the Forest Products Laboratory is chairman of this newly organized committee, which is formulating a program dealing with such matters as use requirements in relation to the physical properties of the finished sheet, the use of waste papers, and the operation of the cylinder machine.

At the request of the National Wood Chemical Association the laboratory developed specifications for hardwood tar oil which were accepted by the association as standard for the organization.

BUREAU OF PLANT INDUSTRY

(Work of the Seed Laboratory)

The seed laboratory, through its representation on the rules committee of the Association of Official Seed Analysts of North America, assisted in the making of rules for seed analysis which have been adopted by that association. The laboratory also has representation on the important committees of the International Seed Testing Association. The object of this association is the unification of the results of seed analyses as made in the countries of the world to facilitate the international trade in agricultural seeds.

BUREAU OF PUBLIC ROADS

Work has been carried on during the past year relative to the standardization of methods for testing highway materials through membership on various national technical organizations, especially those of the American Association of State Highway Officials and the American Society for Testing Materials.

During the past year a representative of the bureau was appointed to membership on the International Committee on Nomenclature and Standardization of Tests of the Association of the Permanent International Road Congresses, and cooperative work is being carried on at the present with this committee.

The subgrade soil investigations, which it is hoped will lead to the standardization of methods of evaluating soil properties as they relate to roads, have been continued actively.

Cooperative committee work has been carried on with the Committee on Bridges of the American Association of State Highway Officials and of the American Railway Engineering Association for the purpose of standardizing specifications for highway bridges.

DEPARTMENT OF COMMERCE

BUREAU OF THE CENSUS

Standardization of Criminal Statistics.—Statistics of crime and criminals in the United States are very inadequate, largely because they are not compiled on a uniform basis. In connection with the annual census of prisoners, which was recently inaugurated, the Census Bureau has issued a printed manual of 64 pages entitled "Instructions for Compiling Criminal Statistics." This booklet, which was prepared with the cooperation of the American Institute of Criminal Law and Criminology, outlines a number of proposed standard forms of statistical tables for the use of penal institutions, police departments, courts, prosecutors, and parole and probation agencies. Procedures are suggested for compiling the proposed data.

A standard record card for the use of prisons and reformatories is illustrated in this manual and has also been reprinted in quantity for sale to institutions which adopted the record card. This card has been officially adopted by the State departments of correction in New York and Massachusetts and by a number of institutions in other States. An important feature of this manual is the standard list of offenses, which classifies a large variety of offenses under 19 principal groups, such as homicide, robbery, burglary, and larceny.

Standardization of Statistics of Mental Patients, Feeble-Minded, and Epileptics.—In connection with the 1923 decennial census of institutions, and also in the annual census, the Census Bureau has adopted the standard classification of psychoses, or types of mental disease, developed by the American Psychiatric Association and the National Committee for Mental Hygiene. Similarly, the bureau has adopted the classifications of feeble-minded and of epileptics which are approved by the National Committee for Mental Hygiene,

and the professional organizations concerned with mental defect and epilepsy. Certain census schedules have also been patterned after the statistical forms developed under auspices of the national committee.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

During the year five standard specifications for iron and steel products were published in the Portuguese group of industrial-standards series and distributed abroad. One new standard was added to the Spanish group, and eight revisions were published covering amendments and changes approved in 1927 and 1928.

In the development of leather raw-stock standardization, a plan has been agreed upon by the leather industry, in collaboration with the bureau, for setting standards in the quality, weight, and trim of calf leather and for fixing uniform nomenclature in the calf-leather trade.

A representative of the bureau is chairman of the technical committee on textiles, Federal Specification Board. This committee developed specifications for several types of carpets and rugs, for window-shade cloth, percale, and drill, all of which have been promulgated. Some 25 additional specifications for textile products are now in final stages of development. With their final promulgation as standards, the work of the committee will be completed except for routine revisions.

To assist in the elimination of waste in distribution, the domestic commerce division has undertaken a national commercial survey, a series of distribution-cost studies, a national retail-credit survey, industry surveys, and related projects. The commercial-survey program will be conducted ultimately in each of the nine regions. To date the results of the Southeast survey have been published, the New England survey is going to print, and field work on the Pacific Southwest has been completed. These surveys outline logical trading areas and describe market factors within each area so as to simplify distribution efforts by eliminating unnecessary or wasteful practices.

These cost studies are designed to simplify stocks, customer accounts, and costs. In applying the results of one study, a hardware wholesaler simplified his inventory from 12,000 to 6,500 items, lopped off a third of his trading territory, dropped one-half of his customer accounts, and, while decreasing his sales one third, increased his net profits 35 per cent.

The national retail-credit survey aims to provide a basis for standardization of credit practices. Some concern has been expressed as to the extent to which consumers may have mortgaged their future

incomes by installment or other credit purchases. It is claimed by those in touch with the situation that the lack of comprehensive and reliable information on retail-credit practices may be placing a burden on both retailer and consumer. These and other angles of the problems will be considered in the survey.

The industrial surveys of the domestic commerce division investigate production capacity (equipment and personnel) and distribution facilities and practices with a view to coordinating supply and demand as far as the industry's products are concerned. The object is to simplify production schedules and to eliminate complaints of "overproduction."

Representatives of the bureau participated in a number of national and international conferences where uniformity and stadardization were major items of agenda. Notable among these was the Sixth International Conference of American States at Habana, Cuba, in January and February. Recommendations were passed there dealing with uniformity of statistics, legal regulations and procedure, traffic laws, and sanitation, as well as with standard practices and simplification in a number of fields.

BUREAU OF LIGHTHOUSES

Improvements in Apparatus and Equipment.—The improvement of radiobeacon installations by providing electron tube transmitters in place of the spark apparatus originally used is proceeding. The modification of present installations by reserving the high-power 500-watt transmitters for certain primary stations only is being continued, all other stations being limited to 200-watt or less power.

The extension and improvement of automatic lighting apparatus is being continued steadily. The use of double pilot burners for unwatched acetylene lights for the purpose of reducing extinguishments is being extended. Particular study at this time is being given to the design of a reliable cluster burner for acetylene gas which can be operated in duplicate from separate flashers and tanks for use in important lights where it is difficult to maintain attendants.

Reflectors are now being manufactured for the service in which the reflecting surface is plated with chromium. It has been determined by service tests of these reflectors that mirrors made with this material will not scratch or tarnish when exposed to the action of the weather or fumes of acetylene. This material has the added advantage that it can not be broken and is thus suitable for use in the service wherever reflectors are necessary.

BUREAU OF MINES

Members of the bureau represent the department on 7 technical committees of the Federal Specification Board and on 20 sectional

committees of the American Standards Association. The bureau is also a member of the A. S. A. Mining Standardization Correlating Committee and the Safety Code Correlating Committee.

Among the investigations in which the bureau was especially active in 1928 are the following:

1. Standard methods for sampling, analyzing, and testing coal in cooperation with various State and municipal organizations and technical societies.
2. Standard methods for determining the fusibility of coal ash as related to formation of clinker.
3. Methods of determining sulphur in coal and coke.
4. Standard testing of explosives to determine their permissibility for use in coal mines.
5. Standard methods of analysis of explosives.
6. Standardization of materials used for rock-dusting coal mines to prevent explosions of coal dust and gas; standard methods for comparing relative explosibility of different coal-mine dusts; and standardization of rock-dust barriers for extinguishment of coal-mine explosions.
7. Standardization of brattice cloth used in connection with the ventilation of mines.
8. Standardization of fire-extinguishing apparatus used in mines.
9. Standardization of electrical apparatus and equipment used in mine operations.
10. Standardization of flame-safety and electric-cap lamps used by miners.
11. Standardization of gas-detecting devices used in mines.
12. Preparation of standard annual reports on mine-accident statistics.
13. Standardization of specifications for lubricants and liquid fuels, and methods of testing these materials.
14. Standardization of gas masks for use in mining, metallurgical, and allied industries.
15. Standardization of mine-rescue methods and apparatus used in mine-rescue work.
16. Standardization of methods of first-aid instruction.
17. Standard methods of reporting mineral and metal statistics.
18. Formulation of standard code of ventilation of coal mines.
19. Standardization of explosion-proof mine stoppings.
20. Mine-timber standardization.

Standard Methods for Sampling, Analysis, and Testing of Coals.—The work of the coal analytical laboratory of the Bureau of Mines consists chiefly of analysis of coals belonging to or for the use of the United States Government.

The methods used in this analytical work are described in Bulletins 22, 85, 116, 119, 123, 193, and 230 and Technical Papers 8, 76, and 133.

In the course of this work, the methods used in the bureau's laboratories have been widely adopted in many laboratories, or are used as a standard check in comparing results of different laboratories. Samples are exchanged with several commercial laboratories for the purpose of checking their methods of analysis and to improve their standards. Referee analyses are often made.

The bureau is cooperating with the American Society for Testing Materials in the obtaining of data on which to define permissible tolerances of analysis of coal and coke.

Coal-Ash Fusibility as Related to Clinker Formation.—Laboratory methods for determining the fusibility of coal ash have been carefully investigated by the Bureau of Mines in cooperation with the American Society for Testing Materials and Carnegie Institute of Technology. The gas-furnace method developed was tentatively adopted as standard by the American Society for Testing Materials.

Methods of Determining Sulphur in Coal and Coke.—In cooperation with committed D–5, on coal and coke, of the American Society for Testing Materials, work is being done on the standardization of methods for determining the sulphur content of coal and coke, with the object of making the most accurate and workable methods available for use by laboratories engaged in analyzing these materials.

Standard Testing of Permissible Explosives.—Investigation having shown that the use of unsafe explosives had caused many mine disasters, the Pittsburgh Experiment Station of the Bureau of Mines in 1908 began making tests to ascertain what explosives were least likely to ignite flammable gas or coal dust. As a result of the tests it approved certain explosives with short, quick flames as permissible for use in gaseous or dusty coal mines.

Standard Methods of Analysis of Explosives.—During 1928 methods have been devised for determining ethylene glycol dinitrate and nitrosugar in admixture with nitroglycerin, substances which are used as low-freezing ingredients. In addition to purely analytical work, physical and chemical constants of the substances used in explosives are being determined.

Standardization of Methods for Rock-Dusting Bituminous Coal Mines and for Analysis of Rock-Dusting Materials.—The bureau has developed methods for the rock-dusting of bituminous coal mines to prevent coal-dust explosions, which are becoming standard practice through their adoption by the mining industry.

Standard Rock-Dust Barriers.—The bureau is conducting a systematic study of the operation of various types of rock-dust barriers, intended to supplement the rock-dusting of bituminous coal mines, with a view to the standardization of these appliances.

Standards for Comparing Relative Explosibility of Different Coal-Mine Dusts.—At the bureau's experimental mine at Bruceton, Pa., near Pittsburgh, numerous tests of the explosibility of different coal-mine dusts are conducted, with a view to formulating standards for comparing their relative explosibility. During 1928, 80 coal-dust explosion tests were made in the experimental mine, some in combination with fire damp. Work was done on the development of

standards for sampling coal-mine dusts to determine the proportion of inflammable matter in road, rib, and timber dust at the place of sampling. The bureau is investigating the limits of quantity of bodies of methane under different conditions in coal mines which, if ignited, may cause a coal-dust explosion.

Standardization of Brattice Cloth Used in Connection with Ventilation of Mines.—In cooperation with the Bureau of Standards, the Bureau of Mines is conducting experiments for the standardization of brattice cloth used annually in large quantities for the purpose of directing air currents in the ventilation of mines.

Standardization of Electrical Apparatus and Equipment Used in Mining Operations.—As many mine disasters have been caused by the ignition of gas or dust by electrical equipment, the bureau has, since its establishment, conducted tests designed to establish standard safety requirements covering electric motors, electric locomotives, switches and junction boxes, telephones, and electric blasting units used in mines.

The system governing this work contemplates allowing the manufacturer to mark his goods with a seal bearing the name of the Bureau of Mines and to state that they are "permissible" or "approved," provided the goods pass certain tests that are prescribed in published schedules.

The bureau prescribes the conditions under which the tests are made and specifies the requirements that an article must satisfy to win the bureau's approval and be marked "approved as permissible."

During 1928, 23 approvals of mining equipment and apparatus were made, and numerous extensions of approval were issued. The bureau's permissible list covers practically every type of equipment used in underground coal mine.

Standardization of Flame Safety and Electric Lamps Used by Miners.—As the cause of some mine disasters has been traced to the ignition of gas or dust by mine lights, the tests for permissibility have been extended to cover the various types of electric lamps and flame safety lamps used in mines.

Standardization of Specifications for Lubricants and Liquid Fuels and Methods of Testing These Materials.—Standardization work concerned with specifications for lubricants and liquid fuels performed during 1928 consisted in the preparation of new standards and improvement of existing standards in connection with the work of the Technical Committee on Lubricants and Liquid Fuels of the Federal Specifications Board.

Six new standards were included in this revision—methods of sampling petroleum products, analysis of grease, penetration of greases and petroleum, emulsion test for soluble cutting oils, neu-

tralization number, and corrosion test for solid and semisolid products. The following standards were discontinued: Melting point of paraffin wax, melting point of petrolatum, spot test, free acid, and unsaturation in transformer oils. In addition, numerous minor changes were made in various methods and specifications.

Further work contemplated and under way includes revision of gasoline, fuel oil, lubricating oil, and motor-benzol specifications, new furnace-oil specifications, and changes in the method of determining viscosity.

Measurement of Flow of Gases.—The bureau is working on the standardization of the method of determining the open-flow capacity of natural-gas wells and in 1928 published Serial 2885, Standardizing the Open Flow from Natural-Gas Wells. Work has been conducted for some time on the standardization of measurements of natural gas by means of the orifice meter. This work is in cooperation with the Bureau of Standards and the American Gas Association.

Standardization of Gas Masks for Use in Mining, Metallurgical, and Allied Industries.—Gas masks are used largely in the mining, metallurgical, and chemical industries to protect men from noxious gases and fumes. In order to stimulate manufacturers of industrial gas masks to make appliances of good quality, and to guide the consumer in purchasing safe masks, the Bureau of Mines has developed a standard system of tests which it is thought covers the requirements of a safe device. Manufacturers of masks examined and approved in accordance with the bureau's schedule of tests are authorized to display and advertise that their product has been "approved." The tests, which are the minimum thought to be compatible with safety, include (1) construction details, (2) life or capacity of the mask to remove deleterious gases, and (3) deterioration during storage. The requirements for permissibility are given in Schedule 14–A, Procedure for Establishing a List of Permissible Gas Masks; Fees, Character of Tests, and Conditions Under Which Gas Masks Will Be Tested, and Schedule 19, Procedure for Testing Hose Masks for Permissibility. A complete list of the masks that have been approved is given in Information Circular No. 6077, July, 1928, under the title List of Permissible Mining Equipment. During the past year in the city of New York passed an ordinance requiring the use in refrigerating plants of masks approved by the United States Bureau of Mines.

Standardization of Mine-Rescue Methods and Apparatus Used in Mine-Rescue Work.—The bureau, in conjunction with mine operators and manufacturers of rescue equipment, has developed improved types of oxygen-breathing apparatus that meet the severe test requirements formulated by the bureau engineers and surgeons on

the basis of years of experience in mine-accident investigations and rescue work and tested out in actual service.

Standardization of Methods of First-Aid Instruction.—Standardized methods of first-aid instruction have been developed by the bureau for the purpose of improving health and safety conditions among those engaged in the mineral industry. The handbook on Advanced First-Aid Instruction for Miners, issued by the bureau was revised in 1928 to include additional standards and new methods developed and adopted by the Bureau of Mines as well as by a number of other Government agencies and industrial organizations. The Bureau of Mines is cooperating with the departments of mines in several States and with the mining companies in establishing a standard method whereby all employees at each mine are to receive first-aid instruction.

The Bureau of Mines cooperated in the standardization of methods of giving artificial respiration by the prone-pressure method adopted by the following organizations: American Telephone & Telegraph Co.; American Red Cross; American Gas Association; Bethlehem Steel Co.; National Electric Light Association; National Safety Council; Bureau of Medicine and Surgery, Navy Department; Office of the Surgeon General, War Department; National Bureau of Standards; and United States Public Health Association. The methods agreed upon have been pubished in reprint No. 1203, 1928, of the United States Public Health Service, on How to Give Artificial Respiration by the Prone-Pressure Method.

Methods of emergency treatment of carbon-monoxide poisoning have been developed and standardized by the Bureau of Mines through a number of years of experimental work on men and animals. These methods are given in Bureau of Mines Technical Paper 373, The Pyrotannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and in Air, and in various other papers published by the Bureau of Mines.

A tentative standard for diagnosis of carbon-monoxide poisoning has been prepared by the Bureau of Mines in cooperation with the American Health Association Committee on Standards of Diagnosis for Occupational Disease, for Disability from Occupational Diseases, both permanent and temporary, and for the best methods of administration of occupational disease laws.

Standard Methods of Reporting Mineral and Metal Statistics.—The Bureau of Mines in its reports on mineral resources, production and consumption, and prices of minerals is working toward a standard method of reporting ores and concentrates based on metal content of the ore.

Standardization of Reports on Mine-Accident Statistics.—With the cooperation of State officials and of individual operators the Bureau of Mines publishes reports dealing with accidents in the mineral industries. These reports give, by causes and States, the fatalities at coal mines and the fatal and nonfatal accidents at metal mines, quarries, coke ovens, and metallurgical works other than iron blast furnaces. Compilation of figures on coal-mine fatalities began in 1910; that for metal mine and quarry accidents began in 1911; work on statistics at coke ovens and metallurgical plants began in 1913. Figures for coal-mine fatalities are published monthly and annually; figures for other accidents are published annually.

Mine-Safety Standards.—The mine-safety board of the bureau passes upon mine-disaster reports by bureau engineers and makes recommendatory decisions on fundamental questions involving safety in mines, which upon affirmation by the director become bureau policy. These formal safety decisions, strictly defining the bureau's attitude, are becoming standard policies through their adoption by other agencies concerned. Among the recent decisions are definitions which specify pure air, intake air, return air, and requirements covering the movement, quantity, and quality of air in mines. Other decisions under contemplation concern standardizing ways of escape from mines.

After considerable investigation of the safety methods used in mines, a standard form of safety organization for coal mines was prepared and issued as an information circular.

Frequent requests for suggestions as to safety codes on various subjects emphasized the need for standard mine-safety codes. Such a standard is now being prepared, and parts of the code have been submitted to committees for review.

A course in standard mine-safety methods has been prepared and is now being revised.

Ventilation Requirements of Coal Mines.—A standard code of ventilation of coal mines is being prepared by the Bureau of Mines, in cooperation with the American Institute of Mining and Metallurgical Engineers' Committee on Mine Ventilation. The bureau has conducted in its experimental mine an extensive series of tests on ventilation in coal mines, with the result that fundamental data are now available from which engineers can determine the ventilation requirements of a given coal mine.

Standardization of Mine Stoppings.—Work was continued, in cooperation with the National Bureau of Standards, on the development of standards for explosion-proof mine stoppings, with special reference to requirements of strength.

Mine-Timber Standardization.—The Bureau of Mines cooperates with the American Mining Congress, the United States Forest Serv-

ice, and the Pennsylvania Forest Products Manufacturers' Association on work directed toward standardizing specifications for mine timbers and simplifying timbering practice in mines.

Standardization of Ore Crushing and Grinding Methods.—At the Intermountain Experiment Station of the Bureau of Mines, Salt Lake City, Utah, methods have been developed for determining the fineness of pulverization of ore and its relation to the work required in the crushing and grinding of ores. This research is a fundamental investigation looking toward the standardization of ore-crushing and grinding operations.

Analysis and Testing of Gases.—The gas laboratory of the bureau's Pittsburgh experiment station has cooperated with the American Gas Association in the preparation of a chapter on methods of analyzing and testing gases. This chapter forms part of the Gas Chemists' Handbook, published by the American Gas Association.

Standard for Determining the Capacity of Low-Pressure Heating Boilers.—The fuel section of the mechanical division of the bureau has worked in close cooperation with a committee of the American Society of Heating and Ventilating Engineers in developing a method for determining the capacity of heating boilers.

Operating Characteristics of Heating Boilers.—The bureau has cooperated during 1928 with a committee of the American Society of Heating and Ventilating Engineers in standardizing the form for data given in the catalogues of manufacturers of heating boilers and the method by which the values shall be determined. The bureau also made an investigation for the committee to determine the relation between the operating characteristics of such boilers and their dependence on the fuel used.

Specific Heats of Metal Oxides and Sulphides.—At the Pacific Experiment Station of the bureau, Berkeley, Calif., determinations are being made of the high and low temperature specific heats of metal oxides and sulphides. Work is also being done on the determination of the heats of reaction in the formation of sulphides and oxides. These data are fundamental to the study of chemical reactions and processes in the metallurgical industry.

Power Test Code.—The mechanical division of the Bureau of Mines cooperated with the American Society of Mechanical Engineers in the work of the Power Test Code Committee.

DEPARTMENT OF THE INTERIOR

OFFICE OF INDIAN AFFAIRS

The Indian Service has been represented first through the Federal Purchasing Board and later through the Interdepartmental Board of Contracts and Adjustments in the discussions pertaining to a devel-

opment of standard specifications governing the purchase of coal. The Indian Service is one of the several Government activities which used for the fiscal year 1928 the proposed standard purchase conditions developed by the Federal Purchasing Board's committee and for the current fiscal year is using the proposed standard contract and purchase conditions governing the procurement of anthracite and bituminous coal, in order that our experience in the practical use of this development might aid and assist the Interdepartmental Contract Board in producing a standard practice that will prove satisfactory to both the Government and those in the coal industry.

The Indian Service has developed a specification on dress gingham, including standard patterns, which gives to the trade a better idea of just what is required by the Indian Service and through which undesirable qualities and patterns are eliminated; it has fixed standards, dimensions, etc., on aluminum ware; before the adoption of the Federal Specification on laundry equipment, the proposed specifications were made effective as they were issued. The Service has developed a standard specification on pianos which, however, is still in its formative stage, and has standardized on 6-ply automobile tires for the southwestern territory, particularly Arizona, New Mexico, southern California, and southern Utah, as being the most effective in resistance to the road and climatic conditions found there. New specifications on single and double mattresses, also mattresses or pads for cots, have been developed, and the Service has standardized on an all-cotton mattress for the use of the Indian-school children.

During the past year this office cooperated with the Department of Justice and the Federal penitentiary at Leavenworth in the production of standard specifications to govern the manufacture of men's and women's shoes for the use of the large boys and girls in Indian schools; also during the year arrangements were made for the further production of all the leather shoes required by the Indian Service for the next year. Specifications were developed also to cover that production.

To supplement the standard Government forms of instructions to bidders and to provide for certain other conditions to govern proposals and contracts, this office has put into effect its own standard forms of supplemental instructions numbered 5–089 and 5–091 and its standard supplemental conditions sheets 5–086 and 5–090. The series 5–086 and 5–089 are for use when a consolidated purchase is made for more than one field unit, whereas 5–090 and 5–091 are used when the purchase is for a single unit.

BUREAU OF RECLAMATION

Members of the bureau represent the department on two technical committees of the Federal Specifications Board, and on two sectional committees of the American Standards Association.

Standardization work that has been approved since October 10, 1927, and now being used by the Bureau of Reclamation, includes the following:

1. Designs for radial gates of various sizes range from 6 to 20 feet and with heads from 7 to 13 feet, including 9 sheets.
2. Radial gate pin bearings, $2\frac{7}{16}$ to $4\frac{7}{16}$ inches in size (1 sheet).
3. Radial gate hoists having capacities ranging from 3,500 to 12,000 pounds (16 sheets).
4. Cast-iron gates, 2 by 2 feet and 4.8 by 6.0 feet, with heads ranging from 30 to 50 feet (2 sheets).
5. Semisteel gates, 4.8 by 6 feet, with heads from 50 to 75 feet (1 sheet).
6. Stems for cast-iron gates, $3\frac{3}{4}$ to 5 inches in diameter (1 sheet).
7. Double drum hoists having capacity of 60,000 pounds (6 sheets).
8. Drum gates, 64 by 14.5 feet (5 sheets).
9. Sixty-inch internal differential needle valves with control stands (19 sheets).
10. High-pressure gates, 5 by 6 feet in size, with and without conduit lining (10 sheets).
11. Eighteen-inch hydraulic hoist (2 sheets).

Standardization work done in this bureau in the past, now in progress, and contemplated in the future, is limited to the development of designs and practices to be adopted as standards by this bureau only, for use in connection with the Federal irrigation projects in the West. In this the interests of this bureau are the controlling factors, and cooperation with outside interests in the matter has been largely incidental. Standard designs have been prepared and are now in use for about 20 groups and classes of machinery and structures, including 450 drawings.

DEPARTMENT OF LABOR

CHILDREN'S BUREAU

During the year ending September 1, 1928, the Children's Bureau has carried on the following activities relating especially to the development of standards:

1. Assistance in birth-registration campaigns in four States since admitted to the United States birth-registration area.
2. Fifth annual conference of State directors of maternity and infancy work, held in the Children's Bureau, Washington, April 2 to 5, 1928.
3. Cooperation with State boards of health in 12 States in study of causes of maternal mortality according to a uniform plan.
4. Collecting on uniform schedule, and compiling, reports on employment certificates issued in the calendar year 1927 to working children in the District of Columbia, 16 States, and 69 cities in 18 other States.
5. Collecting on uniform cards and compiling information concerning juvenile-court cases of delinquency, dependency, and neglect. About 100 courts are now cooperating, and complete reports for the calendar year 1927 were compiled for 42 courts in 15 States.

6. Preparation of statement of general principles which should govern development of family courts, in which a member of the leading authorities on this subject cooperated.

7. Preparation (not yet completed) of a handbook on the administration of mothers' aid, undertaken at the request of the National Committee on Public Aid to Mothers of Dependent Children in Their Own Homes.

NAVY DEPARTMENT

BUREAU OF AERONAUTICS

The airplane, from its very nature, probably touches and uses the resources of more basic industries than any other product of modern days. Impelled by military necessity and popular demand at a rate far in excess of what might be termed "the normal development" of any product, the need for coordination soon became apparent.

Conscious of this need, and of the necessity of coordinating both military and commercial requirements, the Army Air Corps and the Navy Bureau of Aeronautics, as pioneers in the development of the airplane, undertook the work. A particularly important phase of this standardization is the thoroughness with which it has been accomplished. The standards are not only dimensional but include specifications in all instances covering materials, processes, methods of assembly, inspections, and tests. This accordingly assures a uniform interchangeable part or article of equipment which may be purchased anywhere with full assurance of completely satisfactory functioning under all circumstances and conditions.

The Bureau of Aeronautics cooperates closely with the Bureau of Standards in a number of projects involving the development, improvement, and uses of various materials employed in aircraft construction.

BUREAU OF CONSTRUCTION AND REPAIR

The bureau holds membership on a number of committees of the following organizations and has participated actively in the work of these committees on the standardization of material specifications:

The American Standards Association.
The American Marine Standards Committee.
The American Society for Testing Materials.
The Federal Specifications Board (47 committees and subcommittees).

In addition to its membership on the technical committees of the above organizations, the bureau has collaborated with the organizations listed below in numerous standardization projects:

The division of simplified practice.
National Lumber Manufacturers Association.
National Screw Thread Commission.
Commission of Fine Arts—Flag Standardization Committee.

Association of American Steel Manufacturers.
Cordage Institute.
Hemp Brokers Association.

In cooperating with the organizations above mentioned, the bureau is taking an active part in the national standardization movement in connection with engineering materials and in the simplification of sizes and types of these materials and has put into practical effect, wherever applicable to work under its cognizance, any standards which have been approved for governmental use, or which have been adopted as national industrial standards.

Research and tests, both service and laboratory, for the purpose of obtaining technical data for further improvement and standardization of materials have proceeded steadily throughout the year. Some of the materials in which noted improvements have been made are as follows: Horsehair, mechanical refrigerators, hardware, lumber, brushes, lampblack, rosin, corkboard, belt dressings, cordage, laundry machinery, hand tools, pickling of steel, paints and pigments, aluminum alloys, and various textiles.

Studies are being made on other materials, such as bituminous compositions, metal polishes, marine glue, template paper, blue-print and brown-print paper, bullet-proof steel, the newer structural steels, the corrosion of rivets, corrosion of pipe, the revision of standard paint formulas, and special applications of corrosion-resisting steel, which it is anticipated will result in further improvements and standardization in the use of these materials.

BUREAU OF ENGINEERING

The bureau has membership on 16 technical committees of the Federal Specifications Board, and the following additional committees and societies:

American Standards Association: Main, executive, and 13 sectional committees.
American Society for Testing Materials: 14 committees.
American Society of Mechanical Engineers: 7 sectional and 4 standardization committees.
American Marine Standards Committee: Executive board and 12 subcommittees.
National Screw Thread Commission.
American Institute of Electrical Engineers: Radio standardization committee.
Federal Technical and Scientific Board.
National Electric Light Association: Prime movers committee.
Advisory Committee on Nonferrous Metals of the Bureau of Standards.
American National Committee of the International Electrotechnical Commission.
Chief Coordinator's committee on communications for outlining the field to be covered by the Commerce and Navy Departments relative to sound aids to navigation and radio compasses.
Interdepartment Radio Advisory Committee for the consideration of adjustments of frequencies to avoid or reduce interference between Government radio stations.

The bureau has investigated the following subjects with a view toward improving quality of material, method of employment or general knowledge of, by means of new specifications, modified specifications, operating instructions and detailed reports, both public and confidential. Such activity is considered a process of standardization and may be properly included herein. In some instances investigation has been completed and information disseminated, while in others investigation is still under way.

Electric measuring instruments for shipboard use.
Electric cable for shipboard use.
Electrical equipment for metal-arc welding.
Carbon brush material.
Lighting-circuit voltages.
Incandescent electric lamps for shipboard use.
Electrical insulating material (solid and liquid).
Electric machinery temperature gradients.
Lead acid radio "B" batteries.
Dry batteries.
Portable lead acid batteries.
Electric heaters, air, for shipboard use.
Electric heaters, radiant.
Hard fiber for instrument-board use.
Cotton-sleeving insulating material.
Asbestos, linen, and silk insulating tapes.
Commutator conditioning devices.
Portable electric drills.
Motors and controllers (d. c.).
Insulating varnish.
Portable electric ventilating sets.
Motion-picture projectors.
Outboard gasoline engines.
Fireroom draft gauges.
Water meters.
Fuel-oil meters.
Pump governors.
Temperature regulators.
Vacuum traps.
Propeller type forced-draft blower.
Hard-rubber jars for submarine storage batteries.
Electric telegraphs (a. c.) for shipboard use.
Antinoise telephones for shipboard use.
Storage-battery testing outfits.
Radio high-frequency receivers and transmitters.
Radio-wave propagation.
Materials having piezo-electric effects.
Instruments for measuring high frequencies.
Radio traps.
Devices for measuring and recording the direction of static.
Equipment for the transmission of photographs.
Equipment for writing maps and sketches.
Equipment for measuring airplane and submarine antenna constants.
Radio indicating meters.

Resistances and resistors for naval radio equipment.
Condensers (radio).
Vacuum tubes for naval radio equipment.
Transmission ranges of radio frequency.
Aircraft radio installations.
Tachometers, chronometric and centrifugal types.
Steam traps.
Pressure-reducing valves.
Ball bearings.
Apparatus for testing ball bearings.
Bolts, nuts, and screws.
Taps and dies.
Miscellaneous valves for shipboard use.
Heat-insulating materials for use with temperatures about 1,500° F.
Autogenous welding in the fabrication of engineering apparatus.
Antiseize compound for use in threaded aluminum and aluminum alloy parts.
Copper-nickel alloy condenser tubes.
Spring material for Diesel engine valves.
Boiler feed-water treatment.
Chromium plating in naval use.
Centrifugally cast-iron liners for large air pumps.
Corrosion fatigue of metals.
Gasket material.
Packing.
Tool steels.
Cutting oils.
Lubricating oils.
Boiler refractories.
Spark plugs.
Grinding compounds.
Gauge glasses.
CO_2 indicating instruments.

BUREAU OF ORDNANCE

The bureau has been actively engaged in the preparation of specifications and the work of standardization through its membership on the Navy Department specifications board and its connection with the Federal Specifications Board, the Department of Commerce simplified-practice division, and the American Standards Association.

An effort is being made to extend the scope of the Navy Department specifications to cover, as far as possible, all material purchased for the Navy. This has involved the preparation of a large number of new specifications and numerous revisions to existing specifications, which has greatly increased the amount of work of this nature handled by the Bureau of Ordnance as a member of the Navy Department specifications board. Due to improved procedure the bureau has been able to handle an increased volume of work without any increase in the existing personnel.

The following specifications might be referred to as being the most important handled by the Bureau of Ordnance during the past year:

Corrosion-resisting steel.
Steel balls and ball bearings.
Bolts and nuts, wrenches, and machine screws.

At the present time all bolts, nuts, and machine screws purchased for the Navy are in accordance with Navy Department specifications, which agree with Federal specifications covering the same material, the report of the National Screw Thread Commission, and American Standards Association standards.

The bureau maintains a file of Department of Commerce simplified-practice recommendations for reference in the design section.

BUREAU OF SUPPLIES AND ACCOUNTS

Members of the bureau represent the Navy Department on 15 technical committees of the Federal Specifications Board, and a member is chairman of the technical committee on provisions.

This bureau has issued, during the calendar year 1928, 110 new or revised specifications, 43 of which were based on United States Government master specifications.

A standard-stock catalogue for the Navy is issued by the Bureau of Supplies and Accounts. The original edition of the catalogue was issued in loose-leaf form, class by class, between 1915 and 1918. Complete revisions were issued in 1921 and 1924, and a third revised edition is now being printed.

The Navy Department standard-stock catalogue is designed to cover all supplies regularly carried at navy yards and stations and issued to ships. It lists such items by classes according to the standard classification for Government departments issued by the Chief Coordinator, Bureau of the Budget. The items within each class are assigned standard nomenclature, listed in alphabetical arrangement, and each item is assigned a standard-stock number. These numbers are arranged in alphabetical-numerical sequence. All information essential for the procurement, storage, and issue of material is given, such as references to specifications or drawings, die numbers, yards or stations at which manufactured or from which distributed, prices, and any other essential data. In addition, each item is assigned a code word, these code words being alphabetically arranged throughout the catalogue so that supplies may be ordered by telegraph or radio by code word only, the items being located, as are the words, in a dictionary. The standard-stock catalogue includes also the classification index of naval stores and material, which lists in a single

alphabetical arrangement all items of supplies regularly used by the Navy, with class number, title, and bureau or bureaus of the Navy Department having cognizance of each.

BUREAU OF YARDS AND DOCKS

Members of the bureau represent the Navy Department on 14 technical committees of the Federal Specifications Board. The bureau also collaborates with the following organizations:

Navy Department specifications board.
Division of simplified practice.
American Standards Association.
American Society for Testing Materials.

The A. S. T. M. test rack for long-time exposure of galvanized materials at the naval station, Key West, is under the cognizance of this bureau.

The bureau is conducting experiments to establish standards for concrete in sea water at the navy yard, Portsmouth, N. H., and naval operating base, Hampton Roads, Va., the former for Portland cement and the latter high-alumina cement. Experiments are also being conducted on copper-bearing steel sheet piles and electroplated reinforcing bars at the naval station, Key West, Fla.

The bureau has in preparation a standard work entitled "Design data—public works of the Navy" which will be a basic standard of design and construction practice of the work under the bureau's cognizance.

The following standards have also been established:

No. 3Y. Concrete, standards of design. (Revision, now in preparation, should be published by January 1, 1929.)
No. 4Y. Concrete roads. (New. Data collected and being compiled.)
No. 5Y. Radial brick chimneys. (Revision. Printed copies available.)
No. 6Y. Electric bridge cranes. (Revision. Printed copies available.)
No. 7Y. Roofing, siding, sheet-metal work, etc. (Revision. Being printed.)
No. 8Y. Tanks; steel and wood. (Revision. Printed copies available.)
No. 9Y. Electric apparatus and wiring. (Revision. Printed copies available.)
No. 10Y. Steel windows. (New. Being printed.)
No. 11Y. Marble and tile. (New. Printed copies available.)
No. 12Y. Standards of design—structural steel. (New. Being printed.)
No. 13Y. Concrete construction procedures. (New. In preparation.)
No. 14Y. Electric elevators and dumb-waiters. (New. Data being collected.)
No. 15Y. Standard methods of sampling and testing roofing materials. (New.
Mechanical equipment and accessories for shore purposes. New. Being printed.)
Data being collected. A revision and enlargement of the present Navy Department Specification No. 45P2B. Will also include turbo-alternators, refrigerating-plant apparatus, condensers, stokers, exciters, etc.)

No. 16Y. Piping installations. (New. Data being collected. Will include the applicable parts of 45P2B and installation of piping of all kinds.)
Dredging. (New. Data being collected.)
Wire fencing. (New. Data being collected.)
Gravel and macadam roads and bituminous treatments. (New. Data being collected.)

Data are also being collected with a view to establishing specifications for workmanship in operations in frequent use, such as brick and tile masonry, painting, carpentry, plastering, plumbing, etc.

UNITED STATES MARINE CORPS

The Marine Corps is employing Federal specifications in all purchases where such specifications apply, and Marine Corps specifications are revised to conform with the Federal Specification Board's requirements where such revision is necessary. Officers of the Quartermaster's Department, Marine Corps, are representatives on seven technical committees of the Federal Specification Board, and every effort is being made to cooperate.

POST OFFICE DEPARTMENT

SECOND ASSISTANT POSTMASTER GENERAL

Continued progress was made during the year just passed in the building and in the standardization of railway post-office cars.

A total of 186 new steel cars were built and placed in service, replacing nonstandard cars of inferior strength. Of these 10 were full mail cars, 123 were stream-line apartment cars, and 53 were self-propelled cars or trailer apartment cars.

Thirty-three steel full mail cars, 33 steel apartment mail cars, 10 steel underframe apartment mail cars, and 2 wood (steel reinforced) apartment mail cars, a total of 78 cars, were standardized, and, in addition, 1,180 full and apartment mail cars were made to meet more nearly standard construction requirements, and 53 mail cars were equipped with electric lights in place of gas or oil.

FOURTH ASSISTANT POSTMASTER GENERAL

This bureau has continued the development of standardized furniture and screen line for use in post offices, the experience of the past year having demonstrated that it is practicable to use the same units in post offices located in different sections of the country and to move the standard equipment from one location to another when leases are terminated.

With the aid of the National Bureau of Standards a specification has been developed for numbering machines. Thousands of these

machines are used in the Postal Service, and until the adoption of this new specification it was next to impossible to secure a machine under competitive bidding that was sufficiently rugged to stand the severe service to which the machines were subjected.

Heretofore, this department has found that the greatest cause for replacement of the large street letter boxes is the rusting out of legs. A new type of removable leg has been developed. As this is the first part of the letter box to be destroyed by corrosion, the new leg will make it possible to continue in service many boxes that are otherwise in good condition.

The system of paying employees by check which has been adopted by many of the leading business houses of the country has also been adopted by this department for most of the larger post offices. In order to make prompt payment to thousands of employees modern check-writing machines, used in conjunction with addressographs, both of which devices have been especially adapted for use with the Government form of check, are being used.

TREASURY DEPARTMENT

PUBLIC HEALTH SERVICE

Section of Industrial Hygiene and Sanitation.—The Bureau of the Public Health Service is represented on the American Standards Association sectional committee for the development of an industrial sanitary code and is sponsor for the project. The bureau is also represented on additional sectional codes functioning under the American Standards Association procedure.

HYGIENIC LABORATORY

Official standards and standard tests include diphtheria antitoxin, tetanus antitoxin, typhoid vaccine, botulinus antitoxin, perfringens antitoxin (gas gangrene), arsphenamine, scarlet fever streptococcus toxin, scarlet fever streptococcus antitoxin, antimeningococcic serum, antipneumococcic serum, antidysenteric serum, diphtheria toxin-antitoxin mixture, diphtheria toxin for Schick test, and diphtheria toxoid. Work is being done on the standardization of digitalis, pituitary extract, and insulin.

Accomplishments During the Past 12 Months.—Aside from control work connected with the biologics law, progress is being made in the following researches: Tularæmia, vaccination sequelæ, typhus, studies in pathology, medical zoology, oxidation reduction processes, malignant tumors, pneumonia, trachoma, nutrition, tuberculosis, and Rocky Mountain spotted fever.

SUPERVISING ARCHITECT

During the past 12 months, ending September 1, 1928, the only activity along this line that has been possible during the past year has been the revision and, where possible, the extension of previously standardized specifications and drawings in connection with the construction, maintenance, and repair of Federal buildings.

COAST GUARD

The Coast Guard is intensely interested in the standardization and simplification activities of the Department of Commerce and the Bureau of Standards, and throughout its organization takes full advantage of the economies resulting therefrom. In the construction, repair, and equipment of Coast Guard vessels and stations the specifications for material are drawn to require the use of certified standards wherever practicable. The Coast Guard is represented on committees of the Federal Specifications Board and the American Marine Standards Committee, and it encourages in every way the preparation and application of specifications which will be adequate for all activities of the Federal departments.

WAR DEPARTMENT

All supply branches of the Army have members representing the War Department on technical committees of the Federal Specifications Board, the total number of assignments being nearly 100.

United States Government master specifications form the basis of specifications prepared by the War Department, and it is mandatory that each specification so prepared be prefaced with the statement that its technical requirements conform in detail to the United States Government specifications for the commodity, as promulgated by the Federal Specifications Board, giving the number of the master specification applying. (Bulletin No. 24, supplement No. 1, Office of the Chief Coordinator, February 3, 1924.)

After the master specifications are promulgated by the Federal Specifications Board, the War Department representative is furnished copies which are transmitted by him to the War Department branch concerned, where they are republished as United States Army specifications, all technical requirements conforming to the master specifications. The Adjutant General's Office publishes from time to time an index showing the numbers and subjects of all United States Government specifications.

Specifications covering items which are of a strictly military and confidential nature are not considered by the Federal Specifications Board.

American Standards Association.—The War Department is a member body of the American Standards Association and is represented on the standards council of that association by an officer detailed from the office of the Assistant Secretary of War and an alternate detailed from one of the supply services in New York City. The department is also represented on a large number of subcommittees of the association engaged in the work of preparing standards for acceptance.

Division of Simplified Practice.—The War Department participates constructively in the work of the division of simplified practice. Active liaison is maintained with the division through the office of the Assistant Secretary of War. As each project is outlined and submitted it is assigned to the supply branch most closely interested for study and participation, and representation at all important conferences is thereby assured.

National Screw Thread Commission.—Two members of the Ordnance Department represent the War Department on the National Screw Thread Commission.

The War Department is represented by Watertown Arsenal on the joint committee on investigation of the effect of phosphorus and sulphur in steel.

A number of other standardization activities engage the attention and cooperation of the War Department, among which may be mentioned the National Committee of the International Electrotechnical Commission and the aeronautical section of the Society of Automotive Engineers. Direct contact is maintained with a large number of technical societies and associations.

Present Status of War Department Standardization and Results Accomplished During 1928.—The Quartermaster Corps issued 214 new or revised specifications during 1928.

The Ordnance Department issued during the year 38 new or revised specifications. This department has taken an active part during the year in the deliberations of the National Screw Thread Commission. Much work has been done within the department in the elimination of waste and in the commercialization of specifications.

The standardization program of the Air Corps includes the coordination of procurement requirements of the Army and Navy aeronautical activities for equipment and material common to both services. These studies include methods of determining requirements for structural strengths and particularly cover the interchangeability of material. During the past year standardization has been effected and approved between both the Army and Navy aeronautical activities covering 20 important items. Uniform speci-

fications and drawings are being prepared to cover 30 items, all of which were tentatively agreed to at the last Army and Navy conference. The Air Corps also cooperates with the aeronautical section of the Society of Automotive Engineers in effecting standardization of commodities common to commercial and governmental aeronautical activities. An example of this cooperation may be seen in the standardization of rims for wheels used on aircraft.

The Corps of Engineers adopted 40 new specifications during the year. Its standardization activities cover commodities entering into the construction of highway, pontoon, and foot bridges; locks, dams, revetments and floating plant, fortification work, including fixed and mobile antiaircraft 60-inch searchlights; lumbering, mapping, railroad, and road-building equipment, and many other items used for military purposes. This work is largely carried on through the Board of Engineer Equipment.

The Signal Corps has been particularly active during the year in the development of radio communication, and the skill of its technicians has been largely drawn upon in committee and conference work of national scope; 71 new or revised specifications have been made available during the year. The rapid development of this art involves constant change in types of equipment and specifications therefor. The Signal Corps is represented through an officer stationed in New York City on the advisory committee on electrical matters of the American Standards Association.

INDEPENDENT ESTABLISHMENTS

BOARD OF SURVEYS AND MAPS

The board has approved a report of the Committee on Topographic Maps recommending the publication of instructions for topographic mapping. These instructions have been incorporated in a manual of topographic instructions of the Geological Survey.

The board also approved a report of a special committee recommending the establishment of a central agency for the sale of maps for aerial navigation in the Department of Commerce. This department now carries on hand a stock of all maps for aerial navigation produced by governmental agencies.

The board has adopted a report by the Committee on Control concerning the remarking of control stations. The report carried specifications and standards for making connections with any control marks in the vicinity of work established by other member organizations. The services mentioned in the report are: The Geological Survey, the Coast and Geodetic Survey, the Corps of Engineers of the Army, the Forest Service, the Mississippi River Commission, the General Land Office, or other member organizations of the Board of Surveys and Maps engaged in triangulation or traverse.

OFFICE OF THE CHIEF COORDINATOR

The preparation of a Federal standard-stock catalogue, under the direction of the Chief Coordinator, has been advanced during the year to a point where several of its sections can be published as soon as funds for its printing are made available by the Congress. The remaining sections are being held in abeyance, so that their text will include the latest information when the printing of the volume is authorized.

This catalogue is designed to list in orderly and classified arrangement all supplies regularly procured, stored, and issued by or for the various departments of the Government and to furnish in the case of each item of such supplies the information necessary for procurement, storage, and issue. It is intended that the catalogue, when completed, shall include all items of supplies and materials necessary to meet the ordinary requirements of the various departments. It will comprise the following sections:

I. United States Government Master Specifications.—The technical requirements of which are mandatory upon all Government departments and independent establishments. The list will be arranged in two forms, alphabetical and numerical.

II. Groups for Procurement.—Each group representing a major division of productive industry. These groups are in turn subdivided into divisions conforming to the general trend of specialization in industry.

III. Classes for Storage and Issue.—The criteria of classification being similarity of application or storage requirements. This section will embody also storage notes and stowage precautions.

IV. General Index of Federal Property.—Listing in alphabetical arrangement each item of supplies regularly procured, stored, and issued by or for the various Government departments and indicating the United States Government master specification applying thereto, the procurement group, and the class for storage and issue in which each such item should be carried.

V. Group Catalogue.—Embodying detailed information required by Government procurement agencies as to geographical distribution of sources of supply, variation in practice as to production or marketing, and other data requisite for economical and expeditious procurement.

VI. Class Catalogue.—Listing by classes for storage and issue, and in alphabetical arrangement under each class, each item of supplies regularly procured, stored, and issued by or for the various Government departments, standard nomenclature, stock number, data as to departments by which used to facilitate interdepartmental transfer of supplies, approximate prices, and code words to facilitate the placing of orders by radio or telegraph, in the case of each item.

Throughout the various sections of the Federal standard-stock catalogue standardized and uniform nomenclature will be used. The importance of exactness and uniformity with respect to nomenclature can not be overemphasized. In the past, items of supplies or material have been designated very generally in official papers, in whatever manner the writer of the paper might choose, and, as a result, efforts to communicate information, instructions, etc., have been almost as difficult as though the various persons concerned were employing different languages. The resultant errors, complications, and unnecessary correspondence have been productive of delays in the transaction of public business—and of additional expense—which observance of uniform nomenclature will eliminate.

FEDERAL PURCHASING BOARD

During the past year the Federal Purchasing Board has adopted a standard classification of Federal purchases. The symbols and terms of this classification are designed for assignment to items, or groups of items, of commodities studied by the board, so as to indicate in condensed form the board's decision as to the procurement arrangements believed most advantageous to the Government as a whole.

The standard classifications thus assigned to items of supply will be a guide to Federal activities in planning their procurement operations. In following this procedure it is expected that the Government's purchases will benefit by applying to each transaction the decisions of experts in their studies of production and marketing conditions.

In connection with the work of the Federal Purchasing Board, the Office of the Chief Coordinator issued the following bulletin:

BULLETIN NO. 43—SUPPLEMENT NO. 3

To the Heads of all Departments and Establishments:

Subject: Classification of Federal purchases.

The Federal Purchasing Board has adopted a system of classification of Federal purchases to be used by the board in its procurement studies.

The classification terms or symbols will be assigned to commodities by the board to indicate in condensed form its decision as to the procurement arrangements believed most advantageous to the Government as a whole.

The symbols, terms, and definitions of the classification system are as follows:

Classification of Federal purchases

Kind	Character	Type	Contract	Scope	Market
A. Departmental					
B. Interrelated					
C. Interdepartmental.	1. Mandatory 2. Coordinated 3. Cooperative	D. Participating E. Distributing F. Manufacturing	4. Integral 5. Piecemeal 6. Term	G. National H. Sectional J. Local	7. Seasonal. 8. Cyclic. 9. Irregular.

DEFINITIONS

Kind.—A. Departmental.—A purchase of supplies for its own use made by a department or independent establishment, the accomplishment of which is not affected by an expected subsequent transfer of the supplies to another governmental agency; further classification of which to be as directed by the heads of departments or independent establishments concerned, it being discretionary with them as to whether or not the terms employed under interdepartmental purchases are used.

B. Interrelated.—A purchase of supplies for its own use made by a department or independent establishment, the accomplishment of which is not affected by an expected subsequent transfer of the supplies to another governmental agency, but such purchase of supplies being related in time and/or quantity to purchases of identical supplies made by other departments and establishments; further classification of which to be as directed by the heads of the departments or independent establishments concerned, it being discretionary with them as to whether or not the terms employed under interdepartmental purchases are used.

C. Interdepartmental.—A purchase of supplies for the use of two or more departments or independent establishments, the accomplishment of which is affected by the organization, operation, and needs of those agencies. Classification of such purchases is as follows:

Character.—1. Mandatory.—An interdepartmental purchase which is made necessary by reason of law or lawful regulations.

2. Coordinated.—An interdepartmental purchase which is made as a result of the coordinating effort of higher authority, which effort has been suggestive but not directive of such purchase.

3. Cooperative.—An interdepartmental purchase which is made as a result of entirely voluntary action on the part of the agencies concerned to purchase jointly.

Type.—D. Participating.—An interdepartmental purchase which is negotiated by one department or independent establishment for definite or indefinite quantities of supplies and under which other departments or independent establishments order, receive, and make payments for the supplies needed by them.

E. Distributing.—An interdepartmental purchase which is negotiated by one department or independent establishment for definite quantities and under which the negotiating agency obtains deliveries and provides for inspections and deliveries to them of the supplies

included therein for other departments or independent establishments.

F. Manufacturing.—An interdepartmental purchase in which one department or independent establishment sells to other departments or independent establishments supplies which have been partly or wholly manufactured by the former.

Contract.—4. Integral.—An interdepartmental purchase in which one complete purchase transaction covers the procurement of the total definite requirements of the departments and independent establishments concerned.

5. Piecemeal.—An interdepartmental purchase in which several successive purchase transactions cover the procurement of the total definite requirements of the departments and independent establishments concerned.

6. Term.—An interdepartmental purchase in which contract is made for a period, varying from a week to a year, and under which orders may be placed from time to time for varying quantities as necessity arises.

Scope.—G. National.—An interdepartmental purchase in which the purchase transaction covers the requirements of the departments and independent establishments for the entire United States and, in some cases includes those for Alaska and the insular possessions.

H. Sectional.—An interdepartmental purchase in which the requirements of the departments and independent establishments are ascertained by large geographical areas and separate purchase arrangements made for each area or section.

J. Local.—An interdepartmental purchase in which the requirements of the departments and independent establishments are ascertained by small geographical areas or communities and separate purchase arrangements made for each area or community.

Market.—7. Seasonal.—This designation applied to a commodity indicates that the market is affected by influence that recur annually.

8. Cyclic.—This designation applied to a commodity indicates that the market is affected by influences that recur over longer periods than a year and correspond to some extent with the business cycle.

9. Irregular.—This designation applied to a commodity indicates that the market is affected by influences that bear no relation to the seasons or general business conditions.

Example.—Lubricating oils C3D6G9.

H. C. Smither,
Chief Coordinator.

FEDERAL SPECIFICATIONS BOARD

Since the issue of the 1928 Standards Yearbook, the following new master specifications have been issued:

F. S. B. No.

548. Bolts, nuts and machine screws.
549. Steel plates, marine boiler.
550. Steel, staybolt, boiler.
551. Laundry appliances.
552. Bronze, manganese, rods, bars, shapes, and plates.
553. Metal bases for plaster and stucco construction.
554. Mucilage.
555b. Shade cloth (revision). Supersedes that part of F. S. B. No. 367a which covered shade cloth.
556. Percale.
557. Drill (unbleached).
558. Trisodium phosphate, technical (phosphate cleaner).
559a. Bacon, canned (revision). Supersedes part of F. S. B. specification No. 267.
560a. Bacon, sweet-pickled, smoked (revision). Supersedes part of F. S. B. 267.
561a. Beef, corned, canned (revision). Supersedes part of F. S. B. 267.
562a. Beef tongue, canned (revision). Supersedes part of F. S. B. 267.
563a. Beef, dried, sliced, canned (revision). Supersedes part of F. S. B. 267.
564a. Head cheese (revision). Supersedes part of F. S. B. 267.
565a. Hams, sweet-pickled, smoked (revision). Supersedes part of F. S. B. 267.
566a. Hearts, beef (revision). Supersedes part of F. S. B. 267.
567a. Kidneys, beef (revision). Supersedes part of F. S. B. 267.
568a. Liver, beef (revision). Supersedes part of F. S. B. 267.
569a. Luncheon meat (revision). Supersedes part of F. S. B. 267.
570a. Mutton (revision). Supersedes part of F. S. B. 267.
571a. Pork (revision). Supersedes part of F. S. B. 267.
572a. Veal (revision). Supersedes part of F. S. B. 267.
573a. Sausage, pork (revision). Supersedes part of F. S. B. 267.
574a. Sausage, frankfurter-style (revision). Supersedes part of F. S. B. 267.
575a. Sausage, bologna-style (revision). Supersedes part of F. S. B. 267.
576a. Sausage, vienna-style, canned (revision). Supersedes part of F. S. B. 267.
577. Acetone.
578. Castings, copper, nickel-alloy.
579b. Sugar (revision): Supersedes part of F. S. B. 315a.
580. Unions, 300-pound malleable iron or steel.
581. Tires, bicycle, single-tube and clincher.
582. Paper, abrasive, artificial, waterproof.
583. Paper, garnet, waterproof.
584. Trowels, plastering, cement, brick, and pointing.

The following revisions of existing master specifications have been issued since the issue of the 1928 Standards Yearbook:

F. S. B. No.

4b. Oil, linseed, raw.
20a. Drier, paint, liquid.
34a. Powder, scouring, for floors.
60a. Safes and cabinets, insulated.
96c. Packing, asbestos sheet, compressed.
101c. Packing, flax.
126a. Iron, pig, foundry.
253b. Cheesecloth, bleached.
315b. Sirup.
343a. Pipe and fittings, soil, cast-iron, coated, and uncoated.
367b. Shades, window, rollers, slats, cords, and accessories.
378a. Iron, malleable, castings.
385a. Paper, flint.
386a. Paper, garnet.
387a. Cloth, abrasive, aluminum oxide.
388a. Cloth, emery.
415a. Blades, hack-saw.
444a. Integral waterproofing material.
472a. Thermometers, industrial.
475b. Oil, linseed, boiled.
497a. Bunting, wool.
555a. Shade cloth.
559a. Bacon, canned.
560a. Bacon, sweet-pickled, smoked.
561a. Beef, corned, canned.
562a. Beef tongue, canned.
563a. Beef, dried, sliced, canned.
564a. Head cheese.
565a. Hams, sweet-pickled, smoked.
566a. Hearts, beef.
567a. Kidneys, beef.
568a. Liver, beef.
569a. Luncheon meat.
570a. Mutton.
571a. Pork.
572a. Veal.
573a. Sausage, pork.
574a. Sausage, frankfurter-style.
575a. Sausage, bologna-style.
576a. Sausage, vienna-style, canned.
579b. Sugar.

Specification No. 109, Packing Rings for Boiler Blow-off Valves, has been canceled and superseded by Specification No. 96c, Compressed Asbestos Sheet Packing.

UNITED STATES CIVIL SERVICE COMMISSION

Tests for Engineers.—During the year the commission has extended its research in improvement of methods of selecting engineers. In the work it has the cooperation of the Society for the Promotion

of Engineering Education, engineers connected with universities, and engineers employed in private industry. The program undertaken involves the construction of measures so designed as to determine the extent to which an individual applicant possesses engineering information, as well as his ability to make practical application of that information.

Oral examinations are especially valuable in determining an applicant's method of procedure in a difficult situation. By means of carefully planned initial and follow-up questions, the problems presented can be uniformly controlled in the most practical manner. Oral examinations thus serve to verify the written tests in measuring the judgment and resourcefulness required to handle problems of the type involved in the work for which application is made. A more obvious value of oral examinations is that they provide opportunity for determining the applicant's manner, bearing, physical characteristics, and personality—qualities which can not be measured by a written, test.

Other Improved Test Methods.—Considerable progress has been made in the work of construction of examination tests of progressive degrees of difficulty for use in nontechnical examinations. Having available a great number of items ranging from very simple to very difficult, and knowing the degree of difficulty of each item by means of objective trials, it is possible to construct in a very short time a test of any desired range of difficulty, with the correct proportion of items of each degree.

COMPTROLLER GENERAL OF THE UNITED STATES

The General Accounting Office has standardized the following standard forms and procedures:

Standard Form 1044, schedule of collections.
Standard Form 1045, summary of collections.
Standard Form 1046, schedule of transfers and refunds.
Standard Form 1047, public voucher for refunds; letter form (original).
Standard Form 1048, public voucher for refunds; letter form (memorandum).
Standard Form 1049, public voucher for refunds; tabular form (original).
Standard Form 1050, public voucher for refunds; tabular form (memorandum).
(General Regulations No. 40, Supplement 1, September 20, 1927.)

Supplement No. 1 to General Regulations No. 40 was issued September 20, 1927, prescribing a procedure for receipt and disposition of, and accounting for, moneys received by officers and employees of the United States in their official capacities applicable to offices in Washington and, where conditions warranted, to field offices. Standard forms for use in connection with the procedure were also prescribed in the said supplement.

The procedure requires the scheduling of remittances by the receiving officer or employee and the forwarding periodically of such schedules and remittances to the fiscal officer of the office, bureau, department, etc., and a monthly verification of all transactions between the two officers.

Receipts belonging solely to the United States are deposited by the fiscal officer to the credit of the United States, as directed on the schedule of collections, but there are many remittances received which it may be necessary to refund in whole or in part, or from which certain charges must be paid, or which can not be applied promptly upon receipt. These receipts carried as special deposits by fiscal officers are scheduled and verified in the manner described in the preceding paragraph, but separate schedules are required to direct the fiscal officer (1) to transfer amounts to the credit of the United States and make refunds to remitters and (2) to pay expenses incurred and properly chargeable against particular remittances. For scheduling disbursements the standard Form No. 1024 or No. 1025 is used, while the amounts to be deposited or refunded are listed on the standard Form No. 1046. To accompany refund checks there has been provided standard forms of refund vouchers Nos. 1047 and 1049, on which will be shown the amount of remittance, the application thereof, and amount to be refunded, together with other pertinent matters relating to the transaction.

The schedules and refund vouchers are prepared in the administration offices in sufficient number to provide records for all concerned, the original schedules and vouchers being forwarded to the General Accounting Office with the accounts of the fiscal officers. By the use of the prescribed form of schedule of collections and refund vouchers, the preparation of numerous typewritten letters, identical in wording for the most part, to accompany remittances forwarded to fiscal officers has been eliminated and the operation of returning money to remitters has been simplified by use of the standard form of refund vouchers.

Standard Form 1052, statement of advertising rates.
Standard Form 1053, advertising order.
Standard Form 1054, public voucher for advertising (original).
Standard Form 1054a, public voucher for advertising (memorandum).
(General Regulations 66, January 30, 1928.)

Standard forms and procedure prescribed for Government advertising: Sworn statements of commercial advertising rates must be furnished by the publishers of publications in which advertisements are placed. The advertising order form can be used as a combined written authority of the head of department or establishment to

advertise and an order on the publisher to publish the advertisement. Standard voucher Form 1054 is required to be used in making payments for Government advertising.

Standard Form 1055, application for amounts due deceased or incompetent creditors of the United States. (General Regulations 42, Supplement 1, February 23, 1928.)

All claims covering amounts due deceased or incompetent creditors of the United States are required to be submitted on standard Form No. 1055, which supersedes all forms heretofore used. The claims to be applied for on the standard form embrace arrears of pay, etc., of deceased or incompetent civilian employees and officers and enlisted men in the military service, payments due deceased or incompetent contractors or other public creditors for supplies furnished or services performed, and payment of certain unpaid checks or warrants which can not be paid because of death or incompetency of payees.

Standard Form 1058, bill of lading (original).
Standard Form 1058a, bill of lading (memorandum).
Standard Form 1059, bill of lading (shipping order).
Standard Form 1060, temporary receipt.
Standard form 1061, certificate in lieu of lost bill of lading.
Standard Form 1062, extra or continuation sheet for each of the above forms.
(General Regulations 69, August 24, 1928.)

Standard forms are prescribed, and their use explained, covering transportation of Government property: A system of designating symbols is prescribed for identification of the department or establishment making the shipments. These forms, incorporating changes in the conditions of the contract with the carriers, are required to be used after December 31, 1928.

Standard Form 1038, application for advance of funds.
Standard Form 1039, statement to accompany accounts rendered under an advance of funds.
(General Regulations 59, October 19, 1926.)

Standard forms and procedure prescribed for accounting for advance of funds, under the subsistence expense act of 1926 (44 Stat. 689), to employees traveling on official business for the United States: Advances to employees may be made by disbursing officers authorized to pay reimbursement vouchers of such employees upon receipt of standard form of application. An account with each employee to whom funds are advanced must be maintained by the disbursing officer on the application form. A statement on standard Form 1039 is required to be submitted with each expense voucher, and upon completion of his travel the employee to whom an advance

has been made is required to pay direct to the disbursing officer any balance in excess of the amount expended by him for authorized expenses.

Standard Form 1018, special salary payment.
Standard Form 1040, receipt for cash payment for salary.
(General Regulations 60, December 9, 1926.)

Special payments for personal services made on other than regular pay days should be authorized by proper authority in order to avoid possibility of loss to the United States and protect accountability of disbursing officers. Standard Form 1018 has been prescribed for such purpose and requires a statement by a responsible officer of the pay status of employee. Form 1040 is provided for taking cash receipts for the midmonth salary payments and was made necessary by the change from semimonthly to monthly pay rolls authorized by General Regulations 54 of the General Accounting Office.

Standard Form 1041, affidavit to be executed by officers of the United States upon appointment to office. (General Regulations 62, December 27, 1926.)

Standard form and procedure prescribed to meet the provisions of the act of December 11, 1926, as amended March 2, 1927, which requires that each individual appointed as a civil officer of the United States by the President or by a court of law, or by the head of a department, shall file with the Comptroller General of the United States an affidavit stating that he has not given, transferred, promised, or paid any consideration for or in the expectation or hope of receiving assistance in securing such appointment.

Standard Form 1042 was adopted to serve as a schedule of checks drawn, collections, deposits in transit, and certificates of deposit, and is available for all bureaus and offices using a bookkeeping machine of a particular type.

Standard Form 1043, notice of collection of amounts suspended or disallowed. (General Regulations 63, April 7, 1927.)

Prompt adjustment of collections on account of item suspended or disallowed by the General Accounting Office in disbursing officers' accounts is accomplished by the procedure and form prescribed, which permits the early removal of items from the difference sheets, resulting in a saving of time in all offices concerned.

Standard Form 1051, flight certificate and schedule. (General Regulations 64, January 3, 1928.)

Standard form and procedure prescribed for supporting payments of flying pay to officers and enlisted men of the Army, Navy, Marine Corps, and Coast Guard: Uniformity obtained in the scheduling of flights made by members of these services and in the form of certificates of the flyers and their commanding officers.

Standard Form 1056, retirement record card. (General Regulations 65, January 20, 1928, and Supplement 1 of April 18, 1928.)

Standard form and procedure for reporting retirement deductions and interest thereon. The act of July 3, 1926, requires the Comptroller General of the United States to establish and maintain an account showing annual liabilities of the Government to the civil service retirement and disability fund and such other accounts as may be deemed necessary for a proper administration of the act. In order that the data needed for the accounts to be maintained might be accumulated and reported in a uniform manner by all Government departments and establishments, standard Form 1056, Retirement record card, was prescribed for the purpose of recording the required information. Provision has been made for showing on the record data that may be required from time to time by the board of actuaries in making the valuation of the fund authorized by law. General Regulations No. 65, issued January 20, 1928, and supplement thereto dated April 18, 1928, prescribe the use of the standard form and provide for submission of certain data to the General Accounting Office and the Department of the Interior, Bureau of Pensions, which will enable the Comptroller General of the United States to set up the accounts showing the equities of active, former, and retired employees, the liabilities of the United States, and fund income, expense, etc.

Standard Form 1057, pay voucher for six months' death gratuity pay. (General Regulations 68, August 4, 1928.)

For use in making payment of six months' death gratuity pay to beneficiaries of officers, enlisted men, and nurses of the Army, Navy, Marine Corps, and Coast Guard under the acts of December 17, 1919, and June 4, 1920, as amended.

The uniform appropriation and fund accounting system prescribed by the General Accounting Office in July, 1926, has been extended and is now in operation in many bureaus and offices of the various Government departments and establishments both in Washington and the field.

A uniform accounting system for disbursing offices has also been developed and is being installed in offices in Washington and the field.

Standardized accounting procedures prescribed by the General Accounting Office, in addition to those involving the use of standard forms, include the following:

Simplified uniform procedure of settlement between bureaus and offices in the same department or establishment, where services have been performed or supplies furnished by one bureau or office for another. (General Regulations 21, Supplement 1, March 12, 1928.)

Payment of amount of lost, stolen, or destroyed check when drawer is dead or no longer in service of the United States. (General Regulations 61, December 18, 1926.)

Numerical symbols assigned receipt titles, used by the Treasury Department in designating moneys covered into the Treasury of the United States for convenience of administrative and fiscal officers in depositing and accounting for moneys for which the latter are accountable. (General Regulations 67, June 27, 1928.)

Revision of classification of objects of expenditure prescribed for the purpose of uniformity and standardization in administrative fund accounting and in the analysis of governmental expenditures. (Bulletin No. 1, Supplement 3, August 26, 1927.)

With few exceptions, checks issued by Government disbursing officers are covered into an outstanding liability account in the Treasury after prescribed periods of time. Postmasters' checks drawn on local banks and on certain accounts with the Treasurer of the United States, formerly excepted, have now been brought under substantially the uniform procedure. By General Regulations 23, Supplement 2, May 31, 1927, and Supplement 3, August 16, 1928, these checks are now covered into an account "Outstanding liabilities, Postal Service checks," on the books of the General Accounting Office, when they have remained unpaid for three full fiscal years from July 1 after their dates of issue, and the proceeds covered into the Treasury to the credit of the Post Office Department.

The standardization of accounting forms and procedures results in a great saving in the annual expenditures for printing and binding and for the operating personnel of this office and of the various departments and establishments.

FEDERAL RADIO COMMISSION

Through its general orders, the Federal Radio Commission standardizes the conditions of operation of radio-transmitting stations. This has an indirect effect in determing the types of both transmitting and receiving apparatus manufactured. The commission has during the past year performed a direct task of standardization in establishing a channeling system for the radiofrequencies above 1,500 kilocycles per second. This system separates adjacent frequencies assignable to transmitting stations approximately two-tenths per cent. This system is being adopted also in foreign countries.

FEDERAL TRADE COMMISSION

The Federal Trade Commission contributes to standardization through its trade-practice conferences. It sponsors gatherings of a majority of representatives of a given industry for discussion of

unfair trade practices. An industry itself can, and usually does, adopt a set of business principles to be used thenceforth as accepted standards of that industry. Such standards are generally submitted to the commission for approval, and the commisssion leads the way for the industry itself to set them up. Among industries for which conferences were held in 1928 were cottonseed crushing, fur, glass distributing, grocery, hickory handle, millwork, mop manufacturing, paint and varnish, plate glass, publishing, rebuilt typewriter, and waxed paper.

GOVERNMENT PRINTING OFFICE

The Government Printing Office maintains a division of tests and technical control, for the purpose of inspecting and testing all materials offered and delivered for the use of the office; to prepare or assist in the preparation of standard specifications for all materials purchased; to exercise technical control over the quality and production of various materials used or produced, such as manufacture of printing inks, press rollers, type-metal alloys, and adhesive compositions; and to conduct technical research with relation to the various materials and processes used by the office in order to promote the best interests of the Government.

The research investigations of the technical division are of considerable value not only to the office itself, but to the printing industry in general. The results of all technical investigations are published for the benefit of the commercial industries. The Government Printing Office is becoming recognized as a research laboratory for the various branches of the printing, binding, and allied industries.

Standard technical specifications are being developed for all materials, and research is being conducted relative to various processes used in the office. The Government Printing Office includes practically every branch of the printing industry.

The following is an outline showing the scope of the technical work being conducted by the Government Printing Office:

Materials:
- Paper.
- Textiles—
  - Bookbinding cloths.
  - Book-sewing threads.
- Bookbinding leather.
- Ruling inks.
- Adhesives.
- Book-stamping materials.
- Detergents.
- Press rollers.
- Printing and writing inks—
  - (*a*) Raw materials.
  - (*b*) Finished inks.

Materials—Continued.
- Type-metal alloys—
  - (*a*) Linotype metal.
  - (*b*) Monotype metal.
  - (*c*) Stereotype metal.
  - (*d*) Electrotype backing-up metal.

Processes:
- Electroplating.
- Stereotyping.
- Photo-engraving.
- Various printing processes, such as offset, etc.

These investigations are conducted in cooperation with the—

Mechanical department of the American Newspaper Publishers Association.
Standardization committee and research department of the United Typothetæ of America.
National Association of Glue Manufacturers.
Technical Association of the Pulp and Paper Industry.
Paper manufacturers.
Type-metal supply companies.
Bookbinding-leather manufacturers.
Individual printing, binding, and allied manufacturers.

The Public Printer is a member of the standardization committee of the United Typothetæ of America.

The technical director is a member of the research and survey committee for the printing industries division of the American Society of Mechanical Engineers.

The Government Printing Office is represented on the Federal Specifications Board by the technical director and is also represented on nine technical committees of the Federal Specifications Board. It has three representatives on the Paper Specifications Committee appointed by the Joint Committee on Printing to fix the standards for paper for the public printing and binding and for use of the Government departments and establishments in the District of Columbia. The committee meets annually for the purpose of revising the specifications for paper for the use of the Government.

INLAND WATERWAYS CORPORATION

The corporation has investigated a number of types of boats suitable for different streams. It has investigated, and has data upon, the proper types of boats for streams from 4 to 6 foot navigable channel, for streams from 6 to 8 foot navigable channel, for streams from 8 to 12 foot navigable channel, and for the New York State Barge Canal. It has investigated various types of propulsion—stern wheel, twin screw tunnel type, Diesel direct drive and Diesel electric drive. It has investigated the question of fuel—ordinary coal, powdered coal, oil, gas, and Diesel.

It has thoroughly investigated the subject of terminals, and the governing principles controlling the type, and has experimented with direct lift, the escalator type, incline track, and floating terminal. It has advised with and cooperated in the planning of terminals for Kansas City, Minneapolis, St. Paul, Dubuque, Burlington, Davenport, Rock Island, Moline, St. Louis, East St. Louis, Cairo, Memphis, Helena (Ark.), Vicksburg, Baton Rouge, New Orleans, Mobile, Demopolis, Tuscaloosa, Holt, and Birmingham.

It has considered the subject of interior streams, of streams leading to the Gulf of Mexico, into the Atlantic, and into the Pacific, with a view to determining the facts desired.

INTERSTATE COMMERCE COMMISSION

The Interstate Commerce Commission prescribes standard systems of accounts for steam roads, water carriers, electric railways, sleeping-car companies, express companies, pipe-line companies, telephone companies, and telegraph and cable companies, subject to the interstate commerce act. All such carriers are required to file annual reports with the Interstate Commerce Commission on standard forms prepared by the commission.

The commission prescribes the manner in which carriers subject to the act shall prepare their publications containing the rates, charges, and regulations applicable to interstate commerce.

The commission prescribes regulations for the transportation of explosives and other dangerous articles by freight and express and as baggage, including specifications for shipping containers.

The commission, under authority of law, has prescribed the safety-appliance standards of freight and passenger train cars; has promulgated rules and instructions for the inspection and testing of locomotives and their appurtenances, and specifications for automatic train-stop or train-control devices.

The commission also fixes the limits of the standard-time zones for the continental United States and Alaska.

NATIONAL SCREW THREAD COMMISSION

In the interval which has elapsed since the publication of the commission's 1924 report several screw-thread standards, which were then in the early stages of development, have been completed; also, progress and change in industrial methods have necessitated some revision of the standards promulgated. The commission has now prepared and submitted for approval the second revision of its report, which is to be known as the 1928 report.

The general arrangement of the 1924 report has been retained with the addition of sections covering the following items: Wrench head bolts and nuts and wrench openings; other screw, bolt, and nut proportions by reference to certain specifications of the American Engineering Standards Committee and the Federal Specifications Board; standard practice for Acme screw threads, screw threads for oil-country drilling equipment by reference to specifications published by the American Petroleum Institute; standard hose connections for welding and cutting torches; rolled threads for screw shells of electric sockets and lamp bases; and a 12-pitch thread series for special applications.

Revisions of the previous specifications comprise: The addition of sizes from 1½ to 3 inches to the fine-thread series but with coarser

pitches than those originally published in the progress report of 1921; increase of the tolerance on minor diameter of nut, over the range of sizes smaller than 1⅛ inches, of the coarse and fine thread series; the insertion of the 3-inch diameter, 3½ threads per inch, in the coarse-thread series; the substitution of tables of specific pitch-diameter tolerances for threads of special diameters, pitches, and lengths of engagement in place of the method of determining such tolerances by adding together increments, thus establishing consistency with the pitch-diameter tolerances specified for the regular thread series; and revision of head proportions of wood screws. The specifications for pipe threads are carried over in this report in their original form pending completion of the work of the new A. S. A. Sectional Committee on the Standardization of Pipe Threads.

New material added to the appendixes includes the following as useful information: Recommended practice as to design and dimensions of threading tools; standard designs of blanks for plain and threaded plug and ring gauges; specifications covering class 5, wrench fit for threaded studs; common practice as to thread series and class of fit for screws, bolts, and nuts; and wire methods of measurement of thread thickness of Acme threads.

PUBLIC BUILDINGS AND PUBLIC PARKS

This office has participated, through a representative of the Interdepartmental Board of Contracts and Adjustments, in the standardization of Government contract forms.

The office is represented on seven subcommittees of the Federal Purchasing Board.

In addition, this office has participated in the work of standardization through representatives on several of the technical committees of the Federal Specifications Board. Engineers of this office served on the Technical Committee on Bituminous Roofing and Waterproofing Compounds and the Technical Committee on Road and Paving Materials.

UNITED STATES SHIPPING BOARD AND MERCHANT FLEET CORPORATION

The Shipping Board and Merchant Fleet Corporation are represented on the Federal Specifications Board, the American Marine Standards Committee, American Society for Testing Materials, and other bodies engaged in standardization work. Specifications issued by these various bodies are adopted for Shipping Board use in all cases possible. The board is cooperating to the fullest possible extent in the standardization work through its representatives on these various bodies.

VI. NATIONAL BUREAU OF STANDARDS

An outline of the origin and functions of the bureau is given in the 1927 Standards Yearbook. Circular No. 1 and the 1928 Annual Report of the Director should be consulted for a more comprehensive survey of the bureau's work.

RELATION TO GOVERNMENTAL AGENCIES

The relation of the bureau to the various governmental, Federal, State, and municipal agencies is outlined briefly in the 1927 Standards Yearbook.

RELATION TO SCIENCE, COMMERCE, AND INDUSTRY

PUBLICATIONS

The results of the bureau's work are made available in printed publications. Approximately 1,500 pamphlets have been issued to date. Releases to the daily press give briefly the outstanding features of the bureau's activities from a popular point of view. Technical abstracts are prepared for the use of scientific and technical journals. New knowledge of general or pure science and results of direct application in the industries are published in the Bureau of Standards Journal of Research, which is issued once a month. The first number of this journal appeared in July, 1928. It continues the publication of the two series of research papers previously issued—Scientific Papers and Technologic Papers. The union of pure and applied science in one journal will, it is believed, tend to bridge the gap between the two fields and thus shorten the lag between discovery and its application. This journal is obtainable on a subscription basis. Compiled technical or administrative matter is issued as a "circular"; for example, the standard petroleum oil tables, properties of aluminum and light alloys, test schedules, specifications, and the like. Codes and reference texts—for example, the codes of electrical and logging practice, and the manual for weights and measures officials, which must be carried about by the user—are issued in a series of Miscellaneous Publications of pocket size.

The program for the simplification of commercial practice leads to definite proposals known as Simplified Practice Recommendations. Charts, conference reports, and material not suitable for other series are published as Miscellaneous Publications.

The bureau's TECHNICAL NEWS BULLETIN is a monthly periodical containing progress reports of work in the laboratories, brief data on completed investigations, notices of important conferences, and lists of new publications by members of the staff, in the bureau's series and in technical journals. The MONTHLY NEWS BULLETIN of the Commercial Standards Group is issued in multigraph form and is sent to a large mailing list of manufacturers and industrial associations, distributors, and consumers interested in the bureau's simplification and commercial standards work. The bureau also prepares "letter circulars" on specialized subjects for use as replies to inquiries by mail. The 252 letter circulars prepared to date cover a wide range of subjects and represent material not yet ready to be included in the printed series. In addition to the Government publications, papers on subjects within the respective specialties are printed in outside journals.

The publications of the bureau are sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscriptions may be placed in advance for the BUREAU OF STANDARDS JOURNAL OF RESEARCH and for the TECHNICAL NEWS BULLETIN. The bureau issues a descriptive list (Circular No. 24, together with annual supplement) of its published material. Announcement cards giving titles of all new publications in the bureau's series are sent on request to those concerned with the work.

RESEARCH AND TESTING

RESEARCH

Research on problems arising in connection with standards is by act of Congress a primary function of the bureau. Such work includes the devising of methods and apparatus for the precise measurement of standards, the frequent intercomparison of standards to determine their permanency, and the evaluation of standards by absolute methods.

Physical Constants.—The precise determination of certain physical constants and of certain properties of materials is closely related to the establishment of standards. The standard-temperature scale, for example, is defined by a number of thermometric fixed points, such as the boiling point of oxygen, the freezing and boiling points of water, the boiling point of sulphur, and the freezing points of silver and gold. Careful redeterminations of important physical constants, such as the Newtonian constant of gravitation and the mechanical equivalent of heat, lead to more precise evaluations of these widely used "constants." The determination of the properties of saturated steam under high pressures finds immediate application in the design

of steam turbines, while new data on the properties of ammonia and carbon dioxide have corresponding uses in refrigeration engineering.

Research Associates.—Much of the bureau's research is directed to the application of science in commerce and industry. The research-associate [1] plan permits industrial associations or groups to place qualified men at the bureau for intensive study of selected problems approved by the Director of the National Bureau of Standards. Such men utilize the bureau's laboratory facilities and equipment and have the same status as any bureau employee except that their salaries are paid by the supporting group or association.

The work of a research associate on problems of concern to an entire industry is one of peculiar trust. Research results are immediately available to the industry concerned, and are frequently printed in bureau publications. Devices or processes developed during research may not be patented for the benefit of the individual or the group but are for the free use of the industry, the Government, and the public. Correspondence relating to the work of the research associate is conducted through official channels except on purely personal matters.

A list of the research associates and projects under investigation, arranged according to sustaining organizations, is given in the following table. Current work of research associates relating to standards of quality, performance, or practice is given under activities and accomplishments.

[1] For further details see B. S. Circular No. 296.

Research associates

Assigned by—	General field research	Specific project	Research associate
American Association of Textile Chemists and Colorists, W. E. Hadley, secretary, care of Clark Thread Co., Newark, N. J.	Textiles	Standardization of light-fading and washing tests for fastness of dyed fabrics.	Smith, W. C.
American Bureau of Welding, 29 West Thirty-ninth Street, New York, N. Y., and American Electric Railway Association, 292 Madison Avenue, New York, N. Y.; committee on welded rail joints.	Railway materials	Investigation and testing of welded rail joints	McKay, O. R.
American Chemical Society, rubber division, Mills Building, Washington, D. C.	Rubber	Effect of temperature and humidity on rubber compounds.	Rupert, F. E.
American Dental Association, Columbus, Ohio	Dentistry	Study of dental materials	Taylor, N. O.
American Electric Railway Engineering Association, R. H. Dalgleish, Thirty-sixth and M Streets, Washington, D. C.	Oils	Oils for use on street railways	McKee, T. R.
American Electroplaters Society, George Gehling, secretary-treasurer, 5001 Edmund Street, Philadelphia, Pa.	Electroplating	Spotting out of electroplated finishes	Barrows, W. P.
		Chromium plating	Farber, H. L.
American Face Brick Association, 130 North Wells Street, Chicago, Ill.	Structural materials	Prevention of stain on brick structures	Palmer, L. A.
American Gas Association, 420 Lexington Avenue, New York, N. Y.	Gas engineering	Methods of testing gas appliances to determine their safety. Design of burners.	Lutherer, A.
American Petroleum Institute, 250 Park Avenue, New York, N. Y.	Petroleum	Separation, identification, and determination of the chemical constituents of commercial petroleum fractions.	Bruun, J. H.; Jessup, R. S.; Leslie, R. T.; Schicktanz, S. T.
		Corrosion and its prevention in equipment of petroleum industry.	Scott, G. N.
American Society of Mechanical Engineers, C. B. Le Page, assistant secretary, 29 West Thirty-ninth Street, New York, N. Y.	High-temperature measurements	Steam tables	Osborne, N. S.; Stimson, H. F.
	Journal bearings	Investigation of journal bearings	Bell, H. P.
American Zinc Institute, 27 Cedar Street, New York, N. Y.	Metallury	Collection of information on zinc	Upton, F. P.
Asphalt Shingle and Roofing Institute, 2 West Forty-fifth Street, New York, N. Y.	Structuralg materials	Characteristics of felts and asphalts for preparation of bituminous roofing.	Strieter, O. G.
Associated Knit Underwear Manufacturers of America (Inc.), 329 Main Street, Utica, N. Y.	Textiles	Standardization and simplification of underwear sizes.	Hamlin, C. H.
Atlas Lumnite Cement Co., 25 Broadway, New York, N. Y.	Structural materials	Properties of high-alumina cement	Harrison, W.; Rapp, P.; Wright, C. W.
Better Fabrics League of America, 918 Barr Building, Washington, D. C.	Textiles	Suitability of household textiles for intended purposes.	Sturtevant, F. W.
Brown Co., Berlin, N. H.	Paper	Quality of purified wood fiber	Rasch, R. H.; Mead, E. W.
Bunting Brass & Bronze Co., 715–755 Spencer Street, Toledo, Ohio	Metallurgy	Testing of bronze bearing metals	Staples, E. M.
Bureau of Efficiency, Washington, D. C.	Paper	Improvement of paper currency	Hamill, G. K.; Worthington, V.
A. M. Byers Co., 235 Water Street, Pittsburgh, Pa.	Metallurgy	Properties of hand and mechanically puddled wrought iron.	Knight, O. A.
Cast-Iron Pipe Research Association, 566 Peoples Gas Building, Chicago, Ill.	Soil corrosion	Studying cause of soil corrosion of cast-iron pipe.	Holler, H. D.
Celite Products Co., Los Angeles, Calif.	Structural materials	Workability of concrete	Conahey, G.; Noonan, P.
Celotex Co., 645 North Michigan Boulevard, Chicago, Ill.	Heat transfer	Heat transmission of materials	Schmidt, L. D.
Committee on Glass, E. C. Sullivan, chairman, Corning Glass Works, Corning, N. Y.	Glass	Heat treatment of glass	Lloyd, D. B.; Saunders, J. B.
Common Brick Manufacturers Association, 2121 Guarantee Title Building, Cleveland, Ohio.	Structural materials	Brickwork	McBurney, J. W.

Commonwealth Fund, 1 East Fifty-seventh Street, New York, N. Y.	Carbohydrates	Chemistry of carbohydrates	Purves, C. B.
Copper and Brass Research Association, 25 Broadway, New York, N. Y.	Structural materials	Investigation of safe loading of corrugated copper roofing, etc.	Beij, K. H.; Melchior, L. F.
Cotton Textile Institute (Inc.), 320 Broadway, New York, N. Y.	Textiles	Cotton for specific uses	Mercier, A. A.
Dardelet Thread Lock Corporation, 120 Broadway, New York, N. Y.	Locking screw threads	Locking screw threads	C. H. Hochgesang; A. P. James.
Dorr Co., 247 Park Avenue, New York, N. Y.	Structural materials	Fine grinding of cement	Maust, E. J.
Elevator Safety Code Committee, subcommittee on research, approval, and interpretation, American Standards Association, 29 West Thirty-ninth Street, New York, N. Y.	Safety engineering	Elevator safety equipment; development of methods and instruments; construction, maintenance, operation, etc.	Brown, L. W.; Dickinson, J. A.; Seaquist, W. H.
Gypsum Industries, 844 Rush Street, Chicago, Ill.	Structural materials	Investigations of gypsum	Dailey, M. C.; Way, G. H.
Indiana Limestone Co., Bedford, Ind.	do	Properties of Indiana limestone, waterproofing, discoloring, etc.	Dutton, H. H.; Newcomer, H. E.
Insulite Co., Minneapolis, Minn.	Sound	Transmission of sound through walls and partitions	V. L. Chrisler.
International Association of Electrotypers of America, G. C. Stock, field secretary, Leader Building, Cleveland, Ohio.	Electrotyping	Copper electrotyping solutions	Hull, R. O.
International Education Board, 61 Broadway, New York, N. Y.	Optics	Spectral series carbohydrates	de Bruin, T. L.; Pacsu, Eugene.
Magnus Metal Co., 2234 West Forty-third Street, Chicago, Ill.	Metallurgy	Bearing metals	Harbaugh, W. LeC.
Metalloid Co., 53 West Jackson Boulevard, Chicago, Ill.	Nonmetallic earths	Absorption behavior of earthy materials	Hibben, J. H.; Metcalf, N. W.
Midvale Co., Nicetown, Philadelphia, Pa.	Metallurgy	Properties of steel at high temperatures	Kahlbaum, W.
National Association of Dyers and Cleaners, Silver Spring, Md.	Textiles	Fastness of dyes to dry cleaning; development of dry-cleaning processes.	Eichlin, A. S.
National Association of Glue Manufacturers, J. R. Powell, secretary, care of Armour Glue Works, 1355 West Thirty-first Street, Chicago, Ill.	Adhesives	Glue for use in paper sizing	Hamill, G. K.; White, W. E.
National Association of Hosiery and Underwear Manufacturers, 334 Fourth Avenue, New York, N. Y.	Textiles	Development of methods of measuring hosiery; standardization of twist with respect to dye application; lubricating oil for knitting machines.	Schenke, E. M.
National Research Council, Washington, D. C.	Carbohydrates	Carbohydrate research	Dale, J. K.; Austin, W. C.
	Atomic physics	Structure of the alkali atoms	Langer, R. M.
National Terra Cotta Society, 19 West Forty-fourth Street, New York, N. Y.	Structural materials	Investigation of architectural terra cotta	Fuller, D. H.; Pole, G. R.; Schurecht, H. G.
Phillips Petroleum Co., Bartlesville, Okla.	Gas burners	Design of burners for propane gas	Gibbs, L. T.
Portland Cement Association, 111 West Washington Street, Chicago, Ill.	Structural materials	Constitution and hardening of Portland cement.	Ashton, F. W.; Bogue, R. H.; Brownmiller, L. T.; Dillon, M. M.; Hansen, W. C.; Lerch, W.; Taylor, W. C.
Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y.	Automotive	Cooperative fuel research	Bishop, C. B.; Bridgeman, O. C.; Brooks, D. B.; Burr, R. A.; de Bruin, M. H.; Hicks, R. L.
		Automotive headlight investigation	Allen, H. H.
Steel & Tubes (Inc.), Cleveland, Ohio.	Steel structures	Welded steel tubing	Adelson, J. S.; Seaquist, E. O.
Steel Castings Development Bureau, 500 Stock Exchange Building, Philadelphia, Pa.	Metallurgy	Heat treatment of cast steel	McCrae, J. V.

Coordination with Other Research Laboratories.—With the aid of the National Research Council, Committee E–9 of the American Society for Testing Materials on Correlation of Research, the various research laboratories, and many national organizations, every effort is made to coordinate all bureau research work with that done by other bodies to provide the maximum national benefit and to avoid duplication of effort.

Research within the Government service is coordinated by the Chief Coordinator of the Bureau of the Budget.

TESTING

Through the testing of standards sent to the bureau by science and industry, research on standards finds its direct application and fruition. The common acceptance of, and conformity to, uniform standards of measurement are essential to the fullest development of the commerce and industry of the Nation. The testing service of the bureau provides the means of establishing this uniformity.

Fundamental testing involving a comparison, direct or otherwise, with reference standards covers a wide range, including such items as end standards of length; tolerance gauges; screw-thread gauges; standard invar tapes for precise geodetic work; precision weights; volumetric glassware of all kinds; precision timepieces; mercurial and other types of thermometers; pyrometers; barometers; pressure gauges; water-current meters; saccharimeters; electrical standards of electromotive force, resistance, inductance, and capacity; electrical measuring instruments; optical plane surfaces; and many others.

In addition, the bureau acts as a testing agency for the various departments of the Government and in this capacity conducts a great variety of tests to determine whether the item submitted conforms with specifications. This work includes performance tests of a great variety of machines, instruments, and mechanical appliances; analyses to determine the chemical composition or the purity of samples; tests of cement, lime, leather, paper, rubber, textiles, paints, varnishes, etc., to determine conformance with Federal specifications; and tests to determine the physical properties of metals and building materials. Branch testing laboratories are maintained at Northampton, Pa.; Columbus, Ohio; Denver, Colo.; and San Francisco, Calif. Tests of this character are made for the public only in instances where private laboratories are not suitably equipped.

Federal Testing Laboratories.—Several departments of the Federal Government have established laboratories for special testing work where required by the nature or number of tests. When specific investigations are under way the work is frequently divided and

coordinated among several Federal laboratories. A list of such laboratories was given on page 144 of the 1927 Standards Yearbook.

Commercial Testing Laboratories.—In accordance with law, the National Bureau of Standards makes tests and carries out investigations for other Government departments. Because of the large amount of this official work it is impracticable for the bureau to make tests for private individuals if other laboratories can do the work. In Miscellaneous Publication No. 90, entitled "Directory of Commercial Testing and College Research Laboratories," information is given concerning 271 commercial testing laboratories with 92 branch laboratories or offices. This list has been compiled in recognition of the desirability under present conditions of independent commercial testing service and in anticipation of a marked increase in the demand for such service in both domestic and export trade.

Heretofore purchasers not individually equipped to make their own acceptance tests have been reluctant to adopt the specification method of buying commodities because of the fixed belief that many manufacturers work off seconds on such customers. The knowledge that they can at any time, when they so desire, call upon testing laboratories to check the deliveries made to them on contracts based on specifications with which certificates have been issued by the manufacturers will induce a large number of such purchasers to take full advantage of the specification method of buying.

COMMERCIAL STANDARDS

COMMERCE

One of the most important facts about American industry is its ever-increasing efficiency. From 1919 to 1925 the output per wage earner in our factories increased nearly 40 per cent because of greater efficiency of the wage earners themselves, improved management, more scientific methods, wider use of labor-saving machinery, and the general effort of industry to eliminate waste.

In this effort the bureau has assisted nearly 100 industries to reduce the avoidable wastes resulting from the production and distribution of too many varieties of product. Excessive diversity in sizes, dimensions, grades, and qualities have been reduced in 95 different commodity fields to those varieties in common or general demand.

In response to steadily increasing demand by industry for the bureau's cooperation in this direction, there was set up in the bureau in September, 1927, an organization known as "the commercial standards group." The work of this group includes the simplification of commodity sizes and dimensions as carried on by the division

of simplified practice, cooperation with industry in selecting and establishing definite grades and qualities as commercial standards, promulgation of nationally recognized specifications, and the compilation of lists of willing-to-certify manufacturers of products made according to those specifications. The bureau's division of specifications engages in the last-named activity. The promotion of the standard building and plumbing codes produced by the cooperation of the division of building and housing is also included in the work of the commercial standards group.

Assistance in the correlation of the specifications produced by the Federal Specifications Board with those produced by commercial agencies is contemplated by the commercial standards group, which will have liaison duties with other branches of the Department of Commerce and with other departments on matters relating to commercial standards.

In formulating the plans and policies for the guidance of the activities of the commercial standards group, the assistant director is aided by a planning committee, which meets quarterly at the Department of Commerce. This committee, which was appointed by the Secretary of Commerce at the inception of simplified practice, is comprised of the following:

G. A. Renard, secretary, National Association of Purchasing Agents, New York, N. Y.; F. M. Feiker, managing director, Associated Business Papers (Inc.), New York, N. Y.; E. W. McCullough, manager, department of manufacture, Chamber of Commerce, Washington, D. C.; L. G. Puchta, vice president, National Supply & Machinery Distributors' Association, Cincinnati, Ohio; A. W. Shaw, president A. W. Shaw Co., Chicago, Ill.; Brig. Gen. Henry C. Smither, Chief Coordinator Bureau of the Budget, Washington, D. C.; A. A. Stevenson, vice president in charge of manufacture (Standard Steel Works Co., Philadelphia), representing the American Standards Association; and L. W. Wallace, executive secretary, American Engineering Council, Washington, D. C.

Simplified Practice.—Simplified practice is a method of eliminating superfluous variety. It is applied by the collective action of producers, distributors, and consumers, with the cooperation of the division of simplified practice, to eliminate needless variety in sizes, dimensions, and types of commonplace commodities. This method is based on the sensible avoidance of waste caused by excessive and uneconomic diversity. Simplified practice decreases costs and increases the utility and efficiency of production, distribution, and consumption. These ends are accomplished by voluntarily limiting varieties of stock items to those for which there is a constant demand.

Commercial Standards.—A service and procedure has been arranged for establishing as "commercial standards" such nationally recognized specifications as are fully indorsed by the industries concerned. The procedure provides ample safeguards to insure full cooperation and coordination without domination by any group in the selection and approval of a standard. The chief mission is promotional in character, to provide support for a specification or a standard which an industry and its related groups may want to promulgate on a nation-wide or a world-wide basis; to determine its eligibility for promulgation; to publish and broadcast it in the event the prerequisites, including a satisfactory majority of signed acceptances, have been met; to facilitate the application of the certification plan for the assurance and convenience of the small purchaser; to arrange a forum in cooperation with the Bureau of Foreign and Domestic Commerce for the selection and translation of specifications in the promotion of foreign commerce; and to provide a means for controlling periodical audits of adherence.

1. The first step in the procedure is a specific request from some part of industry for the services of the Bureau of Standards looking toward the promulgation of a commercial standard. This service will be extended only upon specific request. Following such request, a preliminary canvass is made to determine the consensus of opinion regarding advantages and benefits of promulgating such commercial standards and probable amount of cooperation which may be expected.

2. If there is ample prospect of full cooperation, a preliminary conference is arranged to survey available standards or to delegate the work of making such a survey. Occassionally this survey may be unnecessary, when it is demonstrated that a given specification is so generally acceptable that it logically forms the basis for consideration as the commercial standard in its field.

3. In the event a survey is necessary, a committee appointed by industry obtains data on present adherence to the various standards in the field, present production and demand for various sizes and qualities, and recommends a given specification limiting grades, qualities, sizes, etc., as a tentative standard to serve as a basis for consideration at the general conference.

4. Acting upon the recommendations of the preliminary conference or the survey committee, agenda are prepared for a general conference of industry, including producers, distributors, and organized consumers. Said agenda are then referred to the proper technical division of the Bureau of Standards for review to insure compatibility with present trend of progress in the art or with recommendations resulting from research or tests, as well as recommendations

supported by various technical societies. When this review has been completed and adjustments made as circumstances warrant, the agenda are then submitted to the committee of industry for review and authorization to call a general conference of all interests.

5. Following such authorization, the Bureau of Standards then forwards the agenda to all known manufacturers, distributors, and organized consumers with an invitation to attend a conference at a specific time and place, usually Washington, D. C. This general conference considers what action is feasible and desirable regarding further distribution, broader promulgation, and application of the recommended standard and votes to establish it as a commercial standard.

6. The Bureau of Standards then disseminates the recommendations of the general conference, with requests for written acceptances from each unit of the whole industry, including manufacturers, distributors, and organized consumers. Upon receipt of signed acceptances representing a satisfactory majority of production or consumption of a commodity by volume, the recommendations are published in uniform style as "commercial standards" and issued to all interested groups.

7. A certification plan is employed in connection with commercial standards by which manufacturers may certify to the consumer that their product is made in accordance with the commercial standard, thus assuring the small consumer that goods purchased will be made in accordance with the specification, without the necessity of his employing laboratory tests to prove the fact.

8. Provision for regular revision is made by the appointment of a standing committee to consider periodically any necessity for revision or extension of the commercial standard, in order that it may be kept constantly compatible with progress in the art.

9. With the cooperation of the Bureau of Foreign and Domestic Commerce an opportunity is provided for the translation and official publication of the commercial standards in other languages as a basis for the extension of foreign commerce through the foreign-trade representatives, particularly in those fields where potential foreign markets are known to exist.

Specifications.—To promote and facilitate the use and unification of specifications, the Bureau of Standards carries on activities involving cooperation with (*a*) technical societies, trade associations, (*b*) and (*c*) Federal, State, and municipal government specifications making and using agencies, (*d*), (*e*), and (*f*) producers, distributors, and consumers, and (*g*) testing and research laboratories.

(*a*) Cooperation with technical societies and trade associations includes ascertaining the standardization and specification promoting activities of these organizations and bringing to their attention the

work being done by the National Bureau of Standards. It also includes the offering of such assistance as it can render in bringing about a change from the prevalent hit-or-miss method of specifying, manufacturing, and testing to a logical method of formulating specifications, manufacturing in conformity therewith, and testing to insure or guarantee compliance therewith.

(*b*) Cooperation with Federal Government specifications making and using agencies involves bringing the United States Government master specifications to the attention of the maximum number of producers and the maximum number of users of commodities covered by these specifications, thereby assisting in broadening the field of supply.

(*c*) Cooperation with State and municipal standardizing and specifications using agencies involves the compilation of a complete list of such agencies, ascertaining the scope of their activities, and offering them the friendly assistance of the Bureau of Standards in substituting the specification for the trade-brand method of buying.

(*d*) Cooperation with producers involves the compilation of complete lists of manufacturers of commodities covered by United States Government master specifications or those conforming to commercial standards and distributing to buyers lists of such of these manufacturers as are desirous of supplying material in conformity with these specifications and standards.

(*e*) Cooperation with distributors involves bringing to their attention the benefits to be derived by them, both as buyers and as sellers, from handling nationally specified, certified, and labeled commodities.

(*f*) Cooperation with consumers involves bringing to their attention the benefits to be derived by them from buying under nationally recognized specifications and commercial standards and facilitating the use of specifications by means of the certification plan applied to nationally recognized specifications (guaranty of quality in delivered commodities which may or may not be labeled) and labeling applied to national standard commodities for identification and which may or may not carry a guaranty.

(*g*) Cooperation with testing and research laboratories involves the compilation, keeping up to date, and distribution of complete lists of commercial testing and college research laboratories for the benefit of not only these laboratories, but also of both the manufacturers and the users of commodities purchased under specifications.

Building and Housing.—The bureau cooperates with business, technical, and professional groups in practically all its undertakings on building and housing. Its work to modernize building codes and to encourage improved standards for the quality of building con-

struction promotes the practical application of the latest development in design and use of building materials. In furthering home ownership, an effort is made to develop an enlarged, steadier, more intelligent, and more discriminating demand for soundly built dwellings, the largest single class of buildings which the construction industries provide. The bureau also cooperates with many business and professional groups in efforts to distribute building activity more evenly throughout the year and to secure less fluctuation from year to year. The work on city planning and zoning has in mind the broad objective of buildings made more useful because well located with respect to other buildings, a well-coordinated street system, and appropriate public works. Good city planning and zoning likewise encourage stability in land values and property uses and thereby contribute to the demand for durable structures.

Standards in Foreign Trade.—A group of industries and organizations have indicated that the work of translating, publishing, and distributing American standards of value in foreign trade should be carried out under the auspices of the Department of Commerce, which division of the Government now maintains a field staff for promotion of commerce abroad. Accordingly, cooperative arrangements have been made between the Bureau of Foreign and Domestic Commerce and the Bureau of Standards to ascertain the desires of industry with respect to translation of such commercial standards as may possess potential foreign markets and to accede to them as far as practicable by sponsoring the translation and publication of such standards in those foreign languages most in demand.

LIAISON

Advisory Committees.—Where a group interested in the formulation of standards for a given industry or in the investigation of specific subjects is not otherwise organized for the purpose the bureau encourages the formation of an advisory committee. These committees function much the same as an informal industrial committee except that the secretarial work is usually conducted by the bureau.

Advisory committees

Name	Purpose	Secretary	Membership
Research Committee of American Electroplaters' Society.	To advise on research work on electroplating problems.	R. J. O'Connor (chairman), 1228 Noble Avenue, Bridgeport, Conn.	Foreman electroplaters.
Advisory Committee on Arch Dam Investigation.	In charge of construction and testing of arch dam in California, 60 feet in height.	Fred A. Noetzli, 928 Central Building, Los Angeles, Calif.	Consulting and professional engineers.
Building-Code Committee.	To formulate and recommend provisions for municipal building-code regulations.	George N. Thompson, division of building and housing, Department of Commerce, Washington, D. C.	Prominent architects and engineers.

Advisory committees—Continued

Name	Purpose	Secretary	Membership
Advisory Committee on Cement.	To advise on work on the constitution and hardening of Portland cement.	George E. Warren, Portland Cement Association, 33 West Grand Avenue, Chicago, Ill.	Committees of Portland Cement Association and American Society of Civil Engineers.
Advisory Committee on Ceramics.	To assist in outlining proposed investigations and reviewing results obtained.	A. V. Bleininger (chairman), Homer Laughlin China Co., Newell, W. Va.	Ceramic associations, brick associations, and tile associations.
Advisory Committee on City Planning and Zoning.	To encourage proper city planning and zoning by drafting standard State enabling acts under which municipalities may take action, and through other publications.	James Spear Taylor, division of building and housing, Department of Commerce, Washington, D. C.	City planners, engineers, realtors, and housing experts.
Advisory Committee on Cleaning.	To advise on technical questions dealing with dry cleaning and redyeing of textiles.	I. M. Tull, National Association of Dyers and Cleaners, Silver Spring, Md.	National Association of Dyers and Cleaners.
----Do----------	------do----------	W. G. Stoddard, 128 Peachtree Street, Atlanta, Ga.	National Association Institute for Dyeing and Cleaning.
Joint Steering Committee on Cooperative Fuel Research.	To assist in formulating program and defining scope of investigations in connection with cooperative fuel research.	C. B. Veal (research manager), care of Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y.	Society of Automotive Engineers; American Petroleum Institute; National Automobile Chamber of Commerce.
Advisory Committee on Cotton.	To advise on technical questions dealing with cotton.	R. T. Fisher, 80 Federal Street, Boston, Mass.	Manufacturers of cotton textiles.
----Do----------	To advise on extent of uses for cotton.	E. C. Morse, Cotton Textile Institute, 320 Broadway, New York, N. Y.	Textile Institute.
Advisory Committee on Cordage.	To advise on technical questions dealing with cordage.	J. S. McDaniel (chairman), 350 Madison Avenue, New York, N. Y.	Cordage Institute.
Advisory Committee on Enameled Sanitary Ware.	To standardize nomenclature, definitions, grading rules, essential dimensions, and types of enameled sanitary ware.	I. J. Fairchild, National Bureau of Standards, Washington, D. C.	All manufacturers of enameled sanitary ware
Subcommittee on Research, Interpretations, and Recommendations of Sectional Committee for Elevator Safety Code.	Performance of elevator safety equipment.	General performance of car under action of hydraulic oil buffers and undercar safeties, including velocities and retardations.	J. A. Dickinson; W. H. Seaquist; L.W. Brown.
Ferrous Metals Advisory Committee.	To guide bureau in selection of research problems in ferrous metals.	Prof. G. B. Waterhouse (chairman), Massachusetts Institute of Technology, Cambridge, Mass.	A. S. T. M., associations of automotive, mining, and metallurgical engineers and foundrymen, and American Society for Steel Treating.
Advisory Committee on Fire Tests with Metal Furniture.	To develop information for reduction of fire hazard and protection of records.	J. D. M. Phillips, Union Trust Building, Cleveland, Ohio.	National Association of Steel Furniture Manufacturers.
Advisory Committee on Gypsum.	To review and criticize work of The Gypsum Industries.	H. J. Schweim, The Gypsum Industries, 844 Rush Street, Chicago, Ill.	Technical problems committee of The Gypsum Industries.
Advisory Committee on Hollow-Tile Investigation.	To assist in formulating program and defining scope of the researches on the properties of clay hollow tile.	J. T. Howington (chairman), Coral Ridge Clay Products Co., Louisville, Ky.	Hollow Building Tile Association.
Advisory Committee on Hosiery.	To advise on technical questions dealing with hosiery.	John N. McCullaugh, National Association of Hosiery and Underwear Manufacturers, 334 Fourth Avenue, New York, N. Y.	Hosiery manufacturers.
Research Committee of International Association of Electrotypers.	To advise on research on electrotyping problems.	Daniel Hoynes (chairman), Central Electrotype Co., 1760 West Forty-second Street, Cleveland, Ohio.	Employing electrotypers.
Advisory Committee on Leather.	To advise regarding effects of various acids on the life and properties of leather.	T. Blackadder (chairman), care of Chas. Lennig & Co., Bridesburg, Pa.	American Leather Chemists Association and Tanners' Council of America.

Advisory committees—Continued

Name	Purpose	Secretary	Membership
Advisory Committee on Leather.	To advise on technical questions dealing with leather.	J. A. Wilson (chairman), care of A. F. Gallun & Sons, Milwaukee, Wis.	American Leather Chemists' Association.
Nonferrous Metals Advisory Committee.	To guide bureau in selection of research problems on nonferrous metals.	W. M. Corse, Investment Building, Washington, D. C.	A. S. T. M., Government departments, and associations of electrochemical, mechanical, mining, and metallurgical engineers.
Subcommittee on Plumbing, Building Code Committee.	To formulate and recommend provisions for State and municipal regulations of plumbing installations.	George N. Thompson, division of building and housing, Department of Commerce, Washington, D. C.	Sanitary and civil engineers.
Advisory Committee on Porcelain Plumbing Fixtures.	To standardize nomenclature, definitions, grading rules, essential dimensions, and types of porcelain plumbing fixtures.	I. J. Fairchild, National Bureau of Standards, Washington, D. C.	All manufacturers of porcelain plumbing fixtures.
Committee on Program on Transverse Fissures in Rails.	To study causes of rail failure.	J. R. Freeman, jr., National Bureau of Standards, Washington, D. C.	Associations of civil and railway engineers and rail manufacturers.
Committee on Properties of Steam and the Extension of the Steam Table.	To direct research on the properties of steam and the extension of the steam table.	George A. Orrok (chairman), 124 East Fifteenth Street, New York, N. Y.	American Society of Mechanical Engineers.
Radio Advisory Committee.	To assist in formulating and revising program of research in radio communication.	J. H. Dellinger, National Bureau of Standards, Washington, D. C.	Associations of radio engineers, electrical engineers, broadcasters, radio and electrical manufacturers.
Riding Qualities Subcommittee of Research Committee of Society of Automotive Engineers.	To assist in formulating program of research on riding qualities of motor vehicles.	H. C. Dickinson (chairman), National Bureau of Standards, Washington, D. C.	Society of Automotive Engineers.
Society of Automotive Engineers Research Committee.	To assist in formulating program on automobile headlight research.	----do----	Society of Automotive Engineers; National Automobile Chamber of Commerce.
Special Research Committee on Lubrication.	To assist in formulating program and defining scope of investigations in connection with cooperative lubrication research.	Alan E. Flowers, engineer in charge of development, The De Laval Separator Co., Poughkeepsie, N. Y.	American Society of Mechanical Engineers.
Advisory Committee on Standardization of Builders' Hardware.	To standardize finishes, nomenclature, definitions, types, and general practice affecting builders hardware.	I. J. Fairchild, National Bureau of Standards, Washington, D. C.	All manufacturers of builders' hardware.
Standard State Mechanics' Lien Act Committee.	To draft a uniform mechanics' lien act for consideration by State legislatures.	Dan H. Wheeler, division of building and housing, Department of Commerce, Washington, D. C.	Architects, lawyers, credit men, and associations connected with building or construction operations.
Advisory Committee on Structures and Fabricated Metals.	The development of apparatus and methods of test to obtain data for correlation of properties of material with behavior of the structure under load.	J. H. Nelson (chairman), Wyman-Gordon Co., Worcester, Mass.	Government departments, engineering societies, steel manufacturers, shipbuiding corporations, engineers, and college professors.
Tank-Car Committee	Investigation of tank-car valves.	A. E. Smith (chairman), Union Tank Car Co., 134 North La Salle Street, Chicago, Ill.	American Railway Association; American Petroleum Institute, American Railway Car Institute.
Advisory Committee on Underwear.	To advise on technical questions dealing with underwear.	Roy A. Cheney, Associated Knit Underwear Manufacturers, Union Station, Utica, N. Y.	Underwear manufacturers.
Manufacturers Advisory Committee on Vitreous China Plumbing Fixtures.	To standardize nomenclature, definitions, grading rules, essential dimensions, and types of vitreous china plumbing fixtures.	I. J. Fairchild, National Bureau of Standards, Washington, D. C.	All manufacturers of vitreous china plumbing fixtures.
Advisory Committee on Wool.	To advise on technical questions dealing with wool.	Walter Humphreys, 80 Federal Street, Boston, Mass.	Manufacturers of wool textiles.

Other Cooperative Activities.—Many national organizations assist the bureau in research, standardization, and simplification projects, and, in turn, the bureau cooperates officially with numerous national organizations engaged in similar efforts, frequently designating members of the staff to serve on committees.

SOME ACTIVITIES AND ACCOMPLISHMENTS

PRACTICAL APPLICATION

Except for necessary administrative functions, all activities of the bureau are directed toward some phase of standardization, from the pursuit of data to serve as the groundword or foundation for fundamental standards, master specifications, and commodity standards to the final check of delivered material for conformity to specification requirements.

The fundamental standards of length, mass, time, and all the other bases of measurement rest upon scientific data of the highest order. As the technique of the various arts, professions, and trades improves, the standards, which are essential tools of the art, must be further refined and more carefully protected from change. The ideal standard of measurement is one that has been defined in terms of a fundamental constant of nature so as to be easily reproduced in the event of destruction of the physical prototype. Thus the inch, upon which so many of our national standards depend, can be reproduced in terms of the wave length of the red cadmium line with an error of less than 1 part in 1,000,000.

The increasing complexity of our industrial and commercial structure is constantly creating new fields in which standards must be developed. Extensive research is crystallized in the standardization of radiofrequency or wave-length measurements, now a vital part of our radio communication system, though an undreamed of requirement 10 years ago. It is therefore essential that the bureau should keep in step with progress in the arts so that standards of measurement may be available as needed.

The results of research are also utilized in the preparation of United States Government master specifications, and the testing facilities of the bureau aid the various departments of the Government in checking delivered materials for compliance with specifications. Such research and tests provide the necessary foundation of unchallenged fact for the various standardization activities of the bureau.

Representative activities and accomplishments are listed alphabetically under titles selected in a practical way for the convenience of the reader without any attempt at systematic classification.

AERONAUTICS

Aircraft Radio Research.—A directive radiobeacon system, using a visual indicator instead of aural reception, was developed as an aid to air navigation. The system employs a visual indicator on the instrument board of the airplane which permits the pilot to follow an airway course in fog or darkness without regard to visible landmarks. When desired, this visual indicator can be thrown out of the circuit and a special receiving set used to pick up telephone or telegraph signals by means of head phones. This receiving set is of a very sensitive type and uses a special form of airplane antenna consisting of a short vertical rod, thus overcoming a number of disadvantages of the trailing-wire antenna.

The use of a very sensitive receiving set necessitates careful shielding of the engine ignition system. A successful shielding was developed which is easily installed and maintained. The spark plugs were found to be a source of considerable interference, and this was eliminated either by use of special shielding caps installed over the spark plugs or by the use of special spark plugs in which the shield is incorporated in the plug.

An airplane of the Pitcairn Aviation (Inc.), in regular use between New York and Washington on the New York-Atlanta air-mail route, was equipped with receiving set and visual indicator. Three airplanes of the National Air Transport Co., air-mail contractor from New York to Chicago, have been equipped with engine shielding, and the owners plan to install radio-receiving equipment. A radio beacon is already in use at College Park, Md., on the New York-Atlanta route, and another, of the visual type, is being installed by the bureau at Bellefonte, Pa., a landing field on the New York-Chicago airway. These installations will give operating data on the beacon system.

Several manufacturers are interested in the problem of equipping airplanes with radio receiving and transmitting sets and are actively engaged in development work. One company is now ready to sell receiving sets with visual indicators and to install them on airplanes, together with complete engine ignition shielding, and it is possible that one or two other companes will soon be able to furnish similar equipment. Several firms are now able to furnish shielding harness for most of the common types of airplane engines, spark-plug covers, and shielded spark plugs.

Publications.—Apparent Night Variations with Crossed-coil Radiobeacons, Haraden Pratt, Proc. Inst. Radio Engrs., **16**, No. 5, p. 652; May, 1928.

Development of Radio Aids to Air Navigation, J. H. Dillinger and Haraden Pratt, Proc. Inst. Radio Engrs., **16**, No. 7, p. 890; July, 1928.

Bibliography on Aircraft Radio, C. B. Jolliffe and E. M. Zandonini, Proc. Inst. Radio Engrs., **16**, No. 7, p. 985; July, 1928.

Note on Radio-frequency Transformer Theory, H. Diamond and E. Z. Stowell, Proc. Inst. Radio Engrs. (in press).

Receiving Sets for Aircraft Beacon and Telephony, H. Pratt and H. Diamond, B. S. Jour. Research, 1, No. 4, p. 543.

Unidirectional Radiobeacon for Aircraft, E. Z. Stowell, B. S. Jour. Research, 1, No. 35, p. 1011.

Design of Tuned-reed Indicators for Aircraft Radiobeacon, F. W. Dunmore, B. S. Jour. Research, 1, No. 5, p. 751.

Aeronautic Instruments.—Technical assistance is being given in the preparation of purchase specifications for service aircraft instruments, the development of instruments and apparatus for use in flight tests of aircraft, and the standardization of the sizes of instruments.

Test data are being accumulated at the bureau on the effect of temperature, vibration, pressure changes, and elastic defects on the performance of service aircraft instruments purchased by the Bureau of Aeronautics. Desirable improvements in the performance and reliability of the instruments are thus brought to light and are incorporated into the instruments with the active cooperation of the Bureau of Aeronautics and the manufacturers. During the past year there has been definite improvement in the performance of altimeters and airspeed indicators; work is in progress on pressure gauges, engine thermometers, tachometers, and other instruments.

The methods of test are being modified in order to obtain quantitative instead of qualitative data. Particular attention is now being given to standardizing the tests for the effect of vibration. A new vibration rack has been constructed which enables independent control of the frequency and amplitude of the vibration. Data are being obtained on the effect of vibration and of the orientation of the instrument. This will give information which will greatly aid in standardizing this test in proper relation to the performance which can be expected from instruments.

The time has arrived for standardizing the size of instruments, bearing in mind the requirements of proper sensitivity, low weight, and ease of manufacture. The Bureau of Aeronautics and the Air Corps have authorized work on this subject. As a first step, specifications have been issued by the Bureau of Aeronautics covering altimeters, airspeed indicators, and tachometers, each having a dial diameter of 2¾ inches, with cases which allow interchangeable mounting on the instrument board. Altimeters and air-speed indicators of this size, which fully meet specifications, are already available, and progress is being made in the manufacture of the tachometer. The Bureau of Standards rendered technical assistance in the preparation of the specifications and subjected the first instruments produced to complete performance tests.

Type Testing of Commercial Airplane Engines.—The Bureau of Standards is by law the testing laboratory for the Aeronautics Branch of the Department of Commerce and as such has assisted in the formulation of technical requirements governing the approval of new types of commercial airplane engines for use in licensed airplanes. Since March, 1928, the bureau has been continuously engaged in testing such engines. A number have been approved, after passing a 50-hour endurance test similar to that required by the military services. In case an engine fails to pass the test, the probable causes of failure are pointed out, and the manufacturer is permitted to submit a second engine of improved design for retest.

These tests of air-cooled engines are made either (1) on a torque stand at College Park, Md., using 4-blade test propellers specially designed to absorb the power and produce a high-velocity air blast on the engine, or (2) in the dynamometer laboratory where the power is absorbed by an electric dynamometer and the cooling blast is furnished by an auxiliary blower. Water-cooled engines can most readily be tested in the laboratory, since no air blast is required for cooling.

Supercharging of Aircraft Engines.—The altitude laboratory has been provided with improved exhausters and increased air-cooling capacity. This will permit carrying the altitude chamber tests under ideal supercharging conditions (mentioned in the 1928 Yearbook) up to at least 25,000 feet. Altitude tests of a Curtiss D–12 engine equipped with a Roots type supercharger are also contemplated.

Gaseous Fuels for Aircraft.—In view of the possibility of increasing the cruising range of lighter-than-air craft through the use of gaseous fuels, an experimental gas-air mixing valve was designed, at the request of the Navy, to be used on an available gasoline engine. The performance of this engine on aviation gasoline, on city illuminating gas, and on mixtures of the two, was studied. Illuminating gas and various gaseous fuels of higher calorific power have since been compared, using the same engine. Further tests of gaseous fuels are being made in a single-cylinder Liberty engine, the compression ratio of which can be varied from 5 : 1 to 9 : 1.

Vapor Lock Investigation.—The bureau has recently undertaken a study of aviation gasolines in order to develop, if possible, a suitable means of distinguishing between fuels which are suitable for use in airplane engines and those which are unsuitable from the point of view of possible difficulty from vapor lock. Vapor lock means the stoppage of gasoline flow because of the formation of gas bubbles in the carburetor or elsewhere in the fuel system. The Federal specifications for aviation gasoline provide that the 5 per cent point on the American Society for Testing Materials' distillation curve shall

not be less than 50° C. (122° F.) as a safeguard against vapor lock, but it is believed that this limits the volatility without any assurance that gasolines which meet this requirement may not cause vapor lock.

Embrittlement of Sheet Duralumin.—Both laboratory and exposure tests have shown that intercrystalline embrittlement by corrosion may be minimized if the material is heat treated by quenching it in cold water instead of in hot water or oil, followed by aging at room temperature instead of at elevated temperatures. Cold-water quenching is now recommended in Army Air Service specifications. Under severe corrosive conditions, especially near the seacoast, even the correctly heat-treated material is not entirely free from embrittlement and needs protection. In all tests the duralumin sheet coated with pure aluminum has continued to give the best results. Of the nonmetallic protective coatings, those which remain somewhat flexible on exposure are preferable. Full accounts of the work so far completed are given in National Advisory Committee for Aeronautics, Technical Notes Nos. 282 to 285, inclusive, by H. S. Rawdon. Experiments are now in progress on the value of nonmetallic coatings for protection of magnesium and its alloys in sheet form. The effect of static tensile stress and of repeated flexural stress on the rate of intercrystalline corrosion of sheet duralumin is being studied.

AUTOMOTIVE FUELS AND ENGINEERING

Thermodynamic Properties of Petroleum Hydrocarbons.—In cooperation with the American Petroleum Institute, two investigations were initiated during the year: (1) A calorimetric investigation on specific heat, latent heat of vaporization, and heat of reaction during cracking; and (2) an investigation on thermal expansion of commercial petroleum products.

The design and construction of special apparatus for the calorimetric investigation has been nearly completed. The calorimeter, which is of the aneroid type, was made of an alloy (80 Cu.–20 Ni.) and gold-plated to minimize corrosion on the internal surface and radiation loss from the external surface.

Thermal-expansion measurements within the temperature range 0 to 50° C. have been completed on the following commercial products: 15 cracked gasolines, 6 straight-run gasolines, 3 motor benzols, and 5 mixtures of straight-run gasoline and motor benzol. The coefficients of expansion of these products were found to be greater than those used as a basis for Bureau of Standards Circular No. 154, National Standard Petroleum Oil Tables, by the following approximate amounts: Liquid-phase cracked gasoline, 5 per cent; vapor-phase cracked gasolines, 10 per cent; mixtures of 75 parts straight-run gasoline and 25 parts motor benzol, by volume, 10 per cent;

mixtures of 50 parts straight-run gasoline and 50 parts motor benzol, by volume, 20 per cent; and motor benzol, 35 per cent.

Before undertaking these experimental investigations a critical study was made of the data available on the subject in the literature. The results obtained from this critical study, when combined with unpublished data obtained at the bureau, appeared of sufficient technical importance to warrant the preparation of preliminary tables covering several of the properties which have been investigated experimentally. Because of the lack of published information in readily useful form, tables containing what appear to be the most reliable values have been prepared in engineering units for publication as a Bureau of Standards circular. A partial summary of the empirical equations which were found to represent with moderate accuracy the results of measurements on various properties, together with their variation with temperature and with the specific gravity of the liquid, is given below.

Property	Empirical equation	Experimental range		Estimated accuracy within
		d	t	
				Per cent
Coefficient of expansion	$\frac{1}{V_{60}}\frac{dV}{dt}=A+2B\,(t-60)$	0.51–1.05	32–200	5
	(In the above equation: $\log(A\times10^5)=0.835+\frac{0.70}{d}$; $\log(B\times10^8)=\frac{2.10}{d}-1.2$)			
Total heat of combustion at constant volume.	B. t. u./lb.$=22320-3780\,d^2$	0.68–0.99		1
	B. t. u./gal.$=186087d-31515\,d^3$			
Specific volume of vapor	Ft.^{3}/lb.$=0.242\,(1.03-d)\,(t+460)\,(1/dp)$	0.51–0.78		5–10
	Ft.^{3}/gal.$=2.02\,(1.03-d)\,(t+460)\,(1/p)$	0.78–0.93		25–50
Specific heat of liquid	B. t. u./lb. °F.$=\frac{1}{\sqrt{d}}\,(0.388+0.00045t)$	0.72–0.96	32–750	5
	B. t. u./gal. °F.$=\sqrt{d}\,(3.235+0.00375t)$			
Latent heat of vaporization.	B. t. u./lb.$=\frac{1}{d}\,(110.9-0.09t)$	0.64–0.96	100–600	10
	B. t. u./gal.$=925-0.75t$			
Heat content:				
Liquid	B. t. u./gal.$=\sqrt{d}\,(3.235t+0.001875t^2-105.5)$	0.64–0.96	32–750	5
Vapor	B. t. u./gal.$=\sqrt{d}\,(3.235t+0.001875t^2-105.5)+925-0.75t$.			
Thermal conductivity of liquid.	$\frac{\text{B. t. u. in.}}{\text{hr. ft.}^2\ F}=\frac{0.813}{d}\,[1-0.0003(t-32)]$	0.78–0.95	32–400	10

d=specific gravity of liquid (vapor condensed to liquid) at 60°/60° F.
t=temperature in degrees Fahrenheit.
p=pressure, absolute, in pounds per square inch.
Unit volume=gallon of liquid, measured at 60° F.

Fractionation of Petroleum.—New and improved apparatus and methods for the fractionation of petroleum and for the identification of its constituents have been developed. Using these methods

the fractionation of petroleum into its chemical constituents is in progress.

Gasoline Volatility.—Further work on the correlation previously found to exist at certain points between the American Society for Testing Materials' distillation curve of a motor fuel and the volatility of fuel-air mixtures has shown that similar relations hold at any percentage evaporated from 10 to 90 per cent. Thus, over this range, the complete equilibrium volatility curves of interest in engine performance, covering air-vapor mixtures from 8–1 to 20–1, may be obtained readily from the customary distillation test without additional experimentation. It has also been shown that the dew point for any desired mixture of any gasoline and air may be computed from the A. S. T. M. 20 per cent point. Determinations of the molecular weights of the gasolines permitted expression of the dew-point data in terms of partial pressures of the gasoline vapor at any pressure such as might exist in the engine manifold. Experiments on vapor pressures are in progress, and it is anticipated that these data also may be correlated with some point on the A. S. T. M. distillation curve.

Publications.—An Interpretation of the A. S. T. M. Distillation Curves of Motor Fuels, O. C. Bridgeman, Bull. Am. Pet. Inst., p. 54; January 31, 1928.

The Lean Explosive Limits of Cracked and Straight-run Gasoline, D. C. Ritchie, Bull. Am. Pet. Inst., p. 69; January 31, 1928.

Volatility Data from Gasoline-distillation Curve, O. C. Bridgeman, Jour. Soc. Auto. Engrs., 22, p. 437; 1928.

Dew Points of Air-gasoline Mixtures from Distillation Curves, O. C. Bridgeman, Indust. and Eng. Chem., 20, p. 821; 1928.

Dew-point Data on Gasoline, O. C. Bridgeman, J. Soc. Auto. Engrs., 23, p. 478; 1928.

Economic Volatility of Motor Fuels.—The effect of fuel volatility on engine acceleration is now being studied in cooperation with the American Petroleum Institute, the National Automobile Chamber of Commerce, and the Society of Automotive Engineers. Three special fuels, the distillation curves of which cross at the 20 per cent point and the 90 per cent point but differ at the 50 per cent point, are being studied to see whether the 50 per cent point in the Federal specification for motor gasoline is important as regards acceleration. A new spark accelerometer giving records of high precision has been developed for use in this work.

Publications.—Some factors in engine acceleration, R. Best and J. O. Eisinger, Bull. Am. Pet. Inst., p. 74; January 31, 1928.

The influence of fuel characteristics on engine acceleration, Donald B. Brooks, J. Soc. Auto Engrs., 23,, p. 235; 1928.

Gumming Test for Motor Fuels.—One of the chief problems in connection with the use of "cracked" fuels is to hold within safe

limits the gum-forming constituents, which may cause a deposit on engine valves and seriously interfere with engine operation. There has been, up to the present, no test which afforded more than a rough qualitative indication of the gum-forming tendency. A test has been devised which measures this property quantitatively, under conditions which are believed to be comparable to those obtaining in an engine.

Density of Gasoline.—An investigation of the density and thermal expansion of "cracked" gasolines and blended motor fuels has been carried out in cooperation with the American Petroleum Institute. The results of this work will serve as an important supplement to the work previously done on petroleum oils at the bureau.

Phenomena of Combustion.—The study of combustion at constant pressure by means of soap bubbles has been continued. A forthcoming technical report of the National Advisory Committee for Aeronautics, on The Gaseous Explosion Reaction: A study of Composite Fuels, by F. W. Stevens, shows that it is possible to predict, from the velocity coefficients of carbon monoxide and methane, the flame velocity of any composite fuel made up of these ingredients for any ignitible mixture of fuel and oxygen. The effect of inert gases on the carbon monoxide-oxygen reaction was found previously to depend on the thermal properties of the inert gas used. Recent experiments using argon indicate that the important factor is the molecular heat rather than the thermal conductivity.

A study of combustion in an actual engine cylinder is also being supported by the N. A. C. A. For this purpose a small single-cylinder engine has been provided with a special head in which there are 31 small quartz windows. By observing these windows through an optical system and a stroboscope it will be possible to determine the average flame position at any point in the cycle and to study the effect of operating conditions and various fuels on flame travel.

Publications.—The Gaseous Explosive Reaction at Constant Pressure: The Effect of Inert Gases, F. W. Stevens; J. Am. Chem. Soc., 50; 1928.

The Gaseous Explosive Reaction at Constant Pressure, F. W. Stevens, Indust. and Engr. Chem. 20; October, 1928.

Measurement of Detonation.—No laboratory test has yet been devised which will take the place of engine tests for comparing the tendency of fuels to knock or detonate. A further survey of the engine tests used by different laboratories for determining the antiknock characteristics of motor fuels shows great diversity as regards equipment and procedure. The bureau is cooperating with representatives of the automotive and petroleum industries in the effort to find some satisfactory common basis for rating antiknock motor

fuels. It is believed that the first step toward the solution of this problem would be the adoption of a common test engine by a considerable number of laboratories.

Publications.—A Detonation Survey, H. K. Cummings, Bull. Am. Pet. Inst., p. 81; January 31, 1928.

Results of Two Recent Detonation Surveys, H. K. Cummings, J. Soc. Auto. Engrs., 22, p. 448; 1928.

Spark Ignition.—Both the Navy and the National Advisory Committee for Aeronautics are supporting an investigation of the relation between the character and intensity of the spark and its ability to ignite the mixtures which actually occur in engines. It is planned to study the regularity of ignition, under various controlled engine-operating conditions, as affected by the electrical characteristics of the spark discharge.

Automotive Headlighting.—A paper on Automotive Headlighting Requirements from the Driver's Point of View, by H. C. Dickinson and H. H. Allen, was presented at the Toronto meeting of the Illuminating Engineering Society in September, 1928. The investigation has been continued along the lines indicated in the 1928 Yearbook, and the large amount of statistical data collected has not yet been completely analyzed.

By mounting a light on the rear of car A and a camera on the front of car B and driving over typical roads with car A a known distance in front of car B, photographic records have been obtained which indicate the light spread necessary for safe driving at various speeds. It is quite evident that the type of beam required for safe driving at normal highway speeds in the absence of approaching light is materially different from the beam required for city driving, for passing vehicles with lights, or for slow speeds.

A car has been provided with a small portable photometer mounted on the windshield. Using this with two hand counters makes it possible for the driver to record the relative number of approaching cars which throw more than a given intensity of light into his eyes. Such "glare data" taken in a number of States indicate that about 16 per cent of the cars met at night throw enough light into the driver's eyes to render the road shoulder not plainly visible.

Publication.—Progress Report on Headlight Investigation, H. H. Allen, J. Soc. Auto. Engrs., 22, p. 305; 1928.

Automobile-Brake Linings.—The standard brake-lining test equipment developed at the bureau is now being built commercially. A number of brake lining manufacturers who have installed such equipment have sent their operators to the bureau for brief periods of instruction in its use.

The present routine method of comparing the durability of brake linings for Government purchase is a severe service test and has served to make available brake linings of greatly improved wearing quality under extreme conditions. Experimental runs are also being made under modified conditions with a view to establishing a basis of grading linings for various types of service such as "moderate" and "heavy" duty. The information thus obtained is being compared with actual road-service tests on typical brake linings.

Publication.—Continuation of the 1922 Report on Brake-Lining Tests, S. von Ammon, J. Soc. Auto. Engrs., 21, p. 551; 1927, and 22, p. 365; 1928.

Vibration of Motor Vehicles.—The vibration of a motor vehicle is influenced by the character of the road, by the tires (size and pressure), by the spring suspension system, by shock absorbers or snubbers, and by such factors as the loading of the vehicle and the speed at which it is driven. The Bureau of Standards is interested in the vibration primarily from the point of view of the passenger, while the Bureau of Public Roads is interested chiefly in the effect on the highway.

The instruments used to record the vertical forces which cause discomfort to the occupants of a vehicle or the vertical impact forces which tend to wear out the road surface are known as accelerometers. A machine for calibrating vertical accelerometers has been set up at the Bureau of Standards, and the two bureaus are cooperating in the calibration of these instruments.

The contact accelerometer with electrolytic recorder has been used several times at the request of the Veterans' Bureau to compare the riding qualities of ambulances and to study the effect of shock absorbers on riding comfort.

Tires.—During the past year 118 endurance tests were made on various types of pneumatic tires for Government agencies, 15 for States and cities, and 39 as part of cooperative investigations.

A study was made of the tread movement of pneumatic tires produced by flexing, and the results have been published in the Journal of Research. Two methods are described for recording tread movements as a tire rolls along under load. One, which is referred to as the wax-plate method, is particularly adapted to this work, as the tread movements can be recorded quickly and easily with very simple equipment. The results of several tests made in this way are shown, and conclusions are reached as to factors in tire operation which affect tread movements. Some suggestions are given as to ways of reducing this tread movement which should have a direct bearing on reducing tread wear.

Publication.—Automobile Tires, P. L. Wormeley, United States Daily; March 14, 1928.

Measurement of the Tread Movement of Pneumatic Tires and a Discussion of the Probable Relation to Tread Wear, W. L. Holt and C. M. Cook, B. S. Jour. Research, 1, No. 1, p. 19.

Use and Care of Automobile Tires, B. S. Circular No. 341.

BUILDING CONSTRUCTION

The object of this work is to promote a wider application of the best standards for building materials and design to new construction for which $6,000,000,000 to $7,000,000,000 is spent each year. It helps to widen the practical usefulness of laboratory and field research and secures a more general adherence to approved specifications and simplified-practice programs.

Building-Code Committee.—For the past seven years the advisory building-code committee has been preparing recommended minimum requirements for building codes. Six reports covering various subjects have been issued, and more than 120 cities have availed themselves of information thus provided when revising their codes. Advisory or mandatory State plumbing codes based on the recommendations of the subcommittee on plumbing have been adopted in seven States, and many cities have used these recommendations in their local ordinances.

The field for this work is still wide, for a recent survey by the bureau indicates that of 751 cities having a population of 10,000 or over according to the 1920 census, more than a quarter had building codes which had not had a major revision in 10 years or over. Many of these local codes are out of date and impose an economic burden upon the municipalities that use them. By making available at nominal expense the results of intensive research the two committees are contributing toward more economical requirements and a greater degree of uniformity. More than 200 cities were revising their codes in 1928, and to these the results of the committees' work were available. In addition to the recommended minimum requirements for building codes, the committees' reports contain appendixes explaining the recommendations and offering much additional information of value to designers and builders.

The recommendations for plumbing originally issued by the subcommittee on plumbing in 1924 were revised during 1928. The original report was confined almost entirely to installations in small buildings. The report has been revised to include all kinds of structures. The building code committee prepared a draft of recommendations for minimum requirements for fire resistance in buildings and invited criticisms from a number of experts on the subject. These are now being considered.

Besides this direct effect, the committee's reports have had a wide indirect influence through the work of trade associations and other

groups, among which the National Committee on Wood Utilization deserves special mention.

Relationship of Building Codes to Commercial Standardization.—To understand the relationship of building codes to standardization it is necessary to take into account the fundamental basis for the existence of code requirements. These are local enactments and as such must have a legal justification that will be upheld in the courts. Any standardization immediately effected is likely to be of local rather than national significance, because our complex political system requires the action of many legislative bodies. Much commercial standardization, on the other hand, is a matter of economic expediency, resting upon mutual agreement of producers and consumers. Its adoption is an economic rather than a political measure, and the possibilities for universal application within a limited time are much greater.

Spontaneous movements looking toward uniform building codes have sprung up in a number of localities. The uniform building code prepared by the Pacific Coast Building Officials' Conference has been well received and has been adopted in a number of municipalities in far western States. The Florida Building Officials' Conference has continued work on a similar document with good prospects of success. The Pacific Coast code employed recommendations of the building code committee and of Bureau of Standards' experts to a large extent. The Building Officials' Conference, covering principally the eastern United States, has under consideration a similar plan for preparing a recommended uniform code covering an even wider area. Codes formulated by such groups have no local effect unless formally adopted by the proper State or municipal authorities, but the public interest in rational requirements which they evoke operates to bring about a greater degree of uniformity.

Mention should also be made of the activities of national organizations representing building-material manufacturers. In many instances these have prepared recommendations on the most effective use of their materials. They also have made use of standard tests as a means of demonstrating the worth of their products and thus have contributed to common understanding in building-code procedure.

Wind Pressure on Structures.—In connection with the standardization of building codes and in response to many requests by architects, engineers, and construction companies, the bureau is engaged in determining coefficients for computing the wind pressure on engineering structures such as tall buildings, chimneys, bridges, radio towers, and power-transmission lines. The wind-pressure coefficients now used by engineers are based on the results of model experiments

made at a time when experimental methods were in the early stages of development, and the models were mainly thin flat plates, forms rarely used in actual structures. The bureau has issued a paper (Scientific Paper No. 523) in which some general aspects of the problem are discussed and in which experimental data are given for a model of a tall building. Values of the local pressures at a large number of points on the walls and roof are given for several wind directions. The measurements were made on a model in the 10-foot wind tunnel.

An extensive series of measurements is in progress to determine the wind loads on tall chimneys. Model experiments have been conducted in the wind tunnel on a model 12 inches in diameter and 60 inches high. It was found that, even with this large model, scale effects were still present, and the values could not safely be applied to chimneys without further investigation. It was necessary, therefore, to supplement the wind-tunnel measurements by measurements on large cylinders in a natural wind. A cylindrical stack 10 feet in diameter and 30 feet high was erected in an exposed position on the roof of one of the bureau's buildings. Provision was made for measurement of the pressure distribution at one elevation and for measuring the overturning moment on the whole structure. Numerous observations have been made, and others are in progress. The preliminary results indicate lower wind loads at a given wind velocity than has been generally supposed. The new power-plant stack at the bureau has been equipped with apparatus for measuring the pressure distribution at one elevation, and as soon as a suitable series of measurements have been made a comprehensive report on this subject will be issued.

City Planning and Zoning.—City planning and zoning have commanded a much larger interest in recent years than formerly. Data obtained by the bureau show that as many as 530 cities and towns, including 206 out of the 287 largest, now have official planning commissions or boards, and that more than 640 municipalities, embracing about three-fifths of the urban population of the country, have adopted zoning ordinances. These measures are in keeping with a growing desire that business structures and dwelling houses should not have their values cut and their useful life shortened by haphazard, ill-planned developments of private buildings and public improvements. Competent city planning and zoning contribute materially to the usefulness of buildings and public works, encourage the erection of durable structures, and stabilize property values.

The demand for a sound guide for legislative action led the advisory committee on city planning and zoning to prepare a standard city planning enabling act, portions of which have been incorporated

and legislation adopted in California, Maryland, and Pennsylvania, and in local enactments.

The act covers the making of the city plan and the organization and powers of the city planning commission, control of subdivisions, control of buildings in mapped streets, and regional planning.

The National Conference on City Planning and the National Association of Real Estate Boards have indorsed the underlying principles of the standard city planning enabling act, as they apply to control of the platting of subdivisions.

City zoning ordinances, which divide municipalities into zones or districts and regulate in them the height, area, and uses of buildings, bear a vital relation to the welfare of property owners and municipalities. The development of zoning has been rapid during recent years. In the 17 years, 1904 to 1920, only 37 cities were reported as having adopted zoning ordinances, while in the 8 years, 1921 to 1928, over 600 were reported.

The standard State zoning enabling act has been used wholly or in large part by the following 29 of the 46 States having zoning legislation:

Arizona.	Maryland.	Rhode Island.
Colorado.	Mississippi.	South Carolina.
Connecticut.	Nebraska.	South Dakota.
Delaware.	Nevada.	Tennessee.
Florida.	New Hampshire.	Texas.
Georgia.	New Jersey.	Utah.
Idaho.	North Carolina.	Virginia.
Illinois.	North Dakota.	West Virginia.
Iowa.	Oklahoma.	Wyoming.
Louisiana.	Pennsylvania.	

The Supreme Court of the United States has approved the general principle of zoning, and its constitutionality also has been upheld by that court and by the highest appellate courts of at least 22 States. The standard zoning act has had considerable influence in guiding the movement along lines which have proved sound in practice and in conformity with constitutional law. As a result of this and other publications of the bureau it is believed that much costly litigation has been avoided, and zoning has been influenced to follow reasonable lines.

Lists of zoned municipalities and of State zoning enabling acts have been compiled from time to time, commencing in January, 1923. The latest list is available in mimeographed form.

CEMENT AND CONCRETE

Cast Stone.—Samples of cast stone made by 21 different manufacturers throughout the United States are being studied with the object of preparing a Federal specification. So far it has been

found that the compressive strength of a 2 by 2 inch cylinder ranges from 2,370 to 10,300 pounds per square inch. The modulus of rupture on a 1 by 1 inch bar in a 6-inch span ranges from 375 to 1,575 pounds per square inch. The absorption at the end of 48 hours ranges from 3.3 to 10.8 per cent. If the specimens, after soaking in water for 48 hours, are boiled for 5 hours, the absorption is then increased to values ranging from 7.3 to 14.6 per cent. In subjecting this material to freezing and thawing some samples have failed at 60 cycles of freezing and thawing, whereas others are still satisfactory at 450 cycles.

Concrete Test Cylinders.—A group of 500 test cylinders of concrete, in part of which the aggregate was composed of pieces as large as 10 inches in length, was tested during the past year. The cylinders varied from 2 to 36 inches in diameter, the heights being equal to twice the diameter. In one series of cylinders, composed of 1 part cement to 2.7 parts of aggregate, all being smaller than the ⅜-inch sieve, there were included all sizes from 2 to 36 inches in diameter. In this series the 36-inch cylinders developed a strength in compression of approximately 2,500 pounds per square inch, the 12, 18, and 24 inch cylinders approximately 3,000 pounds per square inch, the 6 and 8 inch specimens approximately 4,100 pounds per square inch, and the 2 and 3 inch specimens approximately 5,100 pounds per square inch. Tests were made at an age of about 3 months. It is not possible to compare the strengths of the smaller and larger cylinders in the other series because it was impossible to replace the large aggregate in the small cylinders. However, in general the smaller specimens gave higher strengths.

Durability of Concrete Aggregate.—Tests to determine the durability of concrete aggregates when subjected to weathering have been underway for some time. Four methods of simulating weathering conditions were used, in which the aggregate was subjected to (1) alternate immersion in a solution of sodium sulphate and brine, (2) alternate immersion in a solution of sodium chloride and brine, (3) boiling in water and drying, and (4) freezing and thawing. Considering these four methods of test, when applied to limestone, gravel, granite, trap, and slag aggregates, the boiling and drying appears to produce more failures than any of the other methods. The tests are being continued.

Workability of Concrete.—Methods of measuring the workability of concrete have been studied further. Particular attention was given to determining the energy required to deform a mix of concrete contained within a flexible metal cylinder, and also to determining the number of blows required to drive three rods into a mass of concrete. Both of the methods gave interesting results, but neither appears to be completely satisfactory.

Publications.—A Study of Some Methods of Measuring Workability of Concrete, George A. Smith and George Conahey, Proc., Am. Concrete Inst., 24, p. 24; 1928.

Cement as a Factor in the Workability of Concrete, P. H. Bates and J. R. Dwyer, Proc., Am. Concrete Inst., 24, p. 43; 1928.

Portland Cement Association.—The cooperative work with the Portland Cement Association during the past year has been concerned primarily with studies of compositions wherein ferric oxide and magnesia were the principal components. From these studies two new compounds have been noted, $4CaO.Al_2O_3$ and $4CaO.2MgO.Al_2O_3.Fe_2O_3$. These compounds form a complete series of solid solutions with each other. The iron in Portland cement is probably combined either as $4CaO.2MgO.Al_2O_3$ or its solid solution with $4CaO.Al_2O_3.Fe_2O_3$.

Publications.—Further Studies on Portland Cement Compounds by the X-ray Diffraction Method, W. C. Hansen, J. Am. Cer. Soc., 11, No. 68; 1928.

Studies on the System Calcium Oxide-Alumina-Ferric Oxide, W. C. Hansen, L. T. Brownmiller, and R. H. Bogue, J. of the Am. Chem. Soc., 50, p. 396; 1928.

Equilibrium Studies on Alumina and Ferric Oxide and Combinations of these with Magnesia and Calcium Oxide, W. C. Hansen and L. T. Brownmiller, Am. J. Sci., 15, p. 225; 1928.

A New Registering Photodensitometer, E. A. Harrington, J. Opt. Soc. Am., and Rev. Sci. Inst., 16, p. 211; 1928.

A precision Method for Measuring Temperatures of Refractive Index Liquids on a Crystal Refractometer and on a Microscope Slide, F. W. Ashton and W. C. Taylor, Am. Mineral, 13, No. 8, p. 411; 1928.

A Digest of the Literature on the Nature of the Setting and Hardening Processes of Portland Cement, R. H. Bogue, Rock Products (serial form); 1928.

Phase Equilibria in the System $2CaO.SiO_2$—MgO—$5CaO.3Al_2O_3$, W. C. Hansen, J. Am. Chem. Soc., 50, p. 2155; 1928.

Hydration of Cement Compounds.—Studies of hydration of compounds that may be present in Portland cement have shown, in general, that the replacement of alumina by iron oxide increases the strength of the cement, whereas the replacement of the lime by magnesia may cause a slight decrease in strength. It has been found that in the reaction of the aluminates with water a metastable and supersaturated solution of monocalcium aluminate is formed. In the early periods these solutions decompose as the reaction proceeds, with the precipitation of varying amounts of hydrated alumina and a crystalline hydrated tricalcium aluminate.

Publication.—Reaction of Water on Calcium Aluminates, L. S. Wells, B. S. Jour. Research, 1, No. 34, p. 951.

Crazing of Portland Cement Mortars.—The study of the expansion and contraction of Portland cement mortars as the cause of crazing has been continued. A series of stuccoed cement-mortar slabs has been prepared under controlled conditions of temperature and

humidity. In this work humidities of 40 to 50 per cent and 75 to 90 per cent were used in aging the specimens, at temperatures of 100° F. The same humidities have been used when the specimens were prepared and aged at 70° and 85° F. All of the specimens have not been subjected to service conditions sufficiently long to permit of drawing any conclusion.

Publication.—Notes on the Progress of Some Studies of the Crazing of Portland Cement Mortars, P. H. Bates and C. H. Jumper, Proc., Am. Concrete Inst., 24, p. 179; 1928.

Government Tested Cement.—The increased use of cement by the Government resulted in a large amount of work at the three branch laboratories which the bureau maintains to test Government purchases. Cement tested and shipped, 1,210,000 barrels. Cement sampled and tested, but rejected, not meeting certain of the requirements, 76,000 barrels.

Stevenson Creek Dam.—The results of the investigation at the Stevenson Creek Dam, Calif., have been published. These tests were made to determine the distribution of stresses throughout the dam while under various degrees of loading and to note how these fit into the various methods used in designing arch dams. During construction resistance thermometers and electric telemeters were embedded in the concrete to determine the temperatures and strains within the dam. Provisions were also made for determining the deflections of the dam, the movements of the rock abutments, and strains in the downstream face. Observations were begun as soon as the concrete had been placed. All tests were made at night while the dam was kept wet by spray in order to reduce to a minimum the changes due to temperature and humidity. The "cylinder" formula which is used in designing most arch dams was found to give values inconsistent with the measured values. None of the other methods of design in current use was found to be entirely adequate in representing conditions in the test dam.

Publications.—Report of Tests on Stevenson Creek Dam, W. A. Slater, Proc., Am. Soc. Civil Engrs.; May, 1928.

Some Features of the Testing of Stevenson Creek Arch Dam, W. A. Slater, Proc., Am. Concrete Inst., 24, p. 273; 1928.

Combination Hollow-Tile and Concrete Floors.—The integrity of combination hollow-tile and concrete floors is to a large extent dependent upon the adhesion of the concrete to the tiles. Tests have therefore been made to determine the effect of the moisture content and water absorption of the tile on the strength in shear of the bond between the concrete and the tile. In general, the results indicated that the strength was greatest when concrete mixtures containing the minimum amount of water necessary for its proper placement was

used in combination with either dry or only slightly dampened tiles of medium absorption. The concrete usually did not adhere to saturated tiles.

Publication.—Bond Between Concrete and Hollow Tile. J. C. Oleinik; Engineering and Contracting, 67, No. 1; January, 1928.

Effect of Brackets on Frames.—During the World War the Emergency Fleet Corporation carried on an investigation to determine whether a saving in the weight of the transverse frames of concrete ships could be effected by the use of brackets or haunches at the intersections of frame members. Since then a theoretical study of the effect of brackets on stresses in rigid frames has been made and correlated with test data in order to enlarge the utility of the results. The brackets seemed to reduce the high local bending stresses usually present at corners of frames and to increase the resistance of the members to shear. Their effect was equivalent to a shortening of the spans, but the results showed that the shortening was not constant for a given size of bracket but varied with the ratio of height to span of the frame.

Effect of Aggregate on Concrete.—An investigation has been made to determine the effects of sizes, gradations, and proportions of gravel, crushed stone, and slag aggregates on the strength and economy of concretes; 232 different combinations of cements and aggregates were included in the investigation, but this will have to be extended before all the questions involved can be satisfactorily answered. Using the strength per quantity of cement per cubic yard of concrete as a measure of the economy of a mixture, it was found that the most economical mixtures contained from one-half to one volume of sand per volume of coarse aggregate. The minimum strengths of the concretes which were not deficient in sand were closely related to the water-cement ratio, the minimum proportion of sand in each case being the same as that required to produce a satisfactorily workable mix and to give the maximum economy of cement.

CERTIFICATION AND LABELING

Facilitating the Use of Specifications.—The "certification plan" has been extended so as to include commodities covered by a total of more than 250 United States Government master specifications. In order to minimize the task of distributing these lists, there has been prepared a consolidated alphabetical list of manufacturers and a consolidated numerical list of specifications, with alphabetical-numerical cross references between these two lists, which will require perhaps not over one-third the amount of paper which would otherwise be necessary.

Quality Goods for "Over-the-Counter" Buyers.—Manufacturers of certain lines of merchandise are being encouraged to use self-identifying quality-guaranteeing labels to bring to the attention of small-quantity over-the-counter buyers certain well-established kinds of staple commodities manufactured to comply with nationally recognized specifications—an important step in expanding the mass production, mass distribution, mass consumption idea.

Publications.—Certification Service, A. S. McAllister, United States Daily, March 6, 1928.

Labeling and Checking Agencies, A. S. McAllister, United States Daily, March 8, 1928.

Aids for Household Purchases, A. S. McAllister, United States Daily, March 9, 1928.

Certification Plan and Labeling System, A. S. McAllister, Annals Am. Acad. Political and Social Sci., 137, pp. 240–246; May, 1928.

A Guarantee of Quality, A. S. McAllister, Purchasing Agent, 17, pp. 893–896; August, 1928.

CHEMISTRY

Standard Samples for Analysis.—The use of the bureau's standard samples is described on page 151 of the 1928 Yearbook.

Standard Methods of Analysis.—In cooperation with the American Society for Testing Materials, recommended methods of sampling rolled and forged steel products for check analysis were prepared and tests made of the standard methods recommended by the society for checking the chemical requirements of resistance alloys and light aluminum alloys. Standard analyzed samples of the latter are now in preparation. The bureau also cooperated with the American Ceramic Society in the development of methods for the analysis of ceramic materials and is now engaged in the preparation of a standard analyzed sample of opal glass. Assistance has also been given in the analysis of a standard sample of clay prepared by the Ceramic Society of Czechoslovakia for test by members of the International Union of Pure and Applied Chemistry. This work is being done for the purpose of comparing present national testing methods.

Publications.—The Determination of Iron in Glass Sand, G. E. F. Lundell and H. B. Knowles, J. Am. Ceram. Soc., 11, p. 119; 1928.

Analysis of Bauxite and of Refractories of High-Alumina Content, G. E. F. Lundell and J. I. Hoffman, B. S. Jour. Research, 1, No. 1, p. 91; 1928.

Specifications for Analytical Reagent Chemicals.—The bureau's cooperation with the American Chemical Society's committee on analytical reagents was continued. As heretofore, many of the methods of test prescribed for the 13 specifications published during the year and for others in preparation were subjected to critical study to determine their accuracy and sensitiveness.

Physical Constants of Chemical Substances—Heat of Formation of Sulphur Dioxide.—Determinations of this constant are in progress.

Phase equilibrium diagram for the system SiO_2-ZnO has been completed and has been published in International Critical Tables, Volume IV, page 86. The diagram shows the presence of a zinc silicate ZnO-SiO_2, melting at 1,512° C. The melting point of zinc oxide was also determined for the first time and found to be 1,975° C.

Transference Numbers in Aqueous Solutions of Electrolytes.—An improved form of moving boundary apparatus has been devised and tested.

Publication.—A new design of apparatus for the moving boundary method of determining transference numbers, E. R. Smith, J. Am. Chem. Soc., 50, p. 1904; 1928.

Adsorption.—An investigation is in progress for comparing the adsorption behavior of various types of earthy materials, especially those used in commercial clarification operations.

Molecular Weights.—A method has been developed by means of which molecular weights in the vapor state can be determined at temperatures where the vapor pressure of the substance under investigation is very low.

Removal of Dissolved Gases from Liquids.—A method has been developed whereby liquids can be purified from dissolved gases, with practically 100 per cent recovery both of the liquid and the dissolved gas.

CLAY AND SILICATE PRODUCTS

Glazes and Refractories.—At the Columbus branch of the bureau the work on English china clays, the heavy clays of Ohio, the fitting of glazes to bodies, and the study of boiler-furnace refractories has progressed most satisfactorily. In the first two studies the usual properties such as shrinkage, bulk volume, slaking time, modulus of rupture, etc., have been determined on the dry and also on the fired bodies. The data can not be abstracted here, but reports will be found in the Technical News Bulletin of this bureau throughout the past year. In the study of the fitting of glazes to bodies 110 glazes have been made and particular attention paid to determining their modulus of elasticity and coefficient of expansion. The former varied from 4,500 to 9,700 kg/mm.^{2} The effect of the oxides used in these glazes on the modulus of elasticity seems to be in the following order: MgO, CaO, ZnO, Al_2O_3, BaO, Na_2O, PbO, SiO_2, K_2O, B_2O_3, the first mentioned increasing the modulus to the greatest extent. The coefficient of expansion varied from

4.56×10^{-6} to 15.81×10^{-6}. Here the oxides were not in the same order in affecting the coefficient as they were in the case of the modulus of elasticity. For instance, the Na_2O was about ten times as effective in increasing the expansion as B_2O_3.

Feldspars in White-Ware Bodies.—Further work has been done on the investigation of feldspars in white-ware bodies. Determinations of the true specific gravity before firing and after firing to various temperatures showed that there is apparently a definite rearrangement of the molecules in the crystals as the temperature of firing is increased. Thus it was found that there is an average increase in volume for the feldspars studied of 4 per cent on heating to 1,165° C., of 7 per cent on heating to 1,225° C., and of 9 per cent on heating to 1,260° C. Above this there is very little change. Porosity, volume shrinkage, and mechanical strength are influenced more by method of firing and manner of making ware than by the feldspar used. The thermal expansion of bodies containing different spars indicates the marked effect of the free silica in the spar. The kind of feldspar used in a body does not affect its elasticity.

Saggers and Sagger Clays.—The work on the study of saggers and sagger clays has been continued with special reference to combinations of clays with coarse and fine grogs. So far the data show that on the average the saggers containing fine grog fail at 100° C. lower than those prepared from bodies containing coarse grog. The more porous grogs increased the resistance to failure of the sagger over that obtained when a vitreous grog was used. The study of 17 brands of commercial fire brick has been restricted during the year to obtaining the effect on thermal expansion of reheating the brick to 1,400, 1,500, and 1,600° C. In all cases there has been a decided lowering of the coefficient of thermal expansion due to the elimination of the free silica. The clays entering into these brick have also been thoroughly studied for their expansion characteristics, and it was found that one group of these clays had a uniform rate of expansion up to 900° C. Another group had a rapid expansion only below 200° C. Another group had a rapid expansion below 200° C., and again at approximately 550° C. Another had a rapid expansion only at 550° C., and a last group had an increasing expansion between 725 and 850° C.

Publication.—Fourth Progress Report in Investigation of Sagger Clays; Their Elasticity, Transverse Strength, and Plastic Flow at 1,000° C., R. A. Heindl, J. Am. Cer. Soc., 10, No. 12; December, 1927.

Efflorescence of Brick Walls.—The study of efflorescence on brick walls was extended from the process of making of brick to the use of the brick in a wall. By proper procedures in the burning and

drying the tendency of the brick to effloresce can be very largely overcome, but improper use of the brick through defective design or construction or improper maintenance may cause efflorescence, since under these conditions excessive amounts of moisture may enter the wall.

Publications.—Cause and Prevention of Kiln and Dry House Scum and of Efflorescence on Face of Brick Walls, L. A. Palmer, B. S. Tech. Paper No. 370. Wet Walls and Efflorescence, L. A. Palmer, issued by American Face Brick Association, 130 North Wells Street, Chicago, Ill.

Extrusion Machines.—The study of extrusion machines for clay columns has been completed so far as it relates to the design factors of augers, spacers, and dies for brick machines. The study of different combinations of single, double, and triple wing augers, 6, 8, and 10 inch length spacers, and 6, 8, and 10 inch length dies shows that the average relative efficiencies of the three different augers, based on an output of medium plastic clay per unit of power, was 100, 60.5, and 60.5 per cent for the single, double, and triple augers, respectively. The efficiency of the same three augers on output per unit of time was 49, 90, and 95 per cent, respectively.

Publication.—Studies of Machines for Extruding Clay Columns. Augers, Spacers, and Dies for Brick Machines, P. C. Grunwell, B. S. Jour. Research, 1, No. 36, p. 1023.

Crazing of Glazed Ware.—Crazing, occurring after glazed ware has been in service for some time, may in certain cases be caused by an expansion of the body. This is particularly true if ware is submitted to the action of moisture, as during the exposure of glazed ware to the weather. Apparently there is a combination of the water with the body, resulting in increased volume of the body, while the volume of the glaze remains constant. Bodies which tend to develop this defect when glazed show high solubility in concentrated sulphuric acid and high ignition loss about 110° C. Further, such glazed bodies if treated in an autoclave at a pressure of 150 to 175 pounds per square inch for one hour invariably show crazing. Freezing tests have been made on certain types of glazed bodies which are used in veneered buildings. It was found that the resistance of bodies having an absorption of about 12 per cent to freezing depends upon certain of their chemical and physical properties. If the ratio of water absorbed during 48 hours' immersion to that absorbed during 5 hours' boiling is low, the bodies are generally more resistant to freezing than when this ratio is high. This ratio may be reduced and the resistance of the body to freezing increased by eliminating the fine grog from such body mixtures.

Publication.—Methods of Testing Crazing of Glazes Caused by Increase in Size of Ceramic Bodies, H. C. Schurecht, J. Am. Cer. Soc., **11**, No. 5; May, 1928.

Standardization of Lovibond Glasses.—Very gratifying progress is now being made in the standardization of the American Oil Chemists' Society's "Lovibond glasses"—colored glasses used in various combinations for grading the edible oils. The close of 1929 should find the major part of this society's estimated 2,000 glasses standardized in terms of the bureau's set of selected Lovibond glasses, established as reference standards. After several years of preliminary work a series of Lovibond glasses, sufficient in accuracy and number to serve for calibrating the glasses used in the oil chemists' laboratories, has been set up by the bureau. The number of such reference standards is at present about 100 out of 470 different Lovibond glasses in the bureau's set. After completing the program with the oil chemists it is planned to set up other reference standards for similar work in other colors and color ranges. The manufacturer of Lovibond glasses has undertaken to cooperate in this standardization work of the bureau by furnishing the American trade with glasses conforming to the bureau's series of standards.

Publications.—A Study of 129 Lovibond Glasses with Respect to the Reliability of Their Nominal Grades, D. B. Judd and Geraldine K. Walker, Oil and Fat Indus., **5**, p. 16; January, 1928.

Tests of Color Sense of A. O. C. S. Members and Data on Sensibility of Change in Lovibond Red, I. G. Priest, Oil and Fat Indus., **5**, No. 3; March, 1928.

Effect of Temperature Change on the Color of Red and Yellow Lovibond Glasses, D. B. Judd, B. S. Jour. of Research, **1**, No. 31, p. 859.

See also Monthly Reports of Progress on Cooperative Work with the American Oil Chemists' Society, published in Oil and Fat Indus.; December, 1927, to August, 1928.

Color Standards for Glycerin.—In cooperation with the research committee of the American Glycerine Producers' Association, a color test using ferric alum was developed for yellow distilled and dynamite grades of glycerin. This standard was worked out in connection with the formulation of specifications and is designed primarily for the use of testing laboratories not equipped with standardized Lovibond glasses.

Absolute Methods in Reflectometry.—In photometry and colorimetry it is often desirable to obtain an absolute evaluation of the reflective or transmissive properties of walls and ceilings of rooms, color samples, etc. It has usually been most convenient to express these reflective (or transmissive) properties in terms of some material which can be regarded as standard, but reliable methods are needed for the evaluation of the standard (if not the sample itself) in absolute measure, particularly in regard to variations with wave length.

The bureau has developed a new method based on a general law of reciprocity, first stated by Helmholtz, by means of which certain reciprocal relations between the reflective properties for unidirectional and diffused illumination are derived and applied. In operation the sample is illuminated simultaneously from all directions and it brightness observed in any given direction.

Publications.—Absolute Methods in Reflectometry. H. J. McNicholas, B. S. Jour. Research, 1, No. 1, p. 29.

Equipment of Routine Spectral Transmission and Reflection Measurements. H. J. McNicholas, B. S. Jour. Research, 1, No. 30, p. 793.

Standards of Candlepower.—Preparation of the blue-glass filters to be used in measurements of candlepower standards agreed upon at the Bellagio meeting of the International Commission on Illumination in 1927 has required considerable time, and the filters have not yet been received by the bureau. Other work in relation to this problem has, however, been under way, including intercomparisons of the different types of standard lamps maintained at the bureau and a preliminary study of liquid filters of different types which may serve to supplement the blue-glass filters previously proposed.

Measurements on color filters, representing the types of colored materials used in practical illumination work, have been made by the bureau in collaboration with several other laboratories. The results of this comparison were summarized in a paper before the Illuminating Engineering Society, in September, 1928, under the title "An Interlaboratory Comparison of Colored Photometric Filters," by E. C. Chittenden, of the bureau, and A. H. Taylor, of the Lighting Research Laboratory, National Lamp Works of the General Electric Co. The other laboratories which took part in the measurements were the Electrical Testing Laboratories, the Illuminating Engineering Laboratories of the General Electric Co., and the Westinghouse Lamp Co., and the engineering department of the National Lamp Works.

A paper on the Status of Candlepower Standards, by E. C. Crittenden and J. F. Meyer, was presented at the meeting of the International Commission on Illumination in September. This paper makes the definite proposal that the national laboratories agree to accept as standard those values of luminosity which are calculated from spectrophotometric measurements by means of the visibility factors which have already been accepted provisionally by the international commission. These visibility factors are the result of work done by K. S. Gibson and E. P. T. Tyndall and published in Bureau of Standards Scientific Paper No. 475.

COMMERCIAL STANDARDS

Twenty-one industries have requested assistance in the establishment of commercial standards covering their commodities. Seven of these projects have passed the general conference stage, one has been issued in printed form, and five have been submitted to interested producers, distributors, and consumers for written acceptance.

Suggestions received by correspondence and from individuals calling at the bureau reveal 39 additional commodities for which there is need for the establishment of commercial standards, or which represent promising possibilities.

Dress Sizes for Women.—Manufacturers of dress patterns are cooperating on a project to standardize the classification of pattern sizes as well as the important key measurements corresponding to each size, in order to eliminate confusion of the various methods of sizing patterns on the part of dressmakers and housewives.

Chain-Link Fence, Copper-Bearing Steel, Galvanized After Weaving.—A proposed commercial standard for chain-link fence, copper-bearing steel, galvanized after weaving, has been circulated to interested producers, distributors, and consumers for written acceptance. This specification covers the various sizes of wire used for fabric, dimensions of mesh, height, method of galvanizing, thickness of coating, as well as the posts, braces, top rails, gates, and fittings, and should prove a reliable measure of quality for this type of product.

Plug and Ring Gauges.—The American Gauge Design Committee is formulating recommendations for plain, cylindrical, and threaded plug and ring gauges as a basis for establishment of a commercial standard.

Brass Pipe Nipples.—A manufacturer of brass pipe nipples has submitted a preliminary draft of specification with request for assistance in establishment of a commercial standard for this commodity.

Steel Pipe Nipples.—Following the action of a general conference on June 29, 1928, a recommended commercial standard for steel pipe nipples has been circulated to all interested producers, distributors, and consumers for written acceptance. This specification sets up definite requirements for the quality of pipe used in the manufacture of nipples and establishes a table of standard sizes readily available on the market as well as stipulating details for threading, reaming, and chamfering. The Pipe Nipples Standards Corporation, an association of manufacturers, has registered a trade-marked symbol which will be applied to the goods and to the cartons in which they are contained as a guarantee or certification that items labeled thus are in

complete conformity with the commercial standard. The use of the trade-mark symbol for this purpose will be supported by a program of national advertising.

Genuine Wrought-Iron Pipe Nipples.—In accordance with a recommendation of the general conference on June 29, 1928, a recommended commercial standard for genuine wrought-iron pipe nipples has been circulated to all producers, distributors, and consumers for written acceptance. This recommended commercial standard parallels the one on steel pipe nipples and will be supported by national advertising and the trade-marked symbol applied to the goods and to the carton, guaranteeing conformity to the commercial standard.

Pocketing.—A survey is under way by the International Association of Garment Manufacturers for complete information and samples on various grades of pocketing materials regularly used in the manufacture of several items of men's clothing such as suits and overalls. These samples will be tested for thread count, weight, breaking strength, and possibly abrasion, and a specification will be prepared covering those types which seem to be most suitable as a results of the tests. It is planned to use the resultant specification of the International Association of Garment Manufacturers as a basis upon which a commercial standard may be established.

Porcelain Plumbing Fixtures.—As a result of the general conference on June 12, 1928, a proposed commercial standard for staple porcelain (all-clay) plumbing fixtures has been circulated to all interests for written acceptance. This standard covers nomenclature, definitions, grading rules, dimensions, and items retained as staple.

Stoddard Solvent.—Pursuant to a request of the National Association of Dyers and Cleaners, and following a general conference, a proposed commercial standard for stoddard solvent (dry-cleaning solvent) has been circulated to interested producers and consumers for written acceptance. This is a complete specification for the material, including methods of tests, and is designed to provide a suitable dry-cleaning solvent which will leave no residual odor on the garment and with a flash point sufficiently high to materially reduce the fire hazards in this industry. The National Association of Dyers and Cleaners plans to test deliveries of this commodity for conformity to the commercial standard and will supply periodically to its members a list of firms supplying a solvent which fully meets the specification.

Clinical Thermometers.—A very gratifying number of acceptances have been received for the recommended commercial standard on clinical thermometers, including a large majority of the producers, the American Hospital Association, Maine Purchasing Agents' Association, Minnesota Hospital Association, National Association of Retail Druggists, Wisconsin Anti-Tuberculosis Association, Ameri-

can Pharmaceutical Association, the State department of health of New York, the State of Michigan, as well as an unusually large number of private and Government hospitals. The specification sets up very rigid performance requirements for clinical thermometers to assure accuracy and reliability, and the manufacturers will supply a certificate with each certifying it to meet all the requirements and tests as specified in the commercial standard.

Malleable-Iron Unions.—Agreeable to a request from the manufacturers, and following two preliminary conferences with interested producers, a general conference has been called to consider the establishment of a commercial standard for 250-pound malleable-iron unions. The proposed commercial standard to be considered as a basis for discussion, sets up minimum requirements for all important dimensions, and requires tensional tests of the completed unions as well as air-pressure tests under water to guard against the possibility of leakage. This specification is designated as a definite yardstick for quality of malleable-iron unions in regular daily trade.

Cotton-Yarn Sizes.—At the request of the Associated Knit Underwear Manufacturers of America, it is proposed to establish a commercial standard for cotton-yarn sizes and a code to indicate the sizes by color of the cones upon which the yarn is wound. The main purpose is to prevent the mixing up of different yarn sizes on the same cone in the knitting plant as well as the mixing of the cones of different yarn sizes on the same knitting machine.

CORROSION

Test Methods.—Accelerated laboratory corrosion-test methods for zinc-coated steel have been studied. The "salt spray," so often called for in specifications, is not satisfactory for evaluating resistance to atmospheric corrosion. The "simulated atmospheric" test (exposure to an atmosphere of CO_2 and SO_2) appears useful, especially for research purposes. The important factors in the life of a zinc coating appear to be its thickness, uniformity of distribution, and the amount of iron-zinc alloy layer present. Until the exposure tests of the American Society for Testing Materials have been completed and correlated with the results of accelerated laboratory tests the exact meaning of the laboratory tests will remain doubtful. These matters are discussed in Protective Metallic Coatings, H. S. Rawdon, American Chemical Society Monograph No. 40. The degree and uniformity of aeration in a laboratory corrosion test is an important factor and may often account for large discrepancies among the results obtained by different laboratories. A study of the aeration factor in accelerated electrolytic corrosion tests and in submerged corrosion tests is under way.

Ship-Plate Steel.—When submerged in fresh or salt water steels of the type ordinarily specified for ship plates show but little difference in corrosion resistance, according to the tests of the American Society for Testing Materials. The *Leviathan* has been reported as showing marked freedom from corrosion, and this has been ascribed to the special composition of the steel used for her plates. Through the cooperation of the Shipping Board the resistance to corrosion of specimens of these plates and of several other steels is being determined. So far no important difference has been found. Recent inspection of the *Leviathan* shows about the same behavior for her original plates and for replacement plates of ordinary composition. The reported long life of the plates may, perhaps, be attributed to good painting and upkeep rather than to composition of the steel. In that case specifications for special composition of ship-plate steel scarcely appear warranted.

Corrosion in the Oil Industry.—The American Petroleum Institute has appointed a research associate to study the extent, causes, and prevention of corrosion in the oil industry, especially in pipe lines. An extensive preliminary survey of field conditions is being made.

Information on Corrosion.—A letter circular on corrosion resistance of iron and steel, for which there has been much demand, has been revised and brought up to date. This includes comments on laboratory methods for corrosion testing.

Screen Wire Cloth.—With a view to establishing data on which to base specifications for nonferrous screen wire cloth, exposure and laboratory tests are being carried out with the American Society for Testing Materials. Since the resistance to corrosion is the most important factor, and none of the materials deteriorate rapidly on exposure, it will be some years before final conclusions may be drawn.

DENTAL MATERIALS AND METHODS

Composition, Physical Properties, and Manipulation of Dental Materials.—This is the first comprehensive research in this field to be undertaken and financed by the Federal Government. Information already obtained has established many of the important properties of gold alloys and accessory materials used in making dental restorations and has revealed numerous defective materials and technics. Standards have been established for the proper selection of gold-silver-platinum alloys extensively used in the dental profession.

Cooperative Dental Research.—The cooperative research which has been conducted during the past six years, with the financial support of the Weinstein Research Laboratories, has been completed, and final results are now in press. This investigation should be recog-

nized as the pioneer work in the field of dental research at the bureau. Much valuable information was obtained which was made freely available to the public in numerous reports.

On April 2, 1928, a similar investigation was undertaken in cooperation with the American Dental Association. This is expected to extend over a period of at least five years, and it is anticipated that equally valuable results will be obtained.

ELECTRICITY

International Advisory Committee on Electricity.—By amendment to the International Convention on Weights and Measures it has been provided that electrical units and standards shall be dealt with through the organizations which have jurisdiction over the fundamental units of measurement. These organizations are the International General Conference, the International Committee, and the International Bureau of Weights and Measures.

The seventh general conference on weights and measures, held in 1927, approved the formation of a committee on electricity to advise the permanent International Committee on Weights and Measures on questions relating to electrical standards and systems of measurement. This advisory committee was limited to 10 members, including a representative appointed by each of the national laboratories designated by the international committee and additional specialists named individually by that committee. It was provided that a member of the international committee should be chairman of the advisory committee and that a report should be rendered by it not later than March 1, 1929.

The national laboratories designated are the National Physical Laboratory of Great Britain; the Laboratoire Central d'Electricité at Paris; the Physikalisch-Technische Reichsanstalt of Germany; the Central Chamber of Weights and Measures of the Union of Socialist Soviet Republics (Russia); the Electrotechnical Laboratory of the Department of Communications of Japan; and the National Bureau of Standards of the United States. The four additional members are Signor Vito Volterra, of Rome, Italy, chairman of the International Committee; M. Paul Janet, Director of L'Ecole Superieure d'Electricité and the Laboratoire Central, Paris; M. Chas.-Ed. Guillaume, Director of the International Bureau of Weights and Measures; and Prof. L. Lombardi, of Rome, Italy.

An American advisory committee has been formed to assist the Bureau of Standards in formulating proposals representing a consensus of the opinions held in this country. The organizations in-

vited to take part, and the representatives named as members of this committee, are as follows:

National Academy of Sciences.—Prof. A. E. Kennelly.
American Institute of Electrical Engineers.—Prof. A. E. Kennelly.
American Physical Society.—Prof. Henry Crew.
National Electric Light Association.—Dr. Clayton H. Sharp (alternate A. B. Morgan).
Association of Edison Illuminating Companies.—Dr. Clayton H. Sharp.
National Electrical Manufacturers Association.—W. J. Canada.
American Telephone & Telegraph Co.—A. B. Clark (later superseded by W. J. Shackelton).

The questions which these committees have before them may be considered as threefold, namely, (1) the relative functions of the international bureau and the several national laboratories in the future maintenance of the electrical units, (2) the particular values of the units to be adopted, (3) the methods to be used to assure the constancy of these units. These questions are, however, closely interrelated, and in particular the answers to the first two depend upon the last one.

The American advisory committee met at the Bureau of Standards on June 16, 1928, together with a number of members of the staff of the bureau. After due consideration of the information available regarding the present status of electrical measurements, the committee unanimously adopted the following resolutions:

Resolved, That in the opinion of this committee, in view of improvements which are being made in absolute measurements, electrical standards should in future be based upon the absolute system of units.

Resolved, That in the opinion of this committee the functions which it is desirable to have the International Bureau of Weights and Measures undertake in connecton with the electrical units are as follows: (1) A central secretariat to arrange for systematic exchange of standards and compilation of results of intercomparisons thus made among the national laboratories; (2) a laboratory to which concrete standards representing the results obtained in the different countries may be brought for precise comparisons; (3) a repository for international reference and working standards with the necessary equipment so that other standards may be compared with these standards on request.

Resolutions of similar purport have been under consideration by committees of the American Institute of Electrical Engineers for some months and were finally approved by the board of directors June 27, 1928.

When the present international system of electrical units was set up, arbitrary primary standards were considered the most practical basis for defining the units and for checking from time to time the values maintained by resistance coils and standard cells. Developments during the last 20 years have, however, changed the situation materially. In the first place, the standards used purely for main-

tenance purposes have proved surprisingly dependable; in the second place, all scientific workers have come to depend upon the national laboratories to supply certified standards, so that no other laboratory expects to set up independent reference standards; and finally, the experience gained in electrical measurements, together with the refinements made in electrical theory, have apparently made it possible to determine absolute values for the ohm and ampere with an accuracy not less than that attained in reproducing the international units by the prescribed arbitrary primary standards.

The excellent performance of the modern wire resistance coil and standard cell makes it possible to maintain the units for many years with a certainty greater than the values can be reproduced by any single method. In actual practice, whenever mercury ohm determinations have been made during the last 20 years the results have been considered as agreeing with the wire standards within the limits of accuracy attainable by the mercury tubes, and the values assigned to the wire standards have not been changed. Similarly, the second unit actually maintained throughout that period has been the volt, represented by the standard cell; in fact, no final agreement has ever been reached on the precise specifications for the silver voltameter to represent the second international unit.

The logical conclusion seems to be to recognize the fact that the nominally accepted international system of reproducing the units has not worked in actual practice, but that out of experience there has developed a better system. This consists of highly dependable maintenance standards which will serve to maintain continuity and uniformity of values, these values being subject to change by international agreement only when the accumulated evidence of repeated determinations by all available experimental methods shows that there has been a drift or that the values assigned to the working standards are not exactly what they should be.

The American views have been communicated to members of the International Advisory Committee. It is expected that this committee will hold a meeting during the latter part of 1928 to draw up a report to the International Committee on Weights and Measures.

Determination of the Ampere in Terms of Mechanical Units.—A new absolute electrodynamometer has been designed and construction started. It will consist of two solenoids, the large outer solenoid having its axis horizontal and a small inner solenoid having its axis vertical. The inner solenoid will be mounted on the beam of a balance so that the torque which is produced when a current passes through the two solenoids can be balanced by a weight on the pan of the balance. As a form on which to wind the outer solenoid a large quartz cylinder has been procured from the firm of Quartz &

Silice, Paris, France. This cylinder is 110 cm long, 28 cm in diameter, and has a wall thickness of 2½ cm. The inner solenoid will also be wound on a quartz cylinder. Suitable material for this has been obtained from the Lynn Works of the General Electric Co.

Comparison of the Absolute Henry and the International Henry.—The inductance of a coil of definite geometric form can be determined in absolute henries by computation from the mechanical dimensions of the coil. The inductance of the same coil in terms of the international henry can be determined by electrical measurements in terms of the units of resistance and time. Several preliminary sets of measurements have been made on a solenoid wound on porcelain. The results confirm the value previously given, namely, 1 international henry equals 1.0005 absolute or c. g. s. henries.

Measurements with the Silver Voltameter.—The standard for the international volt has been maintained at the Bureau of Standards during a period of 18 years by means of the Weston normal cell. Since the international volt is defined primarily in terms of resistance and current, the value for the Weston normal cell (1.01830 volts) having been derived from such measurements, it is important to determine how well the value of this unit has been maintained. Within the past few months measurements by the use of the silver voltameter have been resumed. It has been possible to make only a small number of deposits as yet. The results of these are given in the following table:

Smith form	Richards form
1.018300	1.018219
339	200
307	207
270	207
321	241
	231
1.018307	1.018218

The electrolyte was prepared from crystallized and fused salt which conformed to specifications for purity published in our earlier work. The difference which has been found between the deposits in the Smith form voltameter and the Richards form is not easily accounted for. A program of voltameter measurements for the coming year has been formulated. Many more deposits must be made before a definite conclusion can be drawn as to the voltage of the Weston normal cell, in terms of the voltameter and the unit of resistance as now maintained by the bureau.

High-Voltage Measurements.—The large absolute electrometer is nearly finished. It is designed on the principle of the classical

Kelvin attracted-disk electrometer but is distinguished from previous instruments by its very large dimensions, much higher range of voltage measurement, and its novel method of shielding. The last produces the same conditions of electrostatic flux as would exist (without shielding) if the upper and lower plates were of infinite diameter, as is assumed in the derivations of the simple formula for the computation of the voltage from the observed force of attraction. It is believed that a conservative value for the upper limit of voltage measurable with this instrument is 250,000 volts.

For many purposes, especially in testing the electric strength of insulating materials and insulating structures, it is desirable to measure the peak (crest) value of an alternating voltage. The sphere gap is the device most generally used for this purpose. The Whitehead corona voltmeter has some advantages over the sphere gap. An experimental investigation of the corona voltmeter has been concluded. Modifications were first made in the instrument to give better control and more accurate measurement of the atmospheric conditions within it. Particular attention was given to the effect of atmospheric humidity on the observed corona-forming voltage. It was found that the effect of humidity on a clean rod was opposite in sign to the effect on a dusty or otherwise soiled rod, and also that the corona-forming voltage was noticeably affected by the very small traces of foreign matter which remained on the rod in spite of a rather drastic process of cleaning.

Publication.—An Experimental Study of the Corona Voltmeter, H. B. Brooks and F. M. Defandorf, B. S. Jour. Research, 1, No. 21, p. 589.

Measurements of Large Alternating Currents.—It becomes difficult, inaccurate, unsafe, and in some cases impracticable to measure current, power, or energy in cases where a current of 500 amperes or more must flow directly through the measuring instrument. For alternating currents the standard practice is to use a current transformer, and with this procedure there is virtually no upper limit. Current transformers have been made which step down in the ratio 6,000:1; that is, a current of 5 amperes in the instrument circuit represents a current of 30,000 amperes in the primary conductor.

The upper limit of testing of current transformers by the bureau is 1,200 amperes, although for transformers of the hole type much higher values can be attained by the expedient of passing the primary conductor more than once through the hole. Progress has been made on the design and construction of air-cooled and oil-cooled noninductive shunts, and a master current transformer with ranges of 1,000 to 12,000 amperes. The completion of this and some related equipment will make it possible for the bureau to test current trans-

formers for the highest values of primary current likely to be submitted for many years to come.

Standardization of Magnetic Permeameters.—In recent years activity in the development of new magnetic materials of superior quality has been steadily increasing. Adequate standards and procedure for the standardization of magnetic permeameters are most important. The bureau has found that the principal problem is the choice and preparation of the bars to be used as standards, since there are few materials naturally homogeneous enough to give satisfactory results. It is necessary to select the materials with care and apply heat treatments calculated to result in the highest degree of uniformity. This is being done with the object in view of building up a series of magnetic standards covering the range of properties ordinarily met with in magnetic testing.

New Magnetic Testing Methods.—In some applications, especially radio, magnetic materials are being employed under conditions of alternating magnetization of very low values. Tests at ordinary values are unsatisfactory for indicating the relative quality of materials at low inductions. An investigation of available test methods is in progress, with the object of selecting the most satisfactory procedure.

Thermomagnetic Measurements.—The thermomagnetic properties of ferromagnetic materials are intimately associated with their composition and structure, and thermomagnetic measurements have been found useful for the study of these factors. Apparatus has been constructed and set up for such measurements, and a paper describing the equipment is in preparation.

Effect of Repeated Stress on Magnetic Properties.—The possibility of conveniently studying the fatigue properties of ferromagnetic materials by magnetic methods has been investigated. It has been found, however, that secondary effects, probably resulting from mechanical strain, completely mask any magnetic changes which may be associated with the progress of a fatigue failure.

Permanent-Magnet Steel.—Notable improvements have been made recently in materials for permanent magnets. By the addition of substantial percentages of cobalt to the composition of permanent-magnet steels, distinctly superior results have been obtained. On account of the increased cost, however, it is not always economical to employ these steels.

Publication.—Some Principles Governing the Choice and Utilization of Permanent-Magnet Steels, R. L. Sanford, B. S. Sci. Paper No. 567.

Submarine Storage Batteries.—Corrosion tests on large storage-battery plates used in submarine cells have been continued to determine the cause of failures. Apparently, while these plates were in

storage an initial stage of the corrosion took place. Lead carbonate was formed, resulting in pits and crevices, which in some cases may have penetrated to larger crevices at the burned joint. The subsequent immersion of these plates in sulphuric acid eliminated the lead carbonate, but the corrosion probably was continued at an even greater rate in these pits and crevices. Crevice corrosion has been found to occur in materials other than lead.

Airplane Storage Batteries.—The effect of temperature on positive and negative plates of airplane storage batteries has been determined. Measurements have been made at three temperatures, three concentrations of the electrolyte, and three different rates of discharge for positive and negative plates considered separately. The temperature coefficient of the negative plate is larger than that for the positive plate. The results have shown quite positively why some aviation batteries have failed to give the service which was expected of them. An abridgement of this work was presented as a paper before the American Electrochemical Society in April, 1928.

Lead Oxides for Batteries.—Work on lead oxides used in the manufacture of storage-battery plates has been mainly concerned with the physical and chemical properties of the oxides and a comparison of the several methods which are employed for measuring apparent density, acid absorption, red-lead content, etc. An air fractionator was devised for separating the oxides into fine, medium, and coarse particles. The terms " fine " and " coarse " are purely relative, however, as nearly all of the material will pass through a screen of the finest mesh. Large and important differences in the physical and chemical properties of these fractions were found, and it is proposed to use the material obtained by the use of this fractionator in the preparation of experimental plates.

Grid Materials.—A beginning has been made on the study of grid materials and structure. The grids which have been cast for experimental work were prepared from pure lead and pure antimony obtained by purchase, but this work has been confined to the preparation of grids required for the experimental work on oxides, and no attempt has been made as yet to study the behavior of different combinations of the alloy or the effect of varying the conditions under which castings are made.

Dry-Cell Standardization.—The United States Government master specification for dry cells and batteries has been revised. The new specifications were approved by the American Standards Association as an American standard and have been put into effect in all the bureau's tests. Qualification tests of dry batteries are made at intervals of approximately six months and are, for the most part, intermittent tests which require a considerable period of time.

They are, therefore, made at stated intervals on batteries selected at the factories by a representative of the bureau. The qualification tests permit the bureau to follow the trend of the manufacturers' product and to give advice to Government purchasing officers as to whether the product of any particular manufacturer meets the Government requirements. Acceptance tests, on the other hand, are made more quickly for comparison with data on similar batteries included in the qualification tests. Acceptance tests are in the nature of inspection tests and are designed to give information on the uniformity of the product which otherwise is known to comply with the detailed requirements of the specifications.

ELECTROLYSIS TESTING

Consulting Service.—Improved street-railway maintenance has reduced the demand for assistance in the mitigation of stray-current electrolysis, and the work of the bureau along this line has been reduced to part time of one man. In 1928 two large cities have made electrolysis surveys under the general direction of this engineer, who visited the cities from time to time to advise with the local engineers regarding plans for the work and interpretation of their data. A laboratory study of the effect of stray current on copper and brass service pipe resulted in a paper entitled "Some Experimental Studies of External Corrosion of Copper and Brass Service Pipe," by K. H. Logan and S. P. Ewing, presented at the annual meeting of the American Water Works Association. It was shown that, when subjected to electrolysis, copper, and brass corrode at approximately the same rate as iron or steel.

Soil Corrosion.—Of the 15,000 specimens buried since the work began in 1922, approximately 4,000 have been removed for examination. A publication has been issued explaining the purpose and scope of the investigation and giving the results of the first four years' work. The type and extent of the initial corrosion of ferrous pipe materials is found to depend more upon the nature of the soil to which the pipe is exposed than the character of the pipe material. The rate of penetration of pits, and usually the rate of loss of weight, appears to decrease with the time of exposure; that is, pipes corrode faster at first than later. Galvanized material was found to last much longer in some soils than in others, while thin bituminous coatings were found to be inadequate for the protection of pipe against severely corrosive soils. Several methods of determining the corrosiveness of soils are under investigation. A study of the causes of corrosion of an oil pipe line in Oklahoma furnished data which indicate that when a pipe line passes through two different soils a galvanic cell is formed and corrosion occurs at one point on the

line, as at the zinc of a dry cell. The results of the study of this line were published in Western Gas.

Publication.—Bureau of Standards Soil-Corrosion Studies. I. Soils, Materials, and Results of Early Observations, K. H. Logan, S. P. Ewing, and C. D. Yeomans, B. S. Tech. Paper No. 368.

FIRE RESISTANCE

Fire Resistance of Walls.—Tests of walls were concerned mainly with heavy hollow units of various shapes intermediate between brick and hollow tile. Their fire resistance was found to range from that obtaining for the heavier hollow-tile designs previously tested to that for solid-brick walls. In some tests, supplementing the program of wall tests completed last year, it was found that the fire resistance of 8-inch unplastered walls built of hard-burned hollow units (water absorption below 4 per cent) was limited by spalling effects; also, that the ends of wood members projecting into a masonry wall, while they reduce its fire resistance, require a higher temperature for ignition than wood freely exposed, and the progress of the fire to the outside of the wall is comparatively slow.

Publications.—Fire Resistance of Brick Walls, Eng. News-Record, 99, No. 16, p. 628; October 20, 1928.

Letter Circulars Nos. 228 and 229 on fire resistance of clay, sand-lime, and concrete-brick walls.

Severity of Building Fires.—Tests with office occupancy were completed, the concluding tests being with record storage occupancy equipped with metal shelving. Metal shelving, particularly that with backs and partitions, was found to restrict the spread of fire from large and small origins, although under conditions favorable for the building up of room temperature, complete burning out of combustible room contents was obtained. The equivalent severity of the fire was, however, less than with wood shelving, being for 50 pounds per square foot of paper contents assumed uniformly distributed over the room area equivalent to not over five hours of the standard furnace test, while the same amount of records on wood shelving gave a fire approximately equivalent to seven hours of this test.

The results of these tests apply to occupancies housed in fire-resistive buildings whose wall, floor, and column constructions can withstand a complete burning out of combustible contents, finish, and trim without collapse. They afford a method for direct application of the results of furnace tests of building materials and construction, since the fire hazard of occupancies and the results of the furnace tests are expressed in terms of the same unit. They enable

the fire-resistance requirements of building codes and similar standards to be placed on a more satisfactory basis in that the fire resistance required for a given building can be made proportional to the severity of the fires that can arise with the occupancy for which it is designed.

The equivalent severity of fires in buildings with nonfire-resistive interior construction that collapses during the progress of the fire is less determinate than in buildings of fire-resistive construction, although of interest as it concerns fire exposure to insulated containers, such as safes and vaults located within the burning building, to the party and fire walls separating it from the adjoining construction, and the fire hazard to neighboring buildings from radiated heat, heated-air currents, and flying brands. A burning-out test with two buildings of this type was made, from which considerable information on some of the above points was obtained.

Publications.—Severity, Duration, and Control of Exposure (committee report), Proc. Nat. Fire Protec. Assoc., **31**, p. 295; 1927.

The Severity of Building Fires, S. H. Ingberg, Proc. fourteenth (1928) annual meeting of Building Officials Conference of America, p. 87; 1928; Quarterly, Nat. Fire Protec. Assoc., 22, No. 1, p. 43; July, 1928; Safety Eng., 56, No. 2, p. 57, August, 1928; and No. 3, p. 103; September, 1928.

Fire Test of Brick-Joisted Buildings; Quarterly, Nat. Fire Protec. Assoc., 22, No. 1, p. 62; July, 1928; Safety Eng., 54, No. 1, p. 27; July, 1928; Jour. Am. Ins., 5, No. 8, pp. 7 and 31; August, 1928.

Fire-Prevention and Fire-Loss Statistics.—Experimental methods were developed for gauging the fire hazard of discarded cigarettes, cigars, and matches, and some modifications in their make-up were shown to decrease the hazard. Tests were also made to determine the autogeneous ignition points of petroleum, nitrocellulose, acetate cellulose, and other fibrous organic products, and the fire-retardant effect of paint and other mineral coatings applied on wood. A study based on State reports was made of the seasonal variation in the fire loss, both as it concerns the total loss and the portions attributed to the main fire causes. A review of causes of fires in dwellings was also made and structural protective measures outlined.

Publications.—Fire-Hazard Tests with Cigarettes and Cigars, P. D. Sale and F. M. Hoffheins, Quarterly of the Nat. Fire Protect. Assoc., **21**, No. 3, p. 237; January, 1928.

Fire-Hazard Tests with Matches. P. D. Sale; Quarterly, Nat. Fire Protect. Assoc., 21, No. 4, p. 331; April, 1928.

The Seasonal Variation in the Fire Loss, Ruth L. Morgan, Safety Eng., 54, No. 4, p. 131; October, 1927; J. Am. Ins., 5, No. 1, p. 13; January, 1928.

Fire Resistance in Dwelling Construction, S. H. Ingberg, Proc., 32d annual convention Nat. Assoc. Mutual Ins. Co., p. 99; 1927.

GAS ANALYSIS AND SERVICE

Gas Analysis.—Several improvements have been made in volumetric gas-analysis apparatus, including convenient means for maintaining an atmosphere of nitrogen in the distributing train, better means of controlling flow, and improvements in absorption pipettes.

Gas-Burner Design.—A study has been made of the design of gas burners for propane, which is being extensively distributed as a domestic fuel. A similar study is being made of butane. Optimum conditions are developed with relation to the efficiency, capacity, and safety of the burners for domestic purposes.

Orifice-Meter Investigation.—The cooperative work being conducted with the natural-gas department of the American Gas Association has been continued, the chief of the section concerned now being in charge of the conduct of the testing. The effects on orifice-meter indications of fittings close to the orifice have been determined. The effect of widely varying rates of flow upon the discharge coefficient was studied, and the results are very satisfactory, check tests indicating that they are of a relatively high degree of accuracy. Apparatus has been designed and built for orifice tests under very high pressures. Work has already been started in accordance with the program for the present season, which includes appropriate tests to determine the effects of (1) actual pipe size; (2) high-line pressures; and (3) flange design.

Service Standards.—The bureau has cooperated with two State commissions and several cities in the study and discussion of the technical phases of proposed readjustments of standards for gas service.

A new edition of Bureau of Standards Circular No. 48, Standards for Gas Service, is in preparation. Most of the data necessary for this revision have been collected.

Assistance has been given the government of the District of Columbia in the preparation of a new code of rules for gas fitting in the District.

GLASS AND GLAZES

Production of Optical Glass.—The investigations of glass are carried on with the assistance of the Navy Department and a glass-research committee representing a large number of American glass manufacturers. Approximately 36,000 blanks of usable optical glass, weighing about 2,700 pounds, were made during the year. The glass was of five types, having the following respective indexes and dispersions: 1.517, 64.0; 1.574, 57.7; 1.605, 43.3; 1.620, 36.6; and 1.650, 33.0.

Effect of Gases in Glass.—In cooperation with the glass-research committee, the effect of gases in glass on its various properties is being studied. This work has, however, only been started, and no data are available. In connection with the studies of changes in composition as affecting physical properties, data were obtained which show that the indexes of refraction and density of lead glass increase 0.000024 and 0.00014, respectively, per °C. decrease in effective annealing temperature. Similarly, a light barium crown glass changes 0.000048 and 0.00034.

Publications.—Cause and Removal of Certain Heterogeneities in Glass, L. W. Tilton, A. N. Finn, and A. Q. Tool, B. S. Sci. Paper No. 572.

Some Effects of Carefully Annealing Optical Glass, L. W. Tilton, A. N. Finn, and A. Q. Tool, J. Am. Ceram. Soc., 11, No. 5; May, 1928.

The Effect of Heat Treatment on the Physical Properties of Glass, A. Q. Tool and D. B. Lloyd, Fuels and Furnaces, 6, No. 3; March, 1928.

Large Glass Disk.—The largest single piece of optical glass ever produced in this country has been made at the bureau. The piece as finally finished, ready for the grinding into the form of a mirror for a reflecting telescope, was 69.75 inches in diameter, 10.5 inches thick, and weighed 3,890 pounds. After the grinding of one surface of this disk it was examined for thoroughness of annealing and was found to be very well annealed, the maximum birefringence observed being about 6 mμ/cm thickness, with symmetrical distribution of the strain. Furthermore, an 8-inch hole was drilled through the center of the disk to permit of mounting in the telescope.

Enameling of Metals.—The study of blistering of enamels on cast iron in cooperation with the enamel division of the American Ceramic Society has led, among others, to the following conclusions: (1) Variations in enameling practice have a considerable influence upon the tendency of a casting to produce blistering, (2) different heats of the same pig iron may have different blistering tendencies, even when melted in the same electric furnace, (3) the source of blistering is apparently on a very thin surface layer of the casting. The removal of this layer by mechanical or chemical means decreases strikingly the tendency toward blistering.

The investigation of possible methods for producing a white ground coat resulted in the development of a method and equipment for determining the bond of enamels to metals. Essentially this consists of clamping together two sheets of metal while the enamel is still soft and allowing them to cool while so clamped. They are then pulled apart in a testing machine. This method of test is being used in studying the effect of the compositions of the ground coats on their adhesiveness.

Publication.—Progress Report on Cast Iron for Enameling Purposes, W. N. Harrison, C. M. Saeger, jr., and A. I. Krynitsky, J. Am. Ceram. Soc., 11, No. 10, p. 595; October, 1928.

Standardization of Thermal-Conductivity Measurements.—A survey has been made to determine the accuracy of the thermal-conductivity measurements of commercial and other laboratories. Flat specimens of a homogeneous cork-composition material were prepared and furnished to several laboratories. Thermocouples for measuring the temperature difference between the two sides were incorporated in the specimens, so that the latter could be calibrated as conductimeters or heat-flow meters. In this way the results could be analyzed more readily, since a means was furnished for a check of the measurement of heat flow, independent of the measurement of temperature difference in any particular apparatus. An improved form of apparatus was designed and built, primarily for the calibration of conductimeters. A large number of measurements were made to determine the performance of this apparatus, and it was concluded that under favorable conditions, such as reasonable thickness and flatness of test specimen, the accuracy of measurement was slightly better than 1 per cent, the limit being imposed by errors in the measurement of thickness rather than in heat flow.

The survey of the results of various laboratories is not yet complete, but the results thus far obtained indicate that the general agreement is of the order of 5 per cent, although a number of individual experiments fall outside this limit.

Heat Transfer Through Building Materials.—Experimental work on this project has been completed, and the forthcoming publication will contain results on a number of types of brick, hollow tile, and frame construction, as well as calculated values of a number of wall combinations not actually tested as such. The effect of workmanship on the insulating value of brick walls is especially noticeable, walls with little mortar in the vertical joints having considerably greater insulating value than those with vertical joints completely filled. Little difference was found between similar walls built of light and heavy common brick of commercial grades. This was verified by actual measurement in a small apparatus of the conductivity of the two kinds of brick used in the construction of the large test panels.

Radiator Investigation.—The question of a proper performance rating for steam and hot-water radiators has assumed considerable importance. The effectiveness of a radiator as a heating element depends on a number of factors, not all of which have been taken into account in the usual test methods employed in the past. A test chamber has been designed and built, preparatory to trying out a method of test which will take into account all of the important factors involved in radiator performance.

Low-Temperature Measurements.—At the last meeting of the International Conference on Weights and Measures numerical values were assigned by international agreement to the temperatures of the fixed points to be used for the calibration of platinum resistance thermometers at low temperatures. Work is in progress at the bureau to insure a uniform temperature scale based upon these fixed points.

The investigation covers three different projects—(1) platinum metal-alloy resistance thermometers, (2) the effect of small amounts of impurities on the resistance of platinum at low temperatures in relation to platinum resistance thermometry, and (3) the calibration of resistance thermometers on the international scale. The third project is part of an international program for the exchange of thermometers for calibration by the Bureau of Standards, the Reichsanstalt, the National Physical Laboratory, and the Cryogenic Laboratory of the University of Leiden.

Material for Coloring Etched Lines on Thermometers.—The materials ordinarily used for coloring the lines and figures on etched-stem thermometers are not permanent under all conditions. The bureau has found that a mixture of water glass with a finely divided inorganic pigment, such as manganese dioxide, is more durable than the materials now in use. A thermometer treated with this material retains the color even when heated to 500° C. and can be used in hot oil, water, or steam without injuriously affecting the visibility of the lines. Clinical thermometers may be treated with any of the common antiseptic solutions without removing the coloring material.

Partial-Immersion Thermometers.—In testing and using partial-immersion thermometers it has been assumed as a first approximation that the temperature of the emergent stem is determined by the bulb temperature and is independent of the conditions of use. For many purposes this approximation has proved adequate. There are, however, a number of types of partial-immersion thermometers, such as those specified by the American Society for Testing Materials and in the Federal Specifications Board specification No. 2d for lubricants and liquid fuels, which are used only with a definite kind of apparatus. For many of these thermometers a higher accuracy is desired than that represented by the approximation mentioned, and this can be obtained by determining and specifying for each type of thermometer the stem temperatures corresponding to various bulb temperatures. Measurements of stem temperatures under conditions of use have been made with a number of types of testing apparatus in order to provide a basis for standardizing such partial-immersion thermometers for the conditions under which they are used.

Temperature Measurements of Molten Cast Iron.—The corrections which must be applied when measuring the temperature of molten iron with an optical pyrometer have been determined directly by making simultaneous measurements of the true temperature with a thermocouple and the apparent temperature with optical pyrometers on about a dozen types of cast iron. The work was done on both streams and ladles of molten iron throughout the whole range of temperatures at which these irons can be cast. Correction factors previously used were found to lead to very large errors, since the character of the surface undergoes an abrupt change in the neighborhood of 1,375° C. true temperature. About this temperature the corrections are large, ranging from 110 to 140° C., while below this temperature the corrections are about 40° C.

The results of this work will appear in the form of a paper entitled "Temperature Measurements of Molten Cast Iron," by H. T. Wensel and W. F. Roeser, in the 1928 Transactions of the American Foundrymen's Association.

Heat Losses from a 75-Ton Hot-Metal Car.—The rate of cooling of molten iron in a car such as is used to transport molten metal from one part of a plant to another was determined. The heat losses by radiation and convection were computed and found to agree well with the losses computed on the basis of conduction through the walls.

The loss from the car with an external surface of 550 square feet, whose gross weight was about 165 tons (car 90 tons and contents 75 tons), was found to be about 35,000 calories per second, corresponding to a cooling rate of about 6° C. per hour after the initial heating of the walls had been accomplished. These figures may also be used to estimate the rate of heat loss from larger or smaller cars of the same type. The results are of interest as indicating how long metal may be allowed to remain in a car, in case of a tie-up of the transportation system, without danger of the metal freezing and ruining the car. The results are published in detail in the 1928 Transactions of the American Foundrymen's Association.

LEATHER

Specifications and Properties of Leather.—The Government's specifications for rigging leather have been revised, involving the analysis of 15 different commercial rigging leathers. The results indicated that the specifications were not in accord with commercial practice with respect to the permissible stretch, percentage of water absorption, and grease content. Accordingly, recommendations for revision were made and adopted by the Federal Specifications Board.

Tensile strength and stretch measurements of calf and sheep skins, representing the light leathers, were completed, involving 1,500 determinations. The results indicated that these properties were influenced to such an extent by the mechanical factors of finishing that in order to secure fundamental data tests would have to be made on the rough unfinished skins.

Publications.—United States Government Master Specification for Bag Leather, B. S. Circular No. 338.

United States Government Master Specification for Rigging leather, B. S. Circular No. 339.

United States Government Master Specification for Leather, Hydraulic Packing (Vegetable-Tanned), B. S. Circular No. 340.

Leather work of the Bureau of Standards, R. C. Bowker, Leather Mfr., January, 1928.

Leather standardization activities at the Bureau of Standards, R. C. Bowker, United States Daily; March 30 and 31, 1928.

Chrome and Vegetable Tanned Sole Leather.—The investigation to determine comparative durability of vegetable-tanned leather and chrome leathers retanned with vegetable tanning materials has continued. The total number of test soles placed in service was 500 pairs, of which 44 are still in service. The results obtained have interested many Government departments, and it appears that a Federal specification for these types of leather will be developed on the basis of the work done.

Curing Calfskins.—At the request of the Calf Tanners' Association the bureau is attempting to develop standards for curing calf leather. The first step in the work, that of securing specifications for salt, has been started.

Acid in Leather.—An investigation is in progress to determine the effects of acid on the life and properties of leather. Six hundred and seventy-two samples of standard leather were tanned in the laboratory and were then treated with different percentages of sulphuric acid varying from 1/4 to 4 per cent, tested for original tensile strength and stretch, and stored for aging, the periods being 2, 4, 6, 9, 12, and 24 months. Complete results are not yet available.

Publication.—Progress Report on the Effects of Acids on Leather, R. C. Bowker, J. Am. Leather Chem. Assoc.; March, 1928.

Cleaning of Fur and Leather Garments.—A number of different methods for cleaning and renovating fur and leather garments have been used with varying success. The dyer and cleaner handling the bulk of the renovation of outer-clothing materials has been called upon to perform this service. The National Association of Dyers and Cleaners, through its research associateship at the bureau, is studying the problems involved.

A method for thoroughly cleaning fur and leather garments, yet retaining the fatty content which is essential to the appearance and pliability of the material, is most desirable. It was found that, by modifying the usual dry-cleaning process by the addition of small percentages of paraffin, this result could be accomplished. Samples cleaned in the laboratory showed no loss of color and good appearance and retained their pliability.

Trials in cleaning plants of preliminary recommendations permitted the fixing of standard practices.

Publication.—Cleaning of Fur and Leather Garments, M. H. Goldman and C. C. Hubbard, B. S. Tech. Paper No. 360.

Imitation Leather.—A Federal specification for imitation leather was 75 per cent completed. The scrub-test apparatus will be in service shortly, and a paper describing the machine is being prepared. Cooperation with the Society of Automotive Engineers committee will be continued.

LIME AND GYPSUM

Adhesion of Plaster to Hollow Tile.—The adhesion of three kinds of plaster (gypsum, cement, and cement-lime) to three different grades of hollow clay tile (hard, medium, and soft) was determined. Five different types of tile surface were used—combed, grooved, wire cut, smooth, and glazed. The results varied from 5.4 to 22.4 pounds per square inch. In all cases the plaster separated from the glazed tile under a force slightly greater than the weight of the tile.

Publication.—Adhesion of Plaster and Stucco to Hollow Clay Building Tile, J. A. Murray and H. D. Foster, Am. Architect, p. 839; December 20, 1927; Contract Record, 42, No. 4, p. 80; Brick and Clay Record, 72, No. 1, p. 34.

Acoustical Plaster.—It was found that a graded porous aggregate, bonded with gypsum plaster, was quite satisfactory in remedying the acoustical defects of auditoriums through sound absorption. If, in addition, the plaster was rendered more porous by generating gas in it during setting, the absorption of sound was further increased.

Properties of Sand-Lime Brick.—The tensile, shear, transverse, and compressive strengths of sand-lime brick from six different plants were determined. These varied from 175 to 220 pounds per square inch, 1,000 to 1,600 pounds per square inch, 580 to 780 pounds per square inch, and 2,360 to 3,500 pounds per square inch, respectively.

Strength of Mortar Joints.—A study was made of the strength of mortar joints between sand-lime brick. A rather complete investigation was made. One striking result may be cited. Bricks mortared together with a cement mortar showed an adhesion of 27 pounds

per square inch after aging 28 days in the laboratory, whereas, on repeating the investigation with specimens on the roof an adhesion of 95 pounds per square inch was obtained at 28 days.

Properties of Chemical Quicklime.—The properties of commercially available chemical quicklimes have been determined. This information is needed in the preparation of specifications for chemical lime. Thirty-five samples were obtained and chemical analyses made, which included, in addition to the usual constituents, the less commonly determined ones such as phosphorous, manganese, and arsenic. The residues on a No. 30 sieve, after slaking, were determined and varied from 0.7 to 50.1 per cent. The amounts passing a No. 200 sieve varied from 46.0 to 96.1 per cent. Available lime was determined by the modified Scaife method and varied from 37.9 to 97.1 per cent.

Publication.—Composition of commercial chemical limes, J. S. Rogers, Indus. and Eng. Chem. 19, No. 10, p. 1157; October, 1927.

LUBRICANTS

Measurement of Oiliness.—When two oily surfaces are in contact or nearly in contact under conditions of very high pressure and low speed, such that the ordinary viscous film can not be maintained, the property of an oil which is responsible for the lubrication of the surfaces is called "oiliness."

An apparatus recently developed at the bureau, and known as the disk-friction machine, affords an inexpensive method of experimentation and yields information as to the relative performance of the numerous bearing metals and lubricants actually used in service. This machine measures the oiliness effect between three ordinary commercial steel ball bearings and a small disk made from the brass, babbitt, or other bearing metal to be tested, the balls and the disk being separated by the "oiliness film" of the particular lubricant under investigation. The lowest coefficients of friction have been obtained using fatty oils on disks high in lead. Many of the fatty oils and mineral oils containing fatty acids were found to be corrosive on bearing metals high in copper.

Several other types of oiliness machines have also been constructed for comparison in order to determine to what extent the relative oiliness of a series of oils is an inherent characteristic of the oils and of the metals, and to what extent it depends on the geometrical form and finish of the bearing surfaces or on the general design of the testing machine.

A mathematical method of analyzing the observations has been worked out for the purpose of distinguishing ordinary viscosity effects from those properly chargeable to oiliness.

Plastic Flow of Lubricants and Paints.—By the use of logarithmic methods of plotting flow pressuregraphs, and with the aid of an improved form of multiple-bulb consistometer, a new characteristic constant of plastic materials has been discovered in addition to two such constants previously used. These three constants are independent of the dimensions of the testing apparatus itself, at least over the customary range of conditions employed in such testing, and, therefore, constitute a definite step of progress toward a rational basis for measuring and specifying the consistency of lubricants, paints, and other plastic substances.

New Consistometer.—A new consistometer has been developed which embodies both speed and wide range of applicability. The new instrument is particularly useful in giving information on the consistency of plastic and semisolid lubricants, such as oils at low temperatures and greases. By the ordinary consistometer, only the unworked consistency or that possessed by the lubricant under starting conditions is measured. The new instrument measures not only the unworked, but also the worked (or broken down) consistency of the lubricant. This latter consistency is that which prevails in the lubricant under running conditions and, in general, is considerably different from the unworked consistency.

Oxidation of Lubricating Oils.—In the past five years considerable attention has been given to the problem of devising a suitable test to measure the tendency of lubricating oils to deteriorate in service as the result of oxidation. This work having been substantially completed, a program of research is in progress to investigate the effect of oxidation on various properties of the oil, such as corrosive action on metals, organic and inorganic acidity, viscosity, resistance to emulsification, and oiliness.

Acidity Test for Oils.—In estimating the neutralization number (acidity) of oils, methods based on changes of color in indicators fail when oils have a very dark color or one which is appreciably soluble in the solution titrated. An apparatus has been set up to provide for such cases, as well as to furnish added information not obtainable from colorimetric methods. In cooperation with the American Society for Testing Materials, various methods of procedure have been tried in the direction of standardizing the methods as a routine test.

Rapid Measurement of Viscosity.—The viscomparator, mentioned in the 1927 Yearbook, has been calibrated and is in use in routine testing of lubricating oils. This instrument affords a very rapid means of measuring kinematic or Saybolt viscosity, and its accuracy is believed to be well within the requirements for commercial or routine work. Arrangements have been made with one of the instrument companies to supply viscometers of this type to other labora-

tories handling large numbers of samples of oil, varnish, or other liquids, the viscosity of which is an important factor.

Reclamation of Used Lubricating Oils.—At the request of the Chief Coordinator and in cooperation with one of the manufacturers of such equipment, a rerefining unit was installed and has been successfully operated. Experience with this apparatus has shown that waste oil as obtained from Government garages and flying fields or public filling stations can be readily rerefined so as to meet the Government specifications for new oil, including both automobile and airplane oil.

Automobile-Oil Recommendations.—The table showing proper viscosity grades of engine oils recommended for motor vehicles in Government use, which was originally based solely on averages of the refiners' recommendations, has been kept up to date and extended by cooperation both with the refiners and automobile manufacturers.

Stability of Oils in Automotive Engines.—A 6-cylinder bus engine has been set up on a permanent foundation for determining the changes which take place in crank-case oils when subjected to long periods of operation.

Law Governing Oil Flow in Wright Engine.—A characteristic curve has been obtained from which the oil flow under starting conditions can be predicted mathematically from a knowledge of its viscosity as determined in the laboratory at the appropriate temperature, provided the oil is a simple viscous liquid; that is, not a plastic oil. In this connection laboratory methods have been developed for readily determining whether any given oil is viscous or plastic.

Lubricating Oils for Knitting Machines.—Oils for lubricating knitting machines are being studied to ascertain those which will not stain the hosiery with which they come in contact. The use of such oils would reduce the expense of removing oil stains which may become "fixed" during the hosiery-finishing processes or while in storage. The efficiency of the oil as a lubricant must not be impaired in obtaining the stainless quality. A number of lubricant manufacturers and suppliers submitted samples. A variety of blends of mineral, animal, and vegetable oils were mixed in the laboratory. Knitted samples of bleached and unbleached cotton have been treated with these oils and subjected to various periods of exposures under mill conditions. An attempt is now being made to remove these oil stains. This work is about three-fourths finished, and results will be reported upon in the next number of the yearbook.

Miscellaneous Publications on Lubrication.—The following papers on various phases of the lubrication work have been published:

Publications.—Viscosity of Lubricants Under Pressure, Mayo D. Hersey and Henry Shore, Mech. Eng., 50; March, 1928.

The Work of the Bureau of Standards on Friction and Lubrication, Mayo D. Hersey, United States Daily; June 14, 1928; and Mech. Eng., 50; August, 1928.

Progress in Lubrication Research, with Bibliography, Trans. Am. Soc. Mech. Eng., 50, No. 2; 1928. Prepared by A. S. M. E. special research committee on lubrication, Mayo D. Hersey, chairman.

MECHANICS

Calibration of Testing Machines.—The dead-weight machine, in which loads can be applied by 10,000-pound increments up to 100,000 pounds, has been used during the past year for calibrating portable calibrating devices, such as proving rings, Amsler boxes, etc. A proving ring having a capacity of 100,000 pounds either in tension or compression has been purchased by the bureau and has been used frequently for calibrating testing machines for other Government departments and private individuals.

There is an insistent demand for proving rings for calibrating testing machines up to 200,000 and 300,000 pounds from laboratories testing concrete and road-building materials. A hydraulic testing machine using the Emery hydraulic support and Bourdon tube pressure gauges for measuring the load is now being made in this country. To demonstrate the accuracy of the loads indicated by this machine, proving rings having a capacity of 300,000 pounds should be available, as the use of other calibrating devices is impracticable.

As the bureau was established primarily to certify weights and measures, and no other agency is in a position to do this work, the bureau should, as soon as possible, obtain the equipment for calibrating proving rings and other devices up to 1,000,000 pounds in order that industry may determine accurately the strength of the materials used in structures and machines.

Locking Screw Threads.—Many failures of machines resulting in damage to property and loss of life are caused by the unscrewing of nuts on bolts and other threaded parts of the mechanism. The importance of locking screw threads to prevent unscrewing has been widely recognized and has received a great deal of attention, as shown by the large number of lock nuts and lock washers now on the market. The number of patents on locking devices for screw threads is enormous. A careful search of the technical literature shows practically no reliable data on the efficiency of screw-locking devices. No methods for testing these devices in the laboratory have been worked out. Although a few of the companies making lock nuts have built machines for testing them, it is believed that these ma-

chines do not simulate all the conditions found in service, and the results are therefore far from conclusive.

In the past, the efficiency of a locking device has been determined by observing its behavior in service and little or no attention given to studying and analyzing the conditions which cause the threads to unscrew or to the effect of changing the dimensions and the materials of the locking device.

In cooperation with the Dardelet Thread-Lock Corporation, the bureau has undertaken an investigation of the fundamentl principles of all types of thread-locking devices and will develop testing apparatus and methods which it is hoped will allow the value of any device to be determined without the necessity for making service tests, which are always expensive and frequently inconclusive.

This investigation, the first of its kind so far as can be determined, should be of great value to the engineering profession and the industries of this country, as it will give reliable information on an important engineering problem.

The cooperation of most of the manufacturers of thread-locking devices is assured, and the preliminary experiments are now under way.

Journal-Bearing Performance.—Tests have been completed on a series of 84 journal bearings, comprising 21 variations of length or clearance dimensions, in order to determine the effect of the length of the bearing and the closeness of fit on the friction loss. This investigation was conducted in cooperation with the American Society of Mechanical Engineers and will provide data for practical design of journal bearings over a considerable range of speed, load, and viscosity of lubricant. In connection with this investigation three types of experimental apparatus have been set up by which measurements of (1) pressure distribution in the oil film, (2) oil flow, and (3) relative oil-film thickness under different operating conditions can all be demonstrated, which will provide important data for reference in design and operation of machinery.

Publications.—The Effect of Running-in on Journal-Bearing Performance, S. A. McKee, Mech. Eng., 49; December, 1927.

Efficiency of Spur-Gear and Worm-Gear Drives.—An investigation has been undertaken in cooperation with the American Electric Railway Engineering Association for the purpose of determining the relative efficiency of different types of reduction gearing under all conditions of load, speed, and lubrication factors which will be met in street-railway service.

Development of Seismometers.—As the result of cooperative work with the Carnegie Institution of Washington extending over several years a special study has been made of seismometers with electro-

magnetic and optical magnification and electromagnetic damping. A more complete theory than has hitherto been available for this type of instrument has been developed, and an experimental instrument has been constructed to record horizontal disturbances. The results obtained with this instrument indicate that it is superior to the best seismometers previously obtainable for observations on distant earth disturbances. The Coast and Geodetic Survey, which is charged with responsibility for seismological observations, is planning to use instruments of this type and has authorized the bureau to proceed with the development of additional instruments for indicating the vertical component of earth disturbances.

Welded Rail Joints.—In addition to the work during the past year on the program which was outlined by the Committee on Welded Rail Joints when this investigation was undertaken, a study was made of the stresses in seam-welded joints using Berry strain gauges. The specimens and the welding as well as the program for the strain-gauge work were provided by the committee, but the work was very generously donated by Prof. L. H. Crook, Catholic University of America, and Prof. T. R. Lawson, Rensselaer Polytechnic Institute, Troy, N. Y.

The program provided for 2-inch gauge lines placed continuously parallel to each seam weld about one-half inch above and one-half inch below it. The length of each gauge was measured before the joint was assembled, after bolting together, after welding all the seams, and when the joint was loaded as a simple beam with the load at the middle of the span. The changes in the gauge lengths and the stresses computed from these changes show where the material is heavily stressed and failure likely to occur.

It is expected that these results will be useful in redesigning the joints to reduce the maximum stresses and therefore give stronger rail joints. The most remarkable results, however, were the stresses computed from the changes in the gauge lines caused by the welding operation. There were in most gauges compressive stresses increasing in magnitude toward the middle of the seam weld. Computed stresses over 200,000 pounds per square inch were found for many gauge lines. As in all probability the compressive yield point of the rail material is only about 100,000 pounds per square inch, it seems evident that the material adjacent to the welds has been permanently deformed. Sections containing the gauge lines will be cut from the joints. The stress existing in the joints can then be determined with considerable accuracy. That the stresses in the material can be measured by cutting out a strip including the gauge line was demonstrated by experiments on a flat plate along one edge of which a bead was welded. A compressive stress of about 48,000

pounds per square inch was produced in the plate adjacent to the bead of this welding operation. When a strip was cut from the plate adjacent to the bead, the gauge lines returned very nearly to the original length. It is probable that much of the difference between the original length of the gauge lines and the length after cutting the strip from the plate was due to errors of observation and perhaps to "locked-up" stresses in the rolled plate. It is expected that further work will give information which will allow stronger seam-welded joints to be designed.

The shearing strength of small welded specimens which have been preheated and postheated to different temperatures will be determined to find the temperature which gives the strongest weld. Seam-welded rail joints will then be made and tested in tension, bending, and, perhaps, under repeated impact to determine the value of preheating and postheating in welding rail joints.

Welded Steel Tubes.—Experiments have shown that structural members made from tubing are stronger than members having other cross sections. This is true not only for shafting subjected to torsional stresses, but for long columns, such as those used in airship girders, in which it has recently been found that the torsional rigidity determines the ultimate strength of the column.

The more extensive use of tubes in structures and machines (which would result in many cases in a decrease in weight over present designs using other cross sections) depends to a great extent upon the cost of the tubes. Because of the expense of the process, seamless tubes cost much more per pound than cast, rolled, or forged members.

Tubes of mild steel are now produced from rolled sheets, formed into cylinders, and the abutting edges electrically welded longitudinally. These tubes are of uniform thickness.

In cooperation with Welded Tubes (Inc.), this bureau is investigating the strength of these electrically welded tubes. Tensile tests of the tubes and of specimens cut from the tubes, both longitudinally and transversely, some having the weld at the middle of the gauge length, are being made for tubes of different thicknesses and different diameters. The bursting strength is being measured by plugging the ends of a tube and applying hydrostatic pressure. Torsional tests are being made using deformation measuring apparatus designed and built for these specimens. The results obtained so far show that there is no marked difference in the strength of the weld and of the material away from the weld. These welded tubes are, therefore, about as strong as seamless tubes made from similar material.

The growing importance of tubular construction in aircraft justifies a careful study of the use of this or some other method for welding tubes made from chrome-molybdenum steel.

Platinum Metals.—The data collected on methods of purifying the six metals of the platinum group were developed into a set of definite procedures for the preparation of these metals in the highest degree of purity. This work was published as Technical Publication No. 87 of the American Institute of Mining and Metallurgical Engineers under the title The Purification of the Six Platinum Metals, by Edward Wichers, Raleigh Gilchrist, and William H. Swanger. Several of the methods involve new reactions and offer certain advantages in speed and ease of handling. With the advent of these methods, exact study of the properties of the uncontaminated metals and alloys becomes possible. In spite of many difficulties, much progress has been made at the bureau in swaging and spinning some of these metals into shapes suitable for testing. Pure rhodium wire has been prepared and, on account of its higher melting point and lower density, promises to serve excellently and economically as a resistor in place of platinum in high-temperature electric furnaces. The 40 per cent rhodium alloy with platinum is already in use in such furnaces, with excellent results.

The platinum-rhodium alloys are being studied, and these and other platinum alloys are being examined as to their relative merits for crucibles for chemical-laboratory use, with a view toward establishment of specifications for better crucibles.

Properties of Pure Metals.—Determination of the physical properties of pure metals has continued, special attention having been given to nickel and thorium. The data for pure nickel are nearly complete, including values for hardness, density, resistivity, thermal expansion, magnetic properties, temperature of the magnetic transformation, and reflectivity. A similar study of pure rhodium is practically finished. The resistivity and temperature coefficient of resistance of extremely pure zinc and cadmium have been determined.

Properties of Metals at Elevated Temperatures.—The study of the ability of metals to retain their original dimensions under long-continued loading at elevated temperatures and the correlation of the high-temperature "flow" with the results of rapid tests at high temperatures has continued in cooperation with the join committee of the American Society of Mechanical Engineers and the American Society for Testing Materials.

A series of special heat-resistant alloys is under test. Some special steels are also under test in cooperation with a research associate from the Midvale Co.

Publications.—Safe Loads for Steels Working at High Temperatures, H. J. French, H. C. Cross, and A. A. Peterson, Iron Age, **121**, p. 1749; 1928.

Martens' Extensometer with Tuckermann Optical Lever System for High-Temperature Tensile Testing, B. S. Letter Circular No. 238.

Flow in a Low-Carbon Steel at Various Temperatures, H. J. French and W. A. Tucker, Canadian Machinery, **39**, p. 31; 1928.

Quenching.—To meet specifications requiring certain hardness and other properties in quenched steel, it is necessary to consider both the critical quenching rate of the steel itself and the ability of the quenching medium or coolant to cause the steel to cool at that rate. The hardening of a given steel in a given coolant is also dependent on the mass of the object, on the condition of the surface, on the circulation of the coolant, and its behavior as to release of gases. Some coolants cause oxide films, formed in heating the steel for quenching, to split off cleanly, while others do not. These factors were studied as part of a research on the temperature of the surface of steel bodies during quenching. Spray quenching gives a surface-cooling curve which shows that rapid cooling is extended to lower temperatures than in an ordinary quenching bath. Cooling rates as high as 12,000° C. per second at the surface of the steel in quenching were recorded in some portions of the cooling curves by the autographic apparatus used in this work.

Publication.—Surface Cooling of Steels in Quenching, H. J. French, G. S. Cook, and T. E. Hamill, Trans. Am. Soc. Steel Treat.; 1928.

Joint Committee on Investigation of the Effect of Phosphorus and Sulphur in Steel.—This committee, which is made up of representatives from several technical societies and operates under the chairmanship of the Director of the Bureau of Standards, has actively continued its work.

Heat treatment of the second series of forging steels and of the series of steel castings, with varying amounts of sulphur, was completed by the bureau and the specimens forwarded to the Naval Experiment Station and the Watertown Arsenal, where the physical tests will be made. Arrangements are nearly complete for the manufacture of a series of samples to show the effect of phosphorus in low-carbon steels and are pending for the manufacture of a third series of forging steels.

When this extensive project is completed, the results will have great weight in the formation or revision of specifications for sulphur and phosphorus in the grades of steel studied. A bibliography of the literature dealing with the effect of sulphur and phosphorus in steel and cast iron was revised, brought up to date, and issued as Bureau of Standards Letter Circular No. 241.

Iron-Nitrogen System.—The advent of the special nitrided steels whose wear-resistant surfaces are finding many applications makes

it important to know more about the relations between pure iron and nitrogen, as such information forms the base line for a study of the more complex nitriding alloy steels. Thermal analysis of nitrided iron specimens, begun several years ago, has been carried further, pressure-temperature curves obtained showing the rate of loss of nitrogen on heating, and X-ray spectrographic and metallographic examinations made. The data are now being correlated and prepared for publication.

Determination of Gases in Metals.—Although the cleanliness of a steel is of great importance for exacting uses, especially when repeated stresses are encountered, specifications and test methods for its determination are not yet very definite. As much of the dirt in steel consists of oxides, a knowledge of the total oxygen present is useful. Various methods for determination of total oxygen have been suggested, the most satisfactory one so far being the vacuum-fusion method developed at the bureau. Practically the same procedure has recently been adopted in Germany, and analyses of the same sample by English and German laboratories were in close agreement with those of the bureau. Marked advances have been made recently in increasing the accuracy and decreasing the time required for the determination, some of these improvements having been made in the laboratory of the Bureau of Standards and some in the German laboratory. A recent use of the vacuum-fusion method by an American steel manufacturer on carburized steel is deemed by him to have shown the way for a better understanding of some obscure problems of carburizing.

Residue methods for the determination of oxygen combined with different deoxidizing elements used in steel are also useful and have been studied.

The hydrogen-antimony-tin method has been examined and found to be of much lower precision and to be much more tedious than the vacuum-fusion method.

A report on the hydrogen-antimony-tin method for the determination of oxygen in cast iron, by B. Kjerrman and L. Jordan, is given in the November (1928) number of the Bureau of Standards Journal of Research, page 701.

Quality of Steel for Carburizing.—Further work on the McQuaid-Ehn test for carburizing steel, which is required in the specifications of some users, tends to verify previous conclusions that although steels differ in their carburizing and hardening qualities, yet by the use of proper and very simple heat-treatment methods difficulties from this source may be overcome. A final report has been prepared for publication.

Publication.—Steel for Casehardening—Normal and Abnormal Steel, S. Epstein and H. S. Rawdon, B. S. Jour. Research No. 14, p. 423.

High-Speed Steel and the Machinability of Steel.—The limit of impurities that may be allowed in high-speed tool steels, while given in some specifications, is not yet well understood. The effects of antimony, arsenic, copper, and tin have been studied. There is a considerable difference in the effect of these impurities, depending on whether a lathe tool is to be used for rough or for finish turning. The impurities, in amounts likely to be present, have little deleterious effect in rough turning, but in finish turning the performance of the tool was adversely affected, antimony being the most harmful and copper the least of the impurities studied.

Methods of test for tool performance in finishing cuts are not so well standardized as those in rough turning, so considerable attention has been given to methods of test. The use of a " trailer " tool which will start to cut when the tool being tested has worn down a definite amount has been found useful.

Publication.—Effects of Antimony, Arsenic, Copper, and Tin in High-Speed Tool Steel, H. J. French and T. G. Digges, Trans. Am. Soc. Steel Treat., 13, p. 919, 1928.

Air-Hardening Rivet Steels.—A study of the properties of special steels for the Ordnance Department of the Army showed that air-hardening steels whose composition is properly specified in respect to the size of the rivet can be used to join heat-treated light armor plate such as is used in armored tanks, the rivets having as good ballistic resistance as the armor itself.

Publication.—Air-hardening Rivet Steels, H. K. Herschman, B. S. Tech. Paper No. 358.

Rail Failures.—Failure of rails from transverse fissures, though relatively rare, is likely to be disastrous when it does occur. The real cause of transverse fissures, though long sought, has not yet been definitely established. It is accepted by all that the failure is of the " fatigue " type developed under the repeated stresses of service, but the time and cause for the creation of the nucleus of the fatigue failure have still to be searched out. More knowledge of the nature and magnitude of the track stresses, of the rate of growth of the fissures, and of the endurance properties of rail steel will help in locating the cause. The track stress committees of the interested engineering societies, the Sperry Development Co., the railroads, and the Bureau of Standards are, respectively, working on these three problems. The endurance properties of steel from new rails from several heats of rail steel, whose history was known from the charging of the furnace on through all the manufacturing processes, were determined and reported last year. Similar endurance tests are being made on steel from rails from the same heats after service in track in order to determine the influence, if any, of service stresses on

their respective endurance properties. The data obtained to date indicate in some instances variations that can not be predicted from the acceptance tests of the rails as prescribed under existing specifications.

The usual method of endurance testing on a rotating specimen does not apply a range of stresses exactly analogous to the stresses imposed in rail service. It is therefore necessary to have a trustworthy comparison of endurance properties under different modes of stressing and ranges of stress. Hence, as a subsidiary problem, the relation of rotary and axial loading in endurance testing—and the effect of varying the stress range—are being studied.

Whether the nucleus of a transverse fissure exists in the rail before it is put in service or is formed in sound metal during service is a matter on which there has been much debate, with no conclusion as yet accepted by all. Clearing up of this point would aid materially in understanding the situation. One method that might throw light on the problem relates to the ability of the steel to withstand contraction stresses on cooling. Some rail steels tested at elevated temperatures show a range of temperatures in which the strength and ductility are both low. This range of "secondary brittleness" varies in position and in the degree of brittleness in different steels. Room-temperature tests give no inkling of this, so that steels varying widely in high-temperature brittleness meet present specifications equally well.

Both the endurance and the high-temperature testing are being applied to rail steels of various compositions and to steel from heat-treated rails.

Publication.—Fatigue Resistance of Rail Steel, J. R. Freeman, jr., Iron Age, 121, p. 1743; 1928.

Strain Lines.—The peculiar markings that occur on steel when it starts to stretch have been studied on polished bars stressed in tension. The effect is decidedly localized in character; it first appears in a tension bar near the fillet and gradually progresses along the reduced section, somewhat like a wave, the rate of travel being determined by the magnitude of the stress and the rate of stress application. The strain markings are related to the local deformation of individual grains of the metal, resulting in the tilting and shifting of other grains. This effect of "yielding" may be shown at stresses well below the "yield point," as yield point is defined in most current specifications.

Publication.—Strain Markings in Mild Steel Under Tension, H. S. Rawdon, B. S. Jour. Research, No. 15, p. 467.

Microstructure of Ferrite.—Peculiarities in the microstructure of pure iron have been examined and discussed. The mechanical prop-

erties of the material as determined at ordinary temperatures do not appear to be affected to any appreciable extent by the structural variations noted. The high-temperature properties (red shortness), however, appear to be related to some of these usual structural features.

Publication.—Unusual Features in the Microstructure of Ferrite, H. S. Rawdon and T. Berglund, B. S. Sci. Paper No. 571.

Effect of Excessive Cold Work.—It has been reported previously that in the cold-rolling of metals the hardness is at first increased, after which additional rolling produces a decrease in hardness.

Investigation has shown that this decrease in hardness is only apparent. It is the result of erroneous readings of the instrument used in the hardness measurements, and which are produced by the so-called "anvil effect." These errors are always present in hardness measurements of thin strip or sheet metal, if the tests are made by the indentation method. The direction of the error gives a higher or lower apparent hardness value, according to the relative hardness of anvil and strip. No entirely satisfactory method of determining hardness of thin strip is available.

Railway Bearing Bronzes.—Specifications of different railroads for bearing bronzes, to be used in similar service, vary greatly, while those of the American Society for Testing Materials allow a considerably wider range of compositions than do the specifications of most individual roads. In a comprehensive study of copper, tin, lead-bearing bronzes—both sand-cast and chill-cast—a laboratory test technique was developed. Impact tests, tests for resistance to pounding, and tests for wear resistance, with and without lubrication, were made, not only at room temperature but also at higher temperatures corresponding to those at which the bearings operate in service. It was found that no one test alone will satisfactorily evaluate a bearing metal. According to the type of service to which the bearing is to be put, one or another of the tests should be given more weight. Properly weighted in respect to type of service, the tests permit an evaluation of different alloys that agrees well with behavior in service.

The rate of freezing of the casting has more effect on the properties of the bearing than do quite wide changes in its chemical composition. For many railroad uses bearings containing 15 to 25 per cent lead may be considered interchangeable, thus the restrictions of many of the present specifications are closer than need be and increase production cost without corresponding increase in quality. The work is now being extended to automotive bearings.

Publications.—Wear and Mechanical Tests of Some Railroad Bearing Bronzes, H. J. French, reprint, 1928 meeting, American Society for Testing Materials.

Wear and Mechanical Properties of Railroad Bearing Bronzes at Different Temperatures, H. J. French, S. J. Rosenberg, W. LeC. Harbaugh, and H. C. Cross, B. S. Jour. of Research, No. 13, p. 343.

Wear Testing of Metals.—In spite of the importance of the resistance of metals to wear, there are no specifications covering wear resistance and no standard methods for its determination. Some phases of the wear-testing problem are being studied, especially in respect to the test methods applicable in evaluating the wear resistance of chromium and nitride coatings on plug gauges, of materials used in the manufacture of shovels, and of bearing bronzes.

Publications.—Recent Experiments Relating to the Wear of Plug Gauges, H. J. French and H. K. Herschman, Trans., Am. Soc. Steel Treat., 12, p. 921; 1927.

Wear Testing of Metals, H. J. French, Engineering (London), 124, p. 279; 1927.

Fusible Plugs.—Fusible plugs, used for protection of boilers on steamboats operating in interstate commerce, which failed to blow when they should, have been studied in cooperation with the Steamboat Inspection Service. Failure was found to be due to lack of satisfactory bonding of the filling to the casing. Revisions of the specifications have been recommended to make certain that a tight filling will be obtained.

Methods for Testing Foundry Sands.—Specifications for molding and core sands are becoming more common as knowledge of their properties increases, and because of the introduction of standard test methods by the American Foundrymen's Association. The bureau has cooperated with the A. F. A. in the development of sand-testing apparatus and methods since the inception of the work. The sintering test recently developed at the bureau is finding increasing application.

In work on core sands the bureau has recently found that rubber and allied materials make excellent core binders. The outstanding advantage of such binders is the fact that while the core retains its shape till the metal solidifies, it then disintegrates completely so that the core sand may be poured out. The cores are extremely high in permeability, if sand of suitable grain size is used, and the resulting freedom from core blows is another advantage. The cores require no baking, as organic solvents for rubber are used and the core hardens as soon as the solvent evaporates. The use of inflammable solvents requires care, in order to avoid fire hazard, but with reasonable precautions this need not prevent use of these binders where their good properties fit them for service. Information on these binders is given in Letter Circular No. 252.

METROLOGY

Ruling of Line Standards by Use of Light Waves.—Five years ago announcement was made that 6-inch line scales divided into intervals of 1 inch and $\frac{1}{40}$ inch and free from errors greater than $\frac{1}{100,000}$ of an inch had been ruled by using light waves as the standard for stepping off the distances. Since that time the machine has been improved so that line scales 4 inches or 10 cm. in length, or any subdivision of these lengths, can be ruled with an error not greater than $\frac{2}{1,000,000}$ of an inch on any interval.

A larger machine is nearly completed. Its six ways (5 feet long), upon which the carriages slide, have been made straight and parallel within $\frac{1}{1,000,000}$ of an inch. With this machine it is planned to make scales 1 m. or 40 inches in length with errors not greater than $\frac{3}{1,000,000}$ of an inch.

At its last meeting (September, 1927) the International Congress of Weights and Measures adopted the wave length of red radiation of cadmium as the standard wave length. If the attempt to produce a line standard 1 meter in length with this machine is successful, the wave length of red radiation of cadmium can then be made the fundamental standard of length and thus avoid all uncertainty arising from possible changes in dimension with time of the material standard.

Dividing Engine.—A linear dividing engine of high precision, suitable for ruling scales and diffraction gratings up to about 8 inches in length, has been designed and built at the bureau. The need for improved apparatus of this type, in the field of spectroscopy and wave-length measurement, is very great. While much attention has been devoted to this problem in recent years, little progress has been made since the unsurpassed work of Rowland more than 40 years ago.

If the major features of the small machine work out in practice as well as is anticipated, work will be started at once to incorporate the same principles in a larger machine capable of ruling scales and gratings up to 40 inches in length.

Precision Length Comparators and Circle Tester.—The special basement room for precision length comparators, circular dividing engine, and circle-testing apparatus was completed and the equipment installed. The apparatus has now been used for six months in regular testing work and in special investigations.

The longitudinal length comparator has been found capable of making comparisons to a high order of accuracy. It is being used in a very complete program of calibration of the bureau's length standards. This includes a comparison of each of the four platinum-iridium standards with the three other similar standards—the first time that these comparisons have been made on so comprehensive

a scale. Before definite results can be announced it will probably be necessary to determine coefficients of expansion of some of the standards.

The circle-testing machine has been used in testing a number of graduated circles submitted to the bureau. Reports on the accuracy of graduation of these circles will be issued at an early date. The accuracy of the work thus far has been limited by the character of the graduations rather than by the testing device.

As an outgrowth of the circle work, requests have been received for the test of transits and theodolites. The best methods of test and equipment needed are being considered.

Optical Screw-Tread Gauge for Internal Threads.—At present there is no method for determining all the dimensions of an internal screw thread, other than those which necessitate the cutting of a section from the gauge, or indirect measurements made on a cast of the thread. An optical instrument has been designed which permits measurements to be made directly on the thread by a coincidence method analogous to that of the coincidence-type range finder. A complete thread gauge will consist of the optical head, by which the coincidences are established, and the ways, arranged to permit the slow motion of the part to be measured in two coordinates, and provided with precision micrometer screws by which the measurements are taken. A general design for the complete instrument has been made, and the work has been carried to a point such that the accuracy and practicability of the instrument seem assured.

PAPER

Paper-Testing Methods.—Bursting Strength.—The most common method for measuring the strength of paper is to determine its bursting resistance. A study of the clamping device of the Mullen bursting tester showed that the clamping faces permitted creepage of the paper, resulting in variable errors. Recommendations were made as to design of clamping surfaces to correct these errors. The Cady tester was also investigated and was found to have several mechanical advantages in respect to ease of operation and rapidity of testing. Two new plunger types of bursting-strength testers, the Thwing impact and the Johnson were studied, the former being found suitable for testing paper boards.

Tensile Test.—A trade-journal article was published which gives the results of experimental tests of the different types of tensile testers commonly used. This contains data which show the relative accuracy of the different types.

Tearing Tester.—Growing out of the demands of an investigation, a means was developed of increasing the capacity of the Elmen-

dorf tearing tester. A calibration formula for the tester was also devised.

Folding Endurance.—The most important test for determining the general resistance of strong papers to wear is the folding test. Frequent calibration of the standard Schopper folding tester is necessary, owing to the many mechanical variables present. A calibrating device was developed which greatly simplifies the calibration. This permits calibration and readjustment of the tester without disturbing the assembly, as was previously necessary.

Conditioning Paper.—While it is necessary that paper be carefully conditioned to a certain moisture content for physical testing, there is lack of exact data as to means of controlling the conditioning atmosphere. Study of the various devices for such control was initiated and is still in progress.

Publications.—Calibration and Adjustment of the Schopper Folding Tester, F. T. Carson and L. W. Snyder, B. S. Tech. Paper No. 357.

A Study of the Mullen Paper Tester—Effect of the Clamping Device on Test Results, L. W. Snyder, Paper Trade J.; August 4, 1927.

Increasing the Capacity of the Elmendorf Tearing Tester, F. T. Carson and L. W. Snyder, Paper Trade J.; March 29, 1928.

A Study of the Thawing Impact Tester, H. C. Eckhardt and L. W. Snyder, Paper Trade J.

Results Obtained With the Various Types of Testers Used for Measuring the Tenstile Strength of Paper, R. E. Lofton and L. W. Snyder, Paper Trade J.

Standardization of Paper—Cooperative Work with Technical Association.—The cooperative work with the Technical Association of the Pulp and Paper Industry on standardization of paper-testing methods was continued. During the past year five additional methods were completed and were adopted by the association, making a total of 26 official methods so far completed. A thorough revision of the association's publication, Paper-Testing Methods, was also made by the committee. This is a very complete handbook of paper testing, containing, in addition to the standard methods, descriptions of all known methods of importance. This cooperative work will continue indefinitely.

Cooperation with American Paper and Pulp Association.—In addition to the usual cooperation with this association, assistance was given in revision of the association's publication, Classification and Definitions of Paper.

Quality Standards.—The research in connection with the development of a Federal specification for fiber wall board was completed and a specification recommended to the committee dealing with this material.

At the request of, and in cooperation with, the National Lumber Manufacturers Association, the bureau has been studying sheathing

papers, for the purpose of developing a standard specification. Considerable information has been developed and a preliminary report issued.

Several studies were made relative to the permanence of papers Rag newsprint paper for permanent library issues was studied and assistance given in developing a satisfactory product for this purpose. A similar service was rendered an insurance company in securing a satisfactory permanent paper for insurance policies, and to the Library of Congress in securing a paper for making permanent photostat records of original material in English libraries relating to the early history of the United States.

Tests made over a period of four years, at the request of the Post Office Department, showed no deterioration of stamped envelopes in that time, thus indicating satisfactory permanence.

Future Work.—In addition to the continuing projects mentioned, a study of the permanence of book paper has been initiated. The immediate purpose is to insure the permanence of the bureau's research publications, but such information will be of value, in general, in respect to preservation of important books and pamphlets.

Publications.—Paper Research of the United States Bureau of Standards During 1927, B. W. Scribner, Paper Trade J.; January 26, 1928.

Paper-Standardizing Activities of the Bureau of Standards, B. W. Scribner, United States Daily; March 15 and 16, 1928.

Fibrous Raw Materials—Waste Thread.—At the request of a manufacturer of automobile tires, the paper-making quality of waste thread from the gum-dipping process was investigated. The cotton thread is of excellent quality for paper making, but it contains a rubber residue which makes its utilization difficult. The results indicate that it could be used for boards or wrappings if the rubber content did not exceed 1 per cent.

Helianthus Argophyllus.—Paper-making tests were made of Helianthus Argophyllus, which is a member of the sunflower plant native to Texas. This test was requested by persons interested in additional development of the national resources of Texas. The plant was found to be poorly suited for paper making owing to the small amount of paper-making fiber present and to the poor quality of the fiber. Additional information on possible uses for this plant will be found under "waste land products."

Waste Rayon.—Investigation of the paper-making quality of waste rayon was undertaken, as this material is being found in increasing amounts in waste cotton and linen rags used for paper making. The work so far done indicates that rayon has no value for paper making. Additional tests are to be made during the following year.

Purified-Wood Fibers—An important development in paper making is the production of purified-wood fibers which are much superior to the common wood fibers and are being substituted for rag fibers. As they cost much less than the rag fibers, a considerable economy is effected by their use. It is important to know definitely, however, if the new product is as permanent as the rag fibers, because the latter alone have hitherto been considered suitable for permanent records. At the request of a manufacturer of the purified-wood fibers, who has provided a research associate to assist in the work, a study of the relative quality of such fibers was undertaken. This includes the usual physical and chemical tests, as well as special aging tests of both pulps and papers. This work will probably extend over the following two years.

Permanency of Cellulose Fiber.—This problem forms the basis of a cooperative research with the Brown Co., of Berlin, N. H. Different manufacturers have sent to the bureau 32 pulp and half stocks, 2 waterleaf papers, and 42 sized-paper samples. These materials are being subjected to accelerated aging exposures. Physical and chemical analyses are made both before and after exposure. One hundred and thirty check alpha cellulose, 65 copper number, and 70 resin determinations have been made. Approximately 60 of the samples were tested for fiber composition, thickness, color, folding resistance, tear resistance, and tensile strength. Determination of the pentosans and the viscosity in copper-ammonia solutions will be made as soon as time permits and the apparatus becomes available.

Various manufacturers have submitted cellulose pulps which they recovered from certain of the so-called waste land products. Hand sheets made from a "chemical cotton" (lint salvaged from cotton-seed hulls) compared very favorably with those made from the best grade of cotton-hull fiber. This pulp seems suitable for replacing the rag fiber used in book and blotting papers. Hand sheets made from "bagasse" pulp gave promise of yielding a book paper equal to that made from ordinary wood pulp.

Manufacture of Wall Board from Cornstalks.—A semicommercial plant for the manufacture of insulating board from cornstalks has been constructed at Iowa State College, Ames, Iowa. The equipment is now running satisfactorily and is producing board 2 feet wide by three-eighths inch thick at a speed of 8 feet per minute.

The cornstalks used were collected by the agricultural experiment station at Ames as the result of their work in developing a new type of harvesting equipment. It was found necessary to work out methods for close chemical control in order that the proper amount of rosin sizing could be introduced to make the board sufficiently water resistant. A surface sizing to be applied after the board

leaves the drier was also developed in order to stop the tendency of the board to dust. The board has been tested in the Washington laboratory of the bureau and found to compare favorably with celotex and similar boards now on the market.

The Maizewood Products Co. has built a factory at Dubuque, Iowa, and has placed the bureau's process in commercial operation.

Present experiments are being conducted along two lines: First, to find some machine more effective than the beater for manufacturing pulp from cornstalks, and, second, to see if the Downingtown machine can be adapted to make a board 1 inch thick instead of three-eighths inch, in order to produce a satisfactory insulating material.

Publication.—Manufacture of Wall Board and Cornstalks, W. E. Emley, New York Herald Tribune; June 10, 1928.

Paper Currency—Development of Commercial Paper.—As noted on page 197 of the 1928 Yearbook, the type of currency paper developed in the bureau's mill was found necessary to effect the optimum increase in the life of paper currency. This type of paper combines the high fiber strength required for resistance to wear, with the softness necessary for satisfactory printing results from the wet intaglio process. Efforts in cooperation with several fine-paper manufacturers were concentrated on commercial development of such paper, as it was a type distinctly different from any now available. Mutual studies were made of experimental paper-making operations in commercial mills and of the stock prepared in these mills. Thorough physical, chemical, and optical tests were conducted on papers, and printing experiments were made at the Bureau of Engraving and Printing. Satisfactory paper was produced only when the fiber-beating procedure developed by the bureau was followed. Such procedure is now being employed for the current deliveries of currency paper, which has very satisfactory quality. The gain in strength of the paper as a result of this cooperative work is reflected in the current contract specification, which requires a folding endurance of 3,000 double folds for unsized paper as compared with the requirement of 1,000 folds for sized paper in existence when the investigation was initiated. This improved quality is being obtained with no increase in cost.

Further Semicommercial Paper-making Experiments.—Additional trials were made of the various paper-making operations to find if further improvement in the quality of currency paper could be made. Caustic soda for cooking the rags, as compared with lime usually used for the purpose, was found to produce a stronger and better printing paper. Various bleaching and beating modifications gave no better results than the previously established procedure. A

number of glue surface-sizing experiments were made to find the optimum sizing conditions. Studies were made of paper composed entirely of cotton fibers and of linen fibers, as well as various mixtures of them, to determine if the present proportion of 75 per cent linen fiber and 25 per cent cotton fiber is the most desirable. These tests indicate that the content of the more expensive linen fiber can be decreased somewhat.

Manufacture of Paper Currency.—Cooperative work on the manufacture of paper currency was conducted with the Bureau of Engraving and Printing. The feasibility of substituting a dry printing process for the present wet process was investigated, as there is a possibility of economy and of a more uniform product with the former. A number of experimental printings were made which indicated that with installation of air-conditioning equipment satisfactory results would be obtained. A study of the present glue-surface sizing of the currency showed that it is unsatisfactory. Apparently it fails to give the desired protection against soiling and surface wear. Considerable work was done on the use of cellulose lacquers for this purpose and their use appears to be promising.

Utilization of Redeemed Paper Currency.—Previous work showed that improvement in the quality of the paper pulp made from redeemed paper currency at the Bureau of Engraving and Printing was feasible. Additional work was done to find if this material could be used as a substitute for the paper toweling used in that bureau for wiping the printing plates. Several lots of paper were made which were given service tests at the Bureau of Engraving and Printing. These experiments showed that the redeemed currency fiber, with the addition of some waste kraft wrapping fiber, could be used satisfactorily.

Considerable work was done in cooperation with O. C. Winestock, who was retained by the Bureau of Efficiency for trial of the application of his pulping process to the recovery of high-grade fiber from the redeemed currency. The pulps made by the Winestock process on a semicommercial scale at the Bureau of Engraving and Printing were all made into papers at the Bureau of Standards, where they were tested for quality. It appears that it would be advantageous to use the Winestock process, in part at least, for this purpose.

Postage Stamps.—A study of the raw materials and processes used in the manufacture of United States postage stamps, and of the finished product, was recently initiated. The purpose is to find if improvement in the manufacturing processes and in the quality of the stamps can be effected. This work is being done at the request of the Treasury Department and in cooperation with the Bureau of Engraving and Printing, where the stamps are made. This research will probably extend over the following two years.

PHOTOGRAPHY

Photographic-Emulsion Investigation.—This investigation includes a quantitative study of the major factors in emulsion making, as a means to the understanding and improvement of photographic sensitivity. A first contribution compares emulsions made with different bromides. The second, now in press, deals with the sensitivity nuclei formed on the silver bromide grains of an emulsion during the "ripening" process. It has been found possible, with considerable limitations, to produce a ripened emulsion by combining an unripened one with a separate preparation of colloidal particles, which thus became sensitivity nuclei. The results obtained support the theory that these nuclei act merely by localizing the latent image and thus increasing its effectiveness from the standpoint of development.

The problem of color sensitization of emulsions by dyes is an important and somewhat distinct phase of this general investigation. Preliminary results have been released illustrating the effects of hydrogen ion and bromide ion concentrations on the efficiency of color sensitization by the dyes erythrosin and pinacyanol.

Publication.—Sensitization of Photographic Emulsion by Colloidal Materials, B. H. Carroll and D. Hubbard, B. S. Jour. Research, **1**, No. 20, p. 565.

PROTECTIVE COATINGS, METALLIC

Chromium Plating.—The past year has witnessed a great increase in the application of chromium plating to automobiles, plumbing fixtures, and mechanical equipment and appliances. To meet the many inquiries for information on various phases of chromium plating, several studies are in progress.

An investigation of the health hazards in chromium plating was made in cooperation with the United States Public Health Service. The results have been published in a paper by J. J. Bloomfield and W. Blum, in the Public Health Reports for September 7, 1928. Copies of this report may be obtained either from the Public Health Service or from the Bureau of Standards.

Additional wear tests are in progress upon chromium-plated gauges. Other properties of electrolytic chromium, such as the hardness, specific gravity, melting point, electrical conductivity, and thermal expansivity, will be measured.

An investigation of the conductivity and constitution of chromium-plating baths is in progress. Studies are also being made upon the throwing power and upon methods of plating chromium upon various metals, including aluminum alloys.

Chromium plating is being used successfully upon the currency and stamp plates at the Bureau of Engraving and Printing. It is also being applied at the Philadelphia Mint upon various parts of their coinage equipment.

Spotting-Out.—Several promising remedies have been developed for each type of spotting-out—that is, the "crystal spotting" of sulphide finishes, and the "stain spotting" of porous cast metals—and are now being subjected to test in several plants.

Copper Electrotyping Solutions.—Studies in progress on the use of addition agents in acid copper solution indicate that under certain conditions they permit the use of much higher current densities, thus shortening the time of deposition.

Iron Deposition.—Methods developed by the bureau for producing thick iron plates are being tried on a small scale at the Bureau of Engraving and Printing with promising results. If they prove applicable, a considerable saving will be effected.

Cyanides for Electroplating.—After numerous trials, sodium and potassium cyanide of very high purity have been prepared and are now being used to study the methods of analysis and control of cyanide solutions.

PROTECTIVE COATINGS, NONMETALLIC

Accelerated Tests.—Further progress has been made in developing methods for the accelerated testing of paint and similar coatings. Methods of determining by electrical conductivity when a protective coating has failed have been developed and found generally easier to use than the air and water permeability tests mentioned last year. A number of coatings of various kinds have been tested in the accelerated cycle. Not only do paints, varnishes, etc., fail in the same way in the accelerated cycle as they do on weather exposure, but the research associate for Asphalt Shingle and Roofing Institute has found that, in addition to furnishing information as to the durability of asphalts, the cycle furnishes a valuable identification test, for the appearance of various asphalts after a few weeks in the accelerated cycle is so characteristic that in many cases the origin of the asphalt can be determined by this test with more certainty than by any other laboratory method. Similar results can, of course, be obtained by out-of-door exposure, but much more time is required.

Publications.—Accelerated Tests of Organic Protective Coatings, P. H. Walker and E. F. Hickson; Indust. and Eng. Chem., **20**; p. 591; June, 1928; and B. S. Jour. Research, **1**, No. 1, p. 1.

Tinting Strength of Pigments.—The value of colored pigments depends upon the color or tinting strength. In connection with

standardization of testing methods, an investigation of the color changes that take place on mixing colored pigments with white was made.

Publication.—Tinting Strength of Pigments, H. D. Bruce, B. S. Jour. Research, 1, No. 2, p. 125.

Miscellaneous Methods of Test.—Considerable experimental work was done by the bureau in cooperation with the American Society for Testing Materials in preparing tentative methods of testing pigments for coarse particles, acidity, bleeding, volatile matter, oil absorption, and certain methods of analysis.

Density of Creosote Oils.—An investigation of the density and thermal expansion of creosote oils was carried out at the request of a joint committee representing the American Wood Preservers Association, the American Society for Testing Materials, and the American Railway Association. The necessary information has been secured, and tables are now in preparation for use by the wood-preserving industries.

RADIO

Standards of Radio-Frequency.—Substantial advances were made in the accuracy of frequency measurement. Standards have been improved largely through the employment of piezo oscillators with temperature control. Intercomparison of the national frequency standards of England, France, Germany, Italy, Canada, and Japan showed that the frequency standards of these countries are in very satisfactory agreement. The requirements for accuracy of frequency standards increased because of great demand for the use of high frequencies for long-distance communication and the more rigid requirements for other transmitting stations. The necessity for securing still greater accuracy continues, and a cooperative research which was started in 1927 was continued. The results thus far obtained in this research were made available to the public by means of more accurate measurements on transmitting station standards and by the transmission of standard frequency signals.

The regular transmissions of standard frequency signals were made monthly and based directly upon a temperature-controlled piezo oscillator. The frequencies of the radio waves transmitted were as accurate as it is possible to make laboratory measurements.

Publication.—The Status of Frequency Standardization, J. H. Dellinger, Proc. Inst. Radio Eng., **16**, No. 5; May, 1928.

Radio Measurements.—Methods of measuring the frequency of piezo oscillators were improved. The comparison of frequency standards involved the measurement of the frequency difference

between two piezo oscillators, which was accomplished by a special oscillograph giving a permanent record of beat frequency.

An improved method of calibrating piezo oscillators for use as standards for transmitting stations was developed. This eliminates the use of a frequency meter as a secondary standard and bases the calibration directly on a temperature-controlled piezo oscillator.

A study of the fundamental principles of piezo oscillators and magnetostriction oscillators was started.

Radio Field-Intensity Measurements.—Radio field-intensity measurements are becoming of increasing importance, especially in the broadcast band. A measuring set was developed for use in connection with fading investigations. This was self-calibrating, but in order to test its reliability a method of calibrating it by means of known field intensities was developed. A large condenser antenna of accurately known dimensions was constructed on the shore of the Potomac River. Measurements were made on the opposite shore giving a transmission path entirely over water. The field intensity produced by a measured current in the condenser antenna can be calculated and compared with the measured value.

This illustrated several errors that have been made in the design of field-intensity measuring sets and assisted in the design of a satisfactory set for use in the broadcasting band. By means of this apparatus field-intensity measuring sets may be tested and calibrated for other laboratories.

Radio-Wave Phenomena.—Experiments on fading led to some general conclusions which mark definite progress in clearing up the mysteries of wave propagation. The irregularities of radio reception are in part due to the fact that the waves sometimes follow a multiplicity of paths in going from the transmitting to the receiving station. The observed behavior of the received waves is due to the varying ionization and other conditions of the atmosphere en route. Experiments with various combinations of transmitting antennas showed that conditions at the transmitting station have little effect on the wave behavior. The use of various types of receiving antennas permits the analysis of the actual behavior of the received waves in any way desired. One result of the measurements of fading was the discovery that fading occurs at much shorter distances than commonly supposed. In some instances it was appreciable as close as 8 miles to a broadcasting station.

A study was made of the apparent direction shifts obtained with the directive beacon developed by the bureau for guiding aircraft. By means of fading and direction measurements with several types of antennas it was found that the direction shifts are due to the horizontal component of the down-coming waves. This led to the

development of a form of antenna for airplanes free from the action of this horizontal component, which is likely to make the radiobeacon operation a practical success.

A number of apparatus improvements were made, including automatic fading recorders and field-intensity measuring devices.

A report of this work was given at the meeting of the American section, International Union of Scientific Radio Telegraphy, which met on April 19, 1928, and at the meeting of this society held in Brussels, September 10 to 15, 1928.

Publication.—Cooperative Measurements of Radio Fading in 1925, J. H. Dellinger, C. B. Jolliffe, and T. Parkinson, B. S. Sci. Paper No. 561.

Radio Antennas.—A special study was made of the calculation of antenna capacity and a publication issued.

Publication.—Methods, Formulas, and Tables for the Calculation of Antenna Capacity, F. W. Grover, B. S. Sci. Paper No. 568.

Standardization of Radio Terminology and Testing Methods.—The bureau is represented by two members on the Committee on Standardization of the Institute of Radio Engineers, which is developing standard definitions and methods of measuring and testing radio apparatus. A preliminary draft of a report for 1928 was prepared. This included a revision of the report of 1926, and in addition contained proposed standard methods for measuring and testing important characteristics of vacuum tubes, broadcast receiving sets, electroacoustic devices, and circuit elements. The material of this report was considered by the standardization bodies of the National Electrical Manufacturers Association, radio division, and the Radio Manufacturers Association, which adopted portions of it in connection with their standards.

This report is being further considered by the Committee on Standardization, and it is expected that the standards will soon be adopted by the Institute of Radio Engineers and presented to the Sectional Committee on Radio of the American Standards Association.

Government Radio Regulation.—It has been necessary to change the frequencies of many Government transmitting stations to bring them within the assignments of the International Radio Conference held at Washington in 1927. The radio act of 1927 required that assignment to Government stations be made by the President. Acting upon the request of the President and the Secretary of Commerce, the Interdepartment Radio Advisory Committee considered the assignment of frequencies to all Government stations and accomplished a reduction in the total number of frequencies necessary. The Government stations will be operating in accordance with the

International Radio Conference when it becomes effective, January 1, 1929.

Technical advice was furnished to the Federal Radio Commission in connection with its regulation of non-Government radio stations. Members of the bureau assisted in drawing up technical principles to be followed in the assignment of high frequencies to commercial companies and also in drawing up a plan for the allocation of frequencies to broadcast stations following the enactment of an amendment to the radio act of 1927.

Sectional Committee on Radio, American Standards Association.—The bureau was represented and took an active part in the work of the technical committees of the Sectional Committee on Radio of the American Standards Association working on vacuum tubes, component parts and wiring, receiving sets, and electroacoustic devices. This work is still in the preliminary stage. One standard, that for the 4-pin vacuum-tube base, was submitted to the sponsors for consideration as an American standard. This sectional committee is not in the main acting as an originating body. In the radio industry there are several active standardizing bodies who submit material to it for consideration as American standards.

RADIOACTIVE SUBSTANCES AND X RAYS

X-Ray Standardization.—In connection with X-ray standardization, efforts have been centered largely on installing adequate equipment for the problems to be attacked.

Work in the laboratory has been limited to the problems of dosage measurement; that is, intensity and quality of high-voltage X rays, such as are used for therapeutic purposes. Ionization chambers suitable for primary standards have been constructed, and preliminary comparisons with the German and American standards have been made. A new Kenetron-tube rectified high-voltage set, including a motor generator, has been installed for precision measurements under constant conditions.

The second International Congress of Radiology held at Stockholm in July, 1928, at which the bureau was represented, adopted the following X-ray unit of dosage:

> That this International Unit be the quantity of X radiation which, when the secondary electrons are fully utilized and the wall effect of the chamber is avoided, produces in 1 cubic centimeter of atmospheric air at 0° C. and 76 cm. mercury pressure such a degree of conductivity that one electrostatic unit of charge is measured at saturation current.
>
> That the International Unit of X radiation be called "The Röentgen" and that it be designated by the small letter "r."

The congress further adopted a series of recommendations regarding safety and protection from X-ray equipment and radio-active

substances. These will be incorporated in a bureau circular to be issued shortly. Through this international agreement and the active cooperation of various national laboratories, the desired international standardization in these fields seems assured.

Publications.—Improved Type of Gas X-Ray Tube, L. F. Curtiss, J. Opt. Soc. Am. and Rev. Sci. Inst., 16, p. 68; 1928.

A Radon Pump, L. F. Curtiss, J. Opt. Soc. Am. and Rev. Sci. Inst., 17, p. 77; July, 1928.

Tests of Radioactive Preparations.—Six hundred and fifty-seven radioactive preparations were tested during the year, from which measurements the sale price, amounting to a total of $600,000, was determined.

Publication.—A Projection Electroscope for Standardizing Radium Preparations, L. F. Curtiss, J. Opt. Soc. Am. and Rev. Sci. Inst., 16, p. 363; May, 1928.

The Geiger Ion Counter.—In the investigation of radioactive substances it is important to measure the number of alpha particles (positive ions shot off with great velocity) emitted per unit time. The Geiger counter—a specially prepared and negatively charged point inside an oppositely charged cavity and between which an electric discharge occurs each time an ion enters the cavity—is used for this purpose. To insure reliable indication, the principle of action of the counter should be understood, and this has puzzled investigators for several years. An important development in the bureau's radium laboratory has been the discovery that a catalytic surface is necessary to sensitize the point in a Geiger ion counter Numerous experiments with a great variety of catalysts and gases have confirmed this new fact about the counter; and these experiments, as far as they have progressed, show a strict correlation between the catalytic behavior of the material used as a point and its action in the counter. This discovery makes possible a more detailed explanation of what actually takes place when an ion is counted and should lead to further improvement in the use of the counter for quantitative work.

Publication.—On the Action of the Geiger Counter, L. F. Curtiss, Phys. Rev. 31, p. 1060; June, 1928.

Alpha Ray Tracks.—Some results have been obtained by use of an automatic Wilson expansion chamber for photographing the tracks of alpha particles. Out of 80,000 photographs, one very close collision between an alpha particle and a nitrogen nucleus has been obtained. The measurement of the tracks of the particles involved in this collision shows that some other factor than mere closeness of approach is involved in determining whether or not an atomic disintegration occurs as a result of the collision.

RAILROAD-TRACK AND OTHER HIGH-CAPACITY SCALES

Railroad-Track Scales.—Three track-scale testing units operated over 68 railroad systems, making tests in 34 States and the District of Columbia. Tests were made on 703 track scales, of which 459 were owned by the carriers, 230 by industries, 4 by States or municipalities, and 10 by departments of the Federal Government. Bureau inspectors adjusted 54 scales to correct for abnormal weighing errors which were due to faulty adjustment. The results of these tests are given in the following table, the scales being grouped according to geographical location and character of ownership. Of all scales, 70 per cent were within the tolerance used by the bureau for grading weighing accuracy. The average error was 0.23 per cent of the applied test loads. Both these values are substantially the same as the corresponding values for the preceding year.

Results of track-scale tests, fiscal year 1928

District and scale ownership	Number of scales tested	Passed		Failed		Mean numerical error in percentage of applied load	Analysis of error of incorrect scale					
							Errors in excess			Errors in deficiency		
		Number	Per cent	Number	Per cent		Number of scales	Incorrect scales	Mean error	Number of scales	Incorrect scales	Mean error
Eastern:												
Railroad	49	38	77.6	11	22.4	0.17	5	45.4	0.26	6	54.6	0.48
Industrial	9	8	88.9	1	11.1	.14	1	100.0	.36	0	0.0	------
Government	4	2	50.0	2	50.0	.17	2	100.0	.26	0	0.0	------
State or municipality	0	------	------	------	------	------	------	------	------	------	------	------
Total	62	48	77.4	14	22.6	.16	8	57.1	.27	6	42.9	.48
Southern:												
Railroad	216	148	68.5	68	31.5	.31	26	38.2	.53	42	61.8	.79
Industrial	92	50	54.4	42	45.6	.29	17	40.5	.32	25	59.5	.59
Government	5	2	40.0	3	60.0	.24	2	66.7	.33	1	33.3	.29
State or municipality	3	1	33.3	2	66.7	.23	0	0.0	------	2	100.0	.32
Total	316	201	63.6	115	36.4	.30	45	39.1	.44	70	60.9	.70
Western:												
Railroad	194	153	78.9	41	21.1	.16	25	60.9	.30	16	39.1	.51
Industrial	129	88	68.2	41	31.8	.20	22	53.7	.37	19	46.3	.45
Government	1	1	100.0	0	0.0	.10	0	------	------	------	------	------
State or municipality	1	1	100.0	0	0.0	.08	0	------	------	------	------	------
Total	325	243	74.8	82	25.2	.17	47	57.3	.33	35	42.7	.48
All districts:												
Railroad	459	339	73.9	120	26.1	.23	56	46.7	.40	64	53.3	.69
Industrial	230	146	63.5	84	36.5	.24	40	47.6	.35	44	52.4	.53
Government	10	5	50.0	5	50.0	.20	4	80.0	.30	1	20.0	.29
State or municipality	4	2	50.0	2	50.0	.19	0	0.0	------	2	100.0	.32
Grand total 1928	703	492	70.0	211	30.0	.23	100	47.4	.38	111	52.6	.65
Grand total 1927	840	589	70.1	251	29.9	.21	125	49.8	.34	126	50.2	.54

Master Track-Scale Depot.—A site for a master track-scale and test-car depot in Clearing Yard near Chicago was donated to the Government by the Belt Railway at the instance of the General Managers' Association of Chicago. The building was completed in Janu-

ary, 1928. Installation of the master scale of the Bureau of Standards, purchased some time ago, was immediately started and the station opened for service in May, 1928. This scale is capable of weighing test cars having a wheel base of up to 12 feet and weighing up to 150,000 pounds. The weights of cars can be certified with an error of less than 1 pound.

Master Track Scales.—Eighteen master track scales were calibrated during the year. Sixteen were found to be within precision-weighing tolerances. One found deficient in performance has been abandoned, and one found to have inherent defects in installation is being rebuilt. A new master scale installed by the Atlantic Coast Line Railroad at Jacksonville, Fla., was placed in service during the year and now forms an added and vital link in the master-scale system of the country.

Railroad-Track Scales in Grain-Weighing Service.—Included among the track scales tested were 54 scales used for weighing grain. To these scales the bureau applies a tolerance which, in effect, is twice as rigorous in its requirements as the regular track-scale tolerance. Thirty-two scales, or 59.2 per cent of the tested grain scales, were correct. However, too few scales were tested to give a reliable average value.

Test-Car Calibration.—The test units calibrated 18 test cars for industries and railroads which do not have access to master scales. The bureau is now regularly depended upon for this service at certain railroad centers, and until additional master scales are installed to serve all localities this function will doubtless be an important one.

Tests of Mine and Tipple Scales.—The mine-scale testing equipment tested 162 mine scales during the fiscal year 1927–28. The distribution of mine-scale tests with the number of correct and incorrect scales is shown below.

State	Number of scales tested	Correct		Incorrect	
		Number	Per cent	Number	Per cent
Indiana	45	18	40.0	27	60.0
Illinois	52	19	36.5	33	63.5
Kentucky	27	5	18.5	22	81.5
West Virginia	38	10	26.3	28	73.7

It will be noted that the percentage of accuracy by States varied from 18.5 to 40 per cent. The average accuracy of all the scales included was about 32 per cent. This figure for accuracy is somewhat lower than last year but is subject to considerable fluctuation from year to year, because the figure for a single year is not, and

can not be with present facilities, representative of the coal regions as a whole. General experience over a period of years demonstrates a gradual improvement in accuracy. Especially it is demonstrated that there is not so great a percentage of scales favoring the operators as was formerly the case.

REFRACTOMETRY

Refractometry of High Precision.—In order to provide adequate standards of index of refraction for testing refractometers, and to meet the demands for increased accuracy in the measurement of indexes of samples submitted for test, it has been necessary to make a survey of the conditions under which the required accuracy may be obtained and to develop auxiliary appartus to meet existing demands. Particular attention has been given to the minimum deviation refractometry of optical glass, including not only geometrical requirements but also the control of those conditions such as temperature, pressure, and humidity, which affect the velocity of light either in the glass itself or in the reference medium. The results of this investigation are being prepared for publication. The first paper will deal, quantitatively, with angle measurement on a spectrometer with an uncalibrated circle, translational adjustment of the prism on the table, prism-table orientation, size of prism, curvature of prism surfaces, collimation of the incident light, and prism aberration.

Tests of Astronomical Objectives.—The modified Hartmann test, developed in the bureau for the measurement of the aberrations of axial image points, has been extended to permit its application to points off the axis. This method also has been applied to two 6-inch and one 12-inch objectives, and the results embodied in contours which show the departure of the actual wave front as focused by the lens under test from the spherical wave front which would result with an ideal lens. The method of test is particularly important in that it yields results similar to those obtained with the lens interferometer and permits the results to be obtained without the use of any optically worked surfaces additional to those of the component under test. A complete test for one image point of an equatorial telescope requires a single exposure with a small screen and plate holder mounted in a drawtube instead of the usual large Hartmann diaphragm in the plane of the objective, and the results are readily interpreted in terms of the wave theory instead of in terms of geometric optics. The results of the test of the three objectives referred to above are being prepared for publication.

Lenses for the Tuckerman Autocollimator.—The performance specifications of the autocollimator demand a lens having an aperture ratio of f/5, with the correction for spherical aberration very

much better than is the usual commercial practice, and with a spacing which might be varied to permit the focal lengths to be adjusted to 250 mm. with a departure not greater than ±0.05 per cent. A special design comprising two doublets was computed. Components have been ground and polished for the assembly of nine lenses, and the performance of the first lens which has been assembled agrees, in a gratifying manner, with the expectations based on the computations.

RUBBER

Aging of Soft Rubber.—Five commercial antioxidants have been studied. The work has included, first, mixing a percentage of these products in rubber compounds, and second, dipping completed rubber products in solutions of antioxidants. The conclusion has been reached that antioxidants in rubber compounds are a decided advantage in preventing deterioration. The life of thin rubber goods, such as gloves, bandages, rubber bands, etc., may be increased considerably by dipping the finished product. Some of the antioxidants are more effective than others.

Publications.—Aging of Soft-Rubber Goods, R. F. Tener, W. H. Smith, and W. L. Holt, B. S. Tech. Paper No. 342.

The Aging Properties of Rubber Bands in Storage, C. E. Boone, India Rubber World, p. 317; September, 1927.

Effect of Temperature and Humidity on the Physical Properties of Rubber.—The research fellowship established by the rubber division of the American Chemical Society was continued during the past year. The investigation of the effect of humidity and temperature on the stress-strain relation of rubber compounds has been completed and a comprehensive report prepared for publication. Work has been started on the effect of these factors on the abrasive resistance and will be continued during the coming year.

Physical Properties of Rubber at High and Low Temperatures.—This investigation was completed and the results published.

Publication.—Tensile Properties of Soft-Rubber Compounds at Temperatures Ranging from −70° C. to +147° C., R. F. Tener, S. S. Kingsbury, and W. L. Holt, B. S. Tech. Paper No. 364.

Electrical Properties of Rubber.—Special attention has been given to the production of pure rubber hydrocarbon and the measurement of its electrical properties. Samples of crude rubber from several different species of plants have been treated to remove all the constituents except the rubber hydrocarbon. Electrical measurements on the resulting materials show that they all have the same properties. It is therefore reasonable to assume that rubber hydrocarbon has a definite molecular constitution independent of its source. In

the following table are given characteristic values for the different electrical properties of plantation crude rubber and rubber hydrocarbon at 25° C. and 1,000 cycles per second.

Material	Dielectric constant	Power factor	Resistivity
		Per cent	*Ohm-cm*
Crude rubber	2.5	0.2	$2+10^{15}$
Rubber hydrocarbon	2.3	.1	$50+10^{15}$

Reclaimed Rubber.—The work on the determination of sulphur in rubber by the perchloric-acid method and the supplementary investigation on the decomposition of barium sulphate by solution of sodium carbonate (which will make the perchloric-acid method of determining sulphur more generally applicable to rubber compounds) have both been finished, and the papers on these subjects are now in the hands of the publishers.

The work on reclaiming proper has been resumed. This problem involves the solution of three more or less distinct subordinate problems, namely, (1) desulphurization, (2) devulcanization, and (3) rejuvenation, or the reversal of the process involved in the "aging" of rubber. The first two may conceivably be achieved simultaneously or separately, while the last will probably require a separate step in the process of reclaiming. Any one of these problems is in itself a problem of major magnitude, especially in view of our limited knowledge of the structure of rubber, the nature of vulcanization, and the nature and causes of aging.

It is proposed for the present to devote attention chiefly to the problem of desulphurizing rubber either with or without simultaneous devulcanization.

Use of Celite in Rubber Compounds.—The research associate of the Celite Co. completed the work outlined. A comprehensive report covering the details of his work has been prepared. The report contains information of decided practical value.

Guayule Rubber.—The results of the investigation of guayule rubber made in cooperation with the Continental Rubber Co. were published. Further natural aging tests made during the past year verify the conclusions drawn in this paper, namely, that by proper treatment guayule rubber can be made to compare favorably with plantation Hevea rubber. It is expected that further cooperative work will be undertaken during the coming year.

Publication.—Some Vulcanization Tests of Guayule Rubber, C. E. Boone and D. Spence, B. S. Tech. Paper No. 353.

Rubber Floor Tile.—Twenty-four samples of rubber floor tile, representing the product of 12 different manufacturers, were ob-

tained for test purposes. The following determinations were made: Hardness, resistance to indentation, resistance to bending, tensile strength and elongation, resistance to abrasion and to staining, resistance to aging, resistance to spreading, and water absorption. The results are being compiled for a report to be presented to the Rubber Association of America. The work is to be continued during the coming year.

Garden Hose.—This investigation was completed and the results published. The publication presents information relative to garden hose which is intended as an aid in its selection, use, and preservation. The design and manufacture of the three types of hose commonly used and known as "wrapped," "braided," and "cotton rubber-lined" are described in some detail. Simple methods of inspection and test are described in a nontechnical way, and suggestions are offered as an aid in the selection of hose to meet different conditions of service. Detailed directions as to the use and care of garden hose are given, and a chart shows graphically the discharge capacities of ½, ⅝, and ¾ inch hose under different pressures.

Publication.—Selection and Care of Garden Hose, B. S. Circular No. 327.

Rubber Rolls for Post Office Department.—Several test rubber formulas were developed for the rubber rolls used on letter-canceling machines. One hundred rolls were made up in the bureau laboratory and tested by the Post Office Department. One particular type proved very satisfactory, and aid was given the Post Office Department in drawing up a specification so that similar rolls could be obtained commercially. This project will undoubtedly result in a considerable money saving to the Government.

Cooperation with the American Standards Association.—The sectional committee of the American Standards Association, representing 12 important interests, has adopted by a substantially unanimous ballot the proposed specifications for cotton rubber-lined fire hose. This important step in the unification of standards practically completes the work of the sectional committee, which was organized in November, 1926, and sponsored by the American Society for Testing Materials and the American Standards Association fire-protection group. The specifications are now before the sponsors for approval.

Testing of Rubber Goods.—The fifth edition of Circular 38, The Testing of Rubber Goods, was issued. This circular gives the methods used at the bureau in the testing of rubber goods. The various physical tests commonly employed and the machines used for this purpose, many of which were designed at this bureau, are illustrated and described in detail. Data are given showing the effect of various factors on the tensile properties of rubber. Special attention is given to the effect of temperature on the physical tests,

The circular also contains a brief outline of the methods of collecting crude rubber and the processes used in the manufacture of various rubber articles. The methods used in the chemical analysis are given, together with an explanation of the reasons for making these tests and their significance. Regulations are given concerning the conditions under which tests are made for State and municipal governments.

Publication.—The Testing of Rubber Goods, B. S. Circular No. 38 (fifth edition).

SAFETY CODES

Safety Engineering.—Standardization of practice for accident prevention is achieved through the formulation of safety codes. In this country these have been and are being developed largely under the procedure of the American Standards Association, and when completed are approved by it.

The following articles, prepared by members of the staff, have been published during the year:

Uniform Traffic Signs, Signals, and Markings, M. G. Lloyd, Annals of the Am. Acad. of Political and Social Sci.; September, 1927.

How Safety Code Applies to Communication Lines, Arthur Halsted, Telephone Eng., **31**, No. 10; October, 1927.

Aviation Develops Safety Standards, Arthur Halsted, Nat. Safety News, **16**, p. 49; October, 1927.

A Study of Types of Goggles and Their Uses, H. S. Norton, Nat. Safety News, **16**, p. 73; October, 1927.

Lightning Protection for Farm Property, M. G. Lloyd, Proc., Nat. Assoc Mutual Ins. Cos.; thirty-second convention, p. 93; 1927.

Uniform Traffic Laws, M. G. Lloyd, American Municipalities, p. 25; March, 1928.

Safety Codes Drafted as Basis of State Laws for Prevention of Accidents, M. G. Lloyd, United States Daily; June 16, 1928.

The Bureau of Standards is sole sponsor for the following, all of which have been issued as bureau publications:

National Electrical Safety Code.

National Safety Code for the Protection of the Heads and Eyes of Industrial Workers.

American Logging and Sawmill Safety Code.

The National Electrical Safety Code is now in its fourth edition, and a new edition of the companion volume, giving a discussion of the code, will come from the press early in the fiscal year 1928–29. A pictorial edition of this code is in preparation. The heads and eyes safety code is in its second edition and is now undergoing revision for a third edition. The logging and sawmill code is in its first edition.

In addition to the above the Bureau of Standards is a joint sponsor for—

Safety Code for Aeronautics (joint sponsorship with the Society of Automotive Engineers).

Safety Code for Elevators, Dumb-waiters, and Escalators (joint sponsorship with the American Institute of Architects and the American Society of Mechanical Engineers).

Gas Safety Code (joint sponsorship with the American Gas Association).

Code for Protection Against Lightning (joint sponsorship with the American Institute of Electrical Engineers).

Colors and Forms for Traffic Signals for Highways and Vehicles (joint sponsorship with the American Association of State Highway Officials and the National Safety Council).

Automobile Brakes and Brake Testing (joint sponsorship with the American Automobile Association).

None of these codes has been published by the bureau, but it is about to publish the Code for Lightning Protection, which has now been completed with respect to protection for persons, livestock, ordinary buildings, oil and gas tanks, cotton warehouses, hangars, airships, smokestacks, miscellaneous structures, ships, and trees.

The bureau also cooperates in the work of sectional committees acting under other sponsorships for a number of other safety codes. During the year active work has been done in connection with a code for window cleaning, and in the revision of the Code for Factory Lighting and the National Electrical Code. In connection with the last, investigations were carried on with particular reference to X-ray apparatus, neon-tube signs, service entrances, and high-voltage circuits and equipment.

All of the codes above referred to have found considerable application as guides to practice and in many cases have been adopted by State and city authorities as mandatory regulations. This is especially true of the National Electrical Safety Code, which has now been adopted in whole or in part by about half of the States. The following table shows the scope of the regulations which have been adopted by the various States:

State actions respecting the National Electrical Safety Code

States using the code verbatim or with slight modifications	Parts of code concerned	Edition of N.E.S.C. used	Date in force
Arizona	All	4	1928
Colorado	Sec. 9	2	1917
Idaho	Sec. 2	4	1927
Iowa	do	4	1927
Maine	Secs. 1, 2, 3, 4, 9	4	1928
Maryland	All	3	1927
Montana	All construction	2	1917
New Jersey	All	4	1927
North Dakota	Sec. 2	3	1920
Oklahoma	do	3	1921
Oregon	Secs. 1, 2, 3, 4, 9	4	1919, 1927
Pennsylvania	Secs. 1, 3, 4, 9	2	1917
Utah	Sec. 2	4	1928

State actions respecting the National Electrical Safety Code—Continued

States adopting rules based on N. E. S. C.	Parts of code concerned	Edition of N.E.S.C. used	Date in force
California	Secs. 1, 2, 3	3	1922, 1925
Connecticut	Sec. 2 (joint use)	3	1922
Illinois	Sec. 2	4	1927
Kansas	do	2	1917
Nevada	do	2	1920
Washington	Sec. 3	3	1924
Wisconsin	Secs. 1, 2, 3, 4, 9	3	1924
Crossing specifications based on N. E. S. C.			
Minnesota	Sec. 2	4	1926
Nebraska	do	2	1919
North Carolina	do	3	1921
South Dakota	do	4	1926
Tennessee	do	3	1921

Elevator Safety Equipment.—Research on the performance of elevator safety appliances is in progress, to aid in the preparation of a safety code covering such equipment. The work is financed by voluntary subscriptions from the elevator industry, casualty insurance groups, and manufacturers of elevator specialties and supplies. A test elevator has been installed in a vacant hoistway, and instruments for recording car travel, velocity, and acceleration have been developed.

At the present time the performance of oil buffers is being studied. As soon as this program is completed work will be started on undercar safeties. When sufficient work has been done to warrant conclusions the elevator safety code will be revised to insure the maximum obtainable safety which may be obtained by equipment that can be produced commercially. In addition to furnishing material upon which to revise the elevator code, these tests will probably result in a standard acceptance test which could be used by any reputable laboratory in making type acceptance tests of such equipment.

Code for Electricity Meters.—The Code for Electricity Meters has been issued in its third edition. It was approved as an American standard by the American Standards Association in February, 1928. The code is published and sold by the National Electric Light Association, 420 Lexington Avenue, New York, N. Y.

In 1910 the meter committees of the Association of Edison Illuminating Cos. and the National Electric Light Association jointly issued a code for electricity meters, which soon became the basis of standard practice in the metering art. Later it received official recognition by several public-service commissions in their rules for electric service. In 1922 the code was approved as an American standard. In 1926 a revision was undertaken by a sectional committee working

under the procedure of the American Standards Association, under joint sponsorship of the Bureau of Standards, the Association of Edison Illuminating Cos., and the National Electric Light Association. A broadly representative committee of meter manufacturers, public-utility meter engineers, public-service commission representatives, and independent experts prepared the third edition. The contents include chapters on definitions, standards, metering, specifications for the acceptance of types of electricity meters and types of auxiliary apparatus for use with meters, installation methods, watt-hour meter tests, laboratory and service tests, and demand meters.

SIMPLIFIED PRACTICE

Simplified Practice Recommendations Completed.—Twenty-four new Simplified Practice Recommendations were completed last year, bringing the total number of completed recommendations to 95. They are as follows:

New recommendations completed during the fiscal year ended June 30, 1928

Completed recommendations	Reduction in varieties		Reduction
	From—	To—	
Composition blackboard:			*Per cent*
Colors	3	1	66
Widths	18	8	55
Lengths	90	13	86
Ash handles (grades)	(1)	3	(1)
Hickory handles (grades)	(1)	11	(1)
Vegetable shortening containers	35	11	69
Lead pencils [2]			
Turnbuckles	248	115	54
Iron and steel roofing [3]			
Malleable foundry refractories	188	15	92
Folding and portable wooden chairs [4]			
Binders' board	718	10	98
Hollow metal doors	(1)	45	(1)
Kalamein doors	(1)	36	(1)
Composition books	86	41	52
Adhesive plaster:			
Rolls	3	2	33
Spools—			
Widths	8	5	38
Lengths	23	13	43
Surgical gauze (constructions)	15	7	53
Forms for concrete ribbed floor construction (widths)	7	2	71
Floor sweeps	11	6	45
Coated abrasive products	8,000	1,976	75
Hacksaw blades	160	38	76
Ply and yarn goods of hard fiber cordage	1,304	391	70
Fire engines (pumping capacities)	14	5	64
Skid platforms [5]			
Ice cake sizes [6]			
Pyroxylin coated fabrics [7]			

[1] Original total not known.
[2] Indeterminate.
[3] Figures on reduction of varieties not yet available.
[4] Elimination estimated by industry as 20 per cent in portable chairs and 19 per cent in folding chairs.
[5] Establishes clearance dimensions and terminology for skid platforms.
[6] Establishes five standard weights, with maximum dimensions.
[7] Establishes basic and uniform standards for pyroxylin-coated fabrics.

Adherence to Recommendations.—Surveys of the various industries to determine the degree of adherence to previously adopted Simplified Practice Recommendations indicate that 85 per cent of the acceptors, by volume of output, were adhering to the standards outlined in the recommendations.

Revisions and reaffirmations for the fiscal year July 1, 1927, to June 30, 1928

SUPPORTED BY ACTUAL FACTUAL SURVEYS

S. P. R.	Title of recommendation	Date action was taken	Degree of adherence
			Per cent
1	Paving brick	Mar. 22, 1928[1]	79.8
5	Hotel chinaware	Dec. 15, 1927[1]	80.6
6	Files and rasps	Oct. 19, 1927[1]	93
8	Range boilers	Apr. 8, 1928[1]	97.87
9	Woven-wire fencing	Sept. 23, 1927[1]	99
13	Structural slate	Jan. 17, 1928[2]	85
14	Roofing slate	do.[2]	98
15	Blackboard slate	do.[1]	93
18	Builders' hardware	Apr. 26, 1928[1]	79.66
19	Asbestos paper and millboard	May 10, 1928[2]	76
20	Steel barrels and drums	Dec. 7, 1927[2]	89.04
28	Sheet steel	May 3, 1928[2]	55
	Roofing portion	Oct. 18, 1927[1]	52
	Sheet-steel portion	do.[1]	85
29	Eaves trough and conductor pipe	do.[1]	92
30	Terneplate	do.[2]	100
32	Concrete building units	Mar. 1, 1928[1]	90
33	Cafeteria and lunch-room chinaware	Dec. 15, 1927[1]	80.6
35	Steel lockers	Dec. 13, 1927[2]	85.18
38	Sand-lime brick	Feb. 1, 1928[1]	77.6
39	Dining-car chinaware	Dec. 15, 1927[1]	80.6
40	Hospital chinaware	do.[1]	80.6
41	Insecticides and fungicides	Jan. 24, 1928[1]	97
42	Paper grocers' bags	May 22, 1928[1]	95.55
43	Paint and varnish brushes	Nov. 15, 1927[2]	80.5
44	Box board	do.[1]	65
46	Tissue paper	Oct. 24, 1927[1]	85
49	Sidewalk, floor, and roof lights	Mar. 27, 1928[1]	94.28
51	Die-head chasers	Dec. 20, 1927[2]	80.74
57	Wrought-iron and wrought-steel pipe	May 9, 1928[1]	99.79
	Average		84.87

NOT SUPPORTED BY ACTUAL FACTUAL SURVEYS

9	Woven-wire fencing	May 2, 1928[1]	89
16	Lumber	May 3-4, 1928[1]	80
31	Loaded paper shot shells	Dec. 7, 1927[2]	----------
50	Bank checks	Oct. 6, 1927[2]	70
52	Vitreous china plumbing fixtures	Sept. 29, 1927[2] Apr. 25, 1928[2]	---------- ----------
56	Carbon brushes	Sept. 29, 1927[1]	----------
62	Metallic cartridges	Dec. 6, 1927[2]	----------
	Average		79.66

[1] Indicates revision. [2] Indicates reaffirmation.

Of the following 43 projects now on the bureau's active list, a large portion will no doubt be completed in the present fiscal year: Concrete sewer, manhole, and catch-basin blocks; paper towels; wax

paper; book cloths; card tables; dental hypodermic needles; dental grinding wheels; wooden dowels; gauze standards; inks and adhesives; calf leather; hardwood lumber; photographic paper; photographic equipment and supplies; wood pipe; wood rulers; steel pen points; paper tags; household textiles; beverage containers; cleaning brushes; glass containers; ice cream cans; hospital plumbing fixtures; can sizes; gas cocks; copper range boilers; pocketknives; marine hardware; olives (sizes); septic tanks; industrial shelving; double-hung windows; steel compartments; cartridge fuses; welded chain; lawn mowers; plow shapes and small farm tools; refrigerators (widths); single trees; trailer body sizes; trailer couplers; and band saws.

A general summary of progress for the past year compared with the previous year shows a 46 per cent gain in the total individual acceptances, notwithstanding a readjustment of the figures to eliminate certain duplications previously carried. Also, it is significant of the sustained interest in simplified practice that the sales of publications has increased 33 per cent.

Progress for fiscal year ended July 1, 1928

Activities	As of July 1, 1927	As of July 1, 1928	Increase	
			Number	Per cent
Simplified practice recommendations completed	74	[1] 95	24	34
Acceptances, by trade associations	898	[2] 883		
Acceptances, by individual firms	6,676	[2] 9,754	3,078	46
Projects based on requests for cooperation	596	623	27	5
Adherence by resurveys, cases	18	47	29	161
Percentage of volume of production	79	85		
Adherence by industry's estimates, cases	4	12	8	20
Percentage of volume of production	84	80		
Previously completed recommendations:				
Revised	12	24	12	100
Reaffirmed	17	42	25	147
Sales of printed recommendations	350,000	466,000	116,000	33

[1] 3 of the projects reported as of July 1, 1927, failed due to lack of adequate producer acceptance, making the total as of July 1, 1928, 95.
[2] Percentage increase for completed projects is based on 71 as of July 1, 1927.

SPECIFICATIONS

Specifications in Various Industries.—There was issued under date of October 5, 1927, with the title Standards and Specifications in the Wood-Using Industries, the first of a series of publications dealing with the standards and specifications in various industries. Future numbers will be issued as rapidly as conditions permit. Manuscript is now being prepared for the second volume of this series to be called Standards and Specifications for Nonmetallic Minerals and Manufacturers Thereof. These publications are supplementary to the National Directory of Commodity Specifications and are being

issued in accordance with the recommendations of an advisory board consisting of official representatives of 14 leading national organizations interested in the preparation, unification, and utilization of specifications.

Cooperation with Public Purchasers.—In connection with the compilation of material for the National Directory of Commodity Specifications and the Standards Yearbook, and the inauguration of the so-called "certification plan," the bureau has cooperated with the public purchasing officers in all of the 48 States and with all of the State highway commissions. It has established contact with more than 1,500 additional public purchasers for all of the cities throughout the country, all of the municipalities having the city manager form of government, and many counties, public schools, hospitals, and other public institutions. To these public purchasers have been sent copies of lists of manufacturers who have expressed their willingness to certify to compliance with 146 United States Government master specifications.

Publications.—Standards and Specifications in the Wood-Using Industries, B. S. Misc. Pub. No. 79.

Commercial specifications, A. S. McAllister, Unted States Daily; March 3, 1928.

Research and testing laboratories, A. S. McAllister, United States Daily; March 5, 1928.

United States Government master specifications, A. S. McAllister, United States Daily; March 7, 1928.

Purchases by public agencies, A. S. McAllister, Untied States Daily; June 13, 1928.

SPECTROSCOPY AND ATOMIC STRUCTURE

Spectrochemical Analysis.—The bureau's methods for making qualitative and quantitative chemical analyses by means of the spectrograph have been greatly extended by the accurate measurement and classification of the spectra of 11 different elements. These methods of analysis, which are effectively applied where the customary methods of chemistry are inoperative, have been successfully employed during the year for determining the composition of 169 different industrial and scientific materials.

Publications.—Multiplets in the CO II spectrum, W. F. Meggers, J. Wash. Acad. Sci., 18, p. 325; 1928.

Interferometer measurements of Wave Lengths in the Vacuum arc Spectrum of Titanium and Other Elements, C. C. Kiess, B. S. Jour. Research, 1, No. 1, p. 75.

Regularities in the Spark Spectrum of Hafnium, W. F. Meggers and B. F. Scribner, J. Opt. Soc. Am. and Rev. Sci. Inst., 17, p. 83; 1928.

Wave-length Measurements in the Arc and Spark Spectra of Hafnium, W. F. Meggers, B. S. Jour. Research, 1, No. 8, p. 151.

Wave Lengths and Zeeman Effects in Yttrim Spectra, W. F. Meggers, B. S. Jour. Research, 1, No. 12, p. 319.

Tables of theoretical Zeeman effects, C. C. Kiess and W. F. Meggers; B. S. Jour. of Research, 1, No. 23, p. 641.

Atomic-Structure Investigations.—Studies with a new type of electrical discharge led to the observation of continuous emission bands in the spectra of various monatomic gases and vapors. Theory indicates that these must result from recombination of ions and electrons. This has afforded an opportunity to measure for the first time an atomic property which has been the subject of much speculation and to develop methods which will be applicable to many other problems.

A study of the Zeeman pattern of the fine structure of the mercury line at 2537A represents an outstanding achievement in technique of timely theoretical interest. Under the highest attainable resolving power, this line is seen to be in reality five very close lines, and in a magnetic field each of these splits into three. The resulting pattern is far beyond the resolving power of any instrument, so that methods were devised to single out various parts of the pattern. The results show that none of the proposed theories of fine structure apply to this case.

Publications.—Recombination spectra of atomic ions and electrons, F. L. Mohler, Phys. Rev. 31, p. 187; February, 1928.

Zeeman pattern of the hyperfine structure lines of the resonance line of mercury, W. A. MacNair, Phys. Rev. 31, p. 986; June, 1928.

STONE

Temperature Distribution in Stone Walls.—To assist in determining the structural movements in buildings, an attempt has been made to determine the temperature distribution in stone walls exposed in Portland, Me., Washington, D. C., and Jacksonville, Fla. The highest temperature noted on the coping stone during the last summer was 121° F., which was 22° higher than that of the free air. At the same time the temperature 2 inches in the stone was 122°, and at a depth of 4 inches it was 113°. The average south-wall temperature at the same time, for these three points, was 93.5°, while the north-wall temperature average was 90.1°.

Physical Characteristics of Slate.—In connection with the investigation of the physical characteristics of slate, 41 samples have been tested from the principal slate-producing districts of the country. The modulus of rupture on these was found to range from 3,700 to 12,000 pounds per square inch, the modulus of elasticity from 9,000,000 to 17,000,000 pounds per square inch, and the absorption from 0.06 to 1.41 per cent. Accelerated weathering tests are in prog-

ress. The freezing tests indicate very marked resistance to frost action. An acid test to simulate the action of rain water has shown a rather pronounced action on some of the slate, causing blistering and discoloration.

Calking Compounds.—It has been found necessary in structures to use certain calking or pointing materials in order to obtain water-tight joints. A number of these have been noted to have certain defects. As a result, 51 of the commercial materials on the market were obtained and subjected to such tests as water-tightness, resistance to temperature changes, and staining properties. A number of joints of limestone masonry were filled with these compounds and exposed for test. These indicate that 37 per cent of the materials examined are not satisfactory and 20 per cent are of doubtful value. Practically all cause staining on limestone masonry, although at later ages this seems to bleach out.

SUGAR

A Scientific By-Product in the Production of Levulose.—In working on the details of a practical method for the production of the sugar known as levulose or fructose, it was found that only 92 per cent of the expected amount of fructose was obtained from the hydrolysis of inulin, the starchlike substance found in the juice of dahlia tubers, and converted by this process into fructose. Since it is probable that fructose will take its place as a large-scale commodity, it was important to learn the nature of so large an impurity in hydrolyzed inulin.

On removing the fructose by precipitation with lime, a residual sirup was obtained which, instead of rotating polarized light 91° to the left, as does fructose, rotated it 55° to the right. This sirup, on further trial, proved to be a mixture of sugars, none of which could be isolated. By treatment with very strong acid at boiling temperature, a partial hydrolysis was effected, and it was found that the sole product was levulose.

The mixture of sugars was then converted to their acetates and from the mixture one acetylated sugar crystallized. It was purified, analyzed, and then converted back to the original sugar, which was finally obtained in crystalline form. This sugar, which has not been hitherto isolated, proved to be a disaccharide composed of two molecules of fructose combined to form a compound sugar rotating polarized light to the right. It is conjectured that it is an integral part of the inulin molecule and will ultimately aid in the determination of the structure of inulin.

Commercial Production of Levulose.—Progress in the development of an economical commercial-scale process for the production of hard

refined levulose has been satisfactory. The bureau expects ultimately to have an experimental plant that can perform the whole of the projected technique of levulose manufacture. Such a plant is essential, because levulose manufacture, like sucrose manufacture, will be an art as well as a science, and a satisfactory technique can be developed only by going repeatedly through the process as a whole, using machines of a sufficient capacity. During the year activity was concentrated on building only those parts of the plant which are indispensable to the main line of work, leaving many details of the process and by-product work for the future. Installation of about 75 per cent of the process pipe work, equipment, and machinery for the immediate limited program has been completed. To control the manufacturing process for levulose a system of analysis has been elaborated which meets the requirements of speed and reliability.

Structure of the Sugars.—The sugars, starches, and celluloses are of such great use that new theoretical knowledge of their molecular structures can hardly fail to open ways for advances of practical importance. It is now evident that the simple sugars (dextrose, levulose, etc.) exist in several molecular forms possessing various ring structures, and that the compound sugars (sucrose, lactose, etc.), the starches, and the celluloses are formed by the union of the simple sugars of certain ring types. Knowledge of the structural chemistry of the sugars is in rapid development, due to this idea of ring types and to the isolation of new derivatives of the sugars possessing new ring structures predicted by theory. Satisfactory progress in experimental and theoretical studies in this field has been made during the year.

Publication.—Alpha-Methyl *d*-lyxoside Triacetate, F. P. Phelps and C. S. Hudson, J. Am. Chem. Soc., 50, p. 2049; 1928.

Sugar and the Tariff.—More than 3,000,000 tons of dutiable sugar and approximately 270,000,000 gallons of molasses enter the United States annually from foreign countries. The scientific supervision of the collection of the duty imposed by the tariff act, about $140,000,000 annually, is one of the functions of the bureau. Even the highest attainable accuracy science can devise does not meet the requirements for this work because of the magnitude of the revenue involved in individual cargoes. The bureau has continued its intensive study of the problems involved. New equipment is continually being designed, studied, and standardized. Immediate shipment of standardized apparatus as required is imperative. Increased facilities have been provided for the storage of supplies of this character. A new short-length polariscope tube for use with liquids of high rotation and small volumes of solutions has been designed and

studied and a supply obtained and distributed to the customs laboratories. In cooperation with the manufacturers, improvements have been developed and incorporated in the design of a standard sugar balance. The analytical methods used in the various customs laboratories must give reproducible and identical results over a wide range of climatic conditions. Further studies of the methods involved have been continued with the main purpose of increasing the precision and appraisal of these products. The methods of determining the densities of molasses and sirups have been under investigation, and a standard table of weights per gallon, important alike to the industry and the Government, has been developed.

TESTS

An itemized statement of tests completed during the fiscal year is given in the table on page 241.

TEXTILES

Study of Aeronautical Fabric Weaves.—The Navy Department has requested the bureau to investigate the possibility of increasing the tear resistance of aeronautical fabrics and of reducing the weight without impairing the strength. In addition, in the case of balloon gas cell and airship cloth, it is important to produce a surface which will require the least amount of covering material, thus reducing the weight of the finished fabric.

Aeronautical fabrics are, in general, plain woven materials. Therefore, it was decided to study the effect of the weave structure on the above characteristics. Forty-four samples of fabrics have been woven in the experimental cotton mill. These include varieties of each of the following classes of weaves: Plain, twill, basket, satin, and mock leno. A leno attachment is being installed so as to include this class. These fabrics were woven under a tension held as constant as practicable, with 90 ends and 90 picks per inch of 60s yarn.

The fabrics have been tested for breaking strength, stretch, tear, weight, thread count, crimp, and yarn size. The data are being correlated. Those fabrics having properties approaching most nearly the desired properties will be selected as a basis for intensive study, using varying counts of yarn, thread counts, etc.

Properties of Parachute Fabrics.—The ability of the parachute to open when the draw string is pulled depends on the springiness and slip of the fabric, and laboratory apparatus for studying this is being developed. Methods for measuring air permeability are being compared. A large number of fabrics, including an excellent range of low-weight silk materials submitted by the Silk Association of America have been collected from various sources and detailed studies of their properties are in progress.

Numbers of test items, determinations, and fee value for tests completed during the fiscal year ended June 30, 1928

Kind of instrument or material, class of test, or nature of service rendered	Number of test items for—			Total number of test items	Number of determinations	Fee value
	Public	Government departments and State institutions	Bureau of Standards			
Electrical standards, instruments, and materials	1,270	500	435	2,205	3,754	$19,644.65
Electric batteries	143	2,522	-------	2,665	5,608	19,173.50
Electric lamps and lighting equipment	392	2,443	793	[1] 3,628	3,714	[2] 19,665.97
Length-measuring devices	188	281	-------	469	2,544	2,624.50
Gauges and gauge steels	1,345	107	1,055	2,507	11,837	2,267.00
Miscellaneous dimensional determinations	2,262	425	106	2,793	12,277	5,826.85
Weights and balances	3,872	1,869	764	6,505	14,066	6,065.90
Scales	8	865	81	954	25,254	39,040.50
Timepieces	268	5	27	300	3,683	702.00
Volumetric apparatus	7,578	4,748	716	13,042	26,543	9,894.10
Hydrometers	364	201	1	566	1,739	825.15
Density determinations, etc	13	38	240	291	535	844.00
Laboratory thermometers	2,526	783	621	3,930	17,860	8,158.75
Clinical thermometers	22,470	20,976	-------	43,446	173,808	4,078.40
Pyrometers, calorimeters, etc	263	54	181	498	6,168	6,609.50
Insulating materials	109	35	11	155	137	870.00
Fire-resisting materials	25	61	-------	86	278	872.20
Fuels and lubricants	246	1,720	100	2,066	12,570	20,357.50
Automotive equipment, etc	-------	221	-------	221	340	2,607.00
Airplane engines	-------	4	-------	4	41	6,050.00
Optical instruments and materials	404	249	174	827	1,208	4,311.90
Carbohydrates	2	1,734	-------	1,736	2,634	2,717.00
Radioactive materials	659	11	-------	670	670	3,668.50
Engineering instruments and appliances	83	1,034	47	1,164	1,283	12,745.50
Aeronautic instruments	17	638	39	694	2,955	7,995.50
Aerodynamic tests of models	10	4	1	15	23	225.00
Physical properties of engineering materials	110	2,927	38	3,075	6,125	17,958.95
Sound-producing and measuring instruments	18	33	15	66	67	678.50
Making of special castings	-------	34	226	260	929	1,777.50
Fusible boiler plugs	-------	359	-------	359	718	717.00
Metallographic examinations	-------	282	85	367	647	2,897.00
Miscellaneous metallurgical tests	-------	231	400	631	1,105	2,917.00
Pottery and chinaware	-------	144	10	154	569	1,115.00
Glass	-------	60	42	102	161	352.00
Refractories and heavy-clay products	2	201	76	279	1,175	2,641.00
Cement, concreting materials, lime, etc	33	11,913	247	12,193	50,841	98,910.00
Stone and sand-lime brick	-------	34	50	84	395	1,147.00
Miscellaneous ceramic materials	-------	1,348	109	1,457	4,406	8,075.00
Rubber	-------	1,496	200	1,696	11,192	19,564.50
Textiles	7	6,842	456	7,305	17,904	34,178.50
Paper	22	1,791	262	2,075	6,460	18,879.00
Leather	25	292	3	320	1,386	2,049.00
Paint, varnish, and bituminous materials	-------	1,438	87	1,525	11,330	16,051.00
Chemical analysis of metals	3	302	343	648	2,862	5,376.50
Chemical tests of miscellaneous materials	23	1,110	95	1,228	4,788	6,874.50
Distribution of standard samples	6,372	577	3	6,952	-------	15,117.00
Total	51,132	72,942	8,139	132,213	[3] 454,589	[3] 465,116.82

[3] Of these totals, 161,951 determinations were for the public, fee value $67,584.32; 267,666 determinations were for the Government departments and State institutions, fee value $351,268.50; 24,972 determinations were for the bureau, fee value $46,264. The number of test items and determinations necessary in connection with the bureau's own work of research and standardization, with the resulting fee values, are not included in these totals.

[1] In addition, the bureau inspected 1,319,456 incandescent lamps at various factories for other branches of the Government.

[2] Includes fee value of $3,484.27 for lamps inspected at factories.

Substitute for Parachute Silk.—The object of this work, which was requested and is partially financed by the National Advisory Committee for Aeronautics, is to design from materials grown in this country a suitable fabric for parachute construction. Cotton fiber was chosen for the initial study, and it is hoped that sufficient data have been obtained on the treatment of the cotton yarn to yield a satisfactory material. At the present time a bale of long-staple Arizona pima cotton is being manufactured into yarn in the cotton mill, and treatments for this yarn have been outlined on a semiplant scale.

Wearing Qualities of Textiles, Carpet-Wear Test.—Apparatus was designed and built to simulate the wear of a carpet, which results from a person walking on it. The machine consists essentially of two abrading wheels, 12 inches in diameter with leather-covered faces 2 inches wide, mounted on a common shaft. A circular carpet specimen (15 inches in diameter) is tacked to a heavy pivoted disk which is caused to bear against the abrading wheels by means of a lever and counterweights. Only one wheel is driven; the other is free on the shaft and is braked so that it is driven by contact with the carpet. Thus horizontal strain is put on the sample and this, together with vertical pressure and the inherent slippage caused by the rotation of the disk, produces the wear. A vacuum cleaner picks up the abraded material.

The arrangement of the weights and brake was such that a 150-pound load was exerted by each abrading wheel. The specimen turned at the rate of 60 r. p. m. Various grades of carpet were tested, and it was found that in 8 to 24 hours the pile structure could be worn off completely. Various systems of measuring the wear were tried. The measurement of the thickness was found to be best, although the weight of the abraded material as collected by the vacuum cleaner showed considerable promise. The influence of the constructional features of the carpet on the wearing qualities will be studied during the coming year.

Tightness of Carpet Pile.—The tightness with which the pile is bound in the base fabric greatly influences the wearing quality of carpets. A method for measuring this tightness has been developed. One end of the pile along 1 inch of the row of pile is held in a special device which is inserted in a testing machine and a curve drawn showing the load and the slip. The Navy Department submitted about 30 different makes of velvet carpeting. These have been tested according to this procedure. A report is now being

prepared discussing the results. Other types of carpet will be tested during the coming year.

Cleavage Fabric.—In cooperation with the Cotton Textile Institute, a cleavage fabric for use in the construction of cement or macadam roads was developed in the experimental cotton mill. The fabric is spread on the roadbed before the cement surface is laid, thus forming a line of cleavage which facilitates repairs and resurfacing.

The requirements of this fabric are (1) cheapness; (2) sufficient body to form a cleavage line; (3) open construction, so that a binding action between the surfacing and the roadbed can take place; (4) sufficient strength to permit the manipulations required in laying it.

Four different weaves were tried. The final fabric is as follows: Yarn count, warp, and filling, 2.75s; weight ounce per square yard, 1.6; threads per inch available, warp 2, available filling, 3.5. The fabric is a plain weave. The warp ends are drawn at the rate of 2.6 to the inch, omitting one end of every four.

Size Standardization.—The National Association of Hosiery and Underwear Manufacturers and the Associated Knit-Underwear Manufacturers of America maintain research associates at the bureau who are working on standardization of sizes.

The report of the hosiery project on ¾ and ⅝ length hosiery was submitted with a suggested plan for simplifying the present ⅞, ¾, and ⅝ length sizes. The manufacturer's committee did not approve the plan, because of the demand for these styles for different purposes. The committee requested that the project be continued and that standards for flat-ribbed hosiery be formulated.

In the knit-underwear industry, in addition to the 16 size specifications that had been adopted a year ago, the following standards have been adopted during the past year:

17. Men's cotton ribbed-knit athletic suits (no sleeves, button shoulder, short leg).
18. Men's cotton flat-knit athletic union suits (no sleeves, button shoulder, short leg).
19. Men's flat fleece union suits.
20. Boys' flat fleece union suits.
21. Boys' ribbed (1x1) worsted, worsted-merino, wool and wool-cotton union suits. (Made from fabric that has been washed in the roll and then cut and seamed.)
22. Women's ribbed (1x1) cotton union suits (high neck, long sleeve, ankle length).

Eight other standards have been approved by the standardization committee of the association and will be considered for final adoption at the next meeting of the association.

The Associated Knit-Underwear Manufacturers of America is also cooperating with the Federal Specifications Board in formulating knit-underwear specifications for the different departments, which will conform as closely as possible to commercial practice. As a result, the size standards already developed at this bureau and adopted by the industry have also been adopted by the Government departments.

Measurement of Rope Twist.—Methods for measuring the degree of twist of a rope and of its component parts have been studied to develop a definite and accurate test procedure.

A method was first employed in which the torque necessary to place an additional amount of twist in a given length of specimen was measured. It was found that the results were dependent not only upon the degree of twist of the rope, but also upon the condition of the component fibers. For this reason it was decided that a more direct method for measuring the twist factors should be developed.

From a study of the structural features of 3-strand rope, it was found that three quantities—rope twist, strand twist, and yarn length per foot of rope—could be obtained, which together would give a measure of the degree of twist. In the experimental work the twist factors were determined from direct measurements on the rope, the strands, and the yarns. A method was also developed by which the factors could be computed from measurements on the surface of the rope. These measurements were made under several different conditions, and from a comparison of the results the most convenient and accurate procedure was selected.

It is believed that these results will be useful in view of the fact that no uniform method has been adopted either for measuring the degree of twist of a rope, or for classifying rope according to their twist.

Endurance Tests of Fiber Rope.—Although from experience manufacturers have developed ropes which are fairly satisfactory for dif ferent classes of service, and are still making changes to improve the serviceability of their products, there is no definite information as to the relative effect of the several constructional features of a rope on its endurance qualities. The type of cordage used for a certain kind of work is determined more by the consumers preference than by actual knowledge.

An endurance machine has been constructed on which specimens are worn out by repeated oscillations over a cast-iron sheave. Wear

of the specimens was caused by internal friction and external abrasion. In addition, specimens were subjected to a varying stress due to the changing acceleration of the reciprocating parts. The tension in a specimen varied throughout one cycle from 350 to 1,200 pounds, approximately.

A preliminary study was made to determine the proper test conditions. The selection of the size of sheave and the amount of load on the specimen was made principally to provide a convenient length of test. A series of tests was then made on rope of different fiber grades and on ropes having different degrees of twist. As a study of the effect of these variables on the endurance of rope, the tests were not conclusive, because several constructional features of the available samples were not under control. The investigations served mainly as a study of the performance of the machine and showed that results could be duplicated fairly well.

Publication.—Endurance Tests of Rope of Different Grades of Abaca, F. A. Johnson and W. J. Stevenson, Cord Age; October, 1927.

Sash-Cord Endurance.—A series of tests was conducted on 20 samples of No. 8 sash cord. These tests were made on the sash-cord bending machine which has been constructed in the conditioning room of the textile section. The data have been studied, frequency charts plotted, and probable errors computed for the purpose of presenting this material in a report on the machine. The data will serve mainly to show the possibilities of the machine.

New Method for Yarn-Strength Determination.—A preliminary survey of projects covering rayon properties showed that a method for determining strength and stretch of yarns would be very desirable. Existing methods were not adequate. Some study in this connection, which was later enlarged to include yarns of other fibers besides rayon, has resulted in the design of apparatus and the formulation of procedure for a method known as the equitension-lea method. This method has all the advantages of the lea method and has a higher degree of accuracy. It consists essentially of winding the yarn under uniform tension on a specimen holder. This holder is inserted between the jaws of the machine, and the specimen is broken. Very consistent results have been obtained both in stretch and strength of yarns of rayon, cotton, wool, etc.

Effect of Twist on Cotton Yarns.—Yarns were spun in the bureau's experimental cotton mill from 1 and $1\frac{1}{16}$ inch staples, middling-grade cotton, using single and double roving organizations. Seven counts of combed yarns ($1\frac{1}{16}$-inch staple) and five counts of carded yarns (1-inch staple) were spun. Different twist factors were used for each yarn.

Measurements were made of strength, diameter, angle of twist, and contraction. Correlations of the results graphically with respect to the twist multiplier were prepared.

Suggestions regarding the application of these data to the cotton mill were presented.

Effect of Laundering Upon the Thermal Insulating Value of Cotton Blankets.—Results of tests to determine the effect of laundering upon the heat-insulating value of cotton blankets have been published. Washing was found to decrease the heat-insulating value to a measurable extent, although the change would, perhaps, not have been large enough to be noticed in use. Renapping almost completely restored the original insulating value. Shrinkage, which resulted in thickening the blankets, had a tendency to increase the insulating value. The laundering and napping processes used simulated regular commercial practice. They were severe enough to cause considerable wear in four applications.

Publication.—Effect of Laundering Upon the Thermal Insulating Value of Cotton Blankets, B. S. Tech. Paper No. 347.

Laundry Deterioration.—Very serious deterioration of cotton materials during the winter months was reported by New England laundries. The bureau undertook a study of this problem at the request of the Laundryowners National Association of the United States and Canada.

A survey of the situation disclosed that the condition was experienced generally throughout the New England district, practically all laundries having experienced the trouble. The damage seems to be confined to materials handled in the "wet wash," although rarely cases in other types of laundering and home laundering have been reported.

Six laundries were selected as "key laundries" in an attempt to trace the difficulty. A chemist from the bureau spent several months in these plants checking formulas and other conditions. Case histories were obtained on a number of items. Numerous samples were collected and are being studied in the laboratory. Although valuable data have been obtained, the problem of eliminating this damage is not yet solved.

This project will be continued during the next fiscal year, during which the laundry formula and procedure developed in the bureau laboratory will be put into operation in several of the cooperating laundries.

Development of Cleaning Processes.—A cooperative effort has been arranged with the National Association Institute for Dyeing and Cleaning, in an endeavor to formulate standard specifications for soap used in the dry-cleaning processes. A preliminary survey

of the present conditions disclosed that 30 to 40 different soaps are now in use, practically all of which are bought on brand name. It was not thought desirable to attempt any exhaustive analysis of these soaps, but rather to attempt to mix the necessary ingredients for proper detergent action in a dry-cleaning process. Accordingly, the bureau made up a sample of this material and it was tried in the model plant of the institute. A favorable report was given, and on the basis of this a much larger sample was made which was divided into several lots and submitted to cleaners in various parts of the country for trial. The reports from these cleaners should indicate what further action is necessary.

Graying of Garments.—Dry-cleaning establishments throughout the country have been troubled with a deposit on wet woolens and silk which is commonly referred to as "graying." It is believed that this is caused by the corrosion of their metallic equipment which is deposited in a very finely divided state on the material. Laboratory apparatus was set up in an attempt to corrode these metals with dry-cleaning solvents and detergents. Although not definitely conclusive, the results of these tests were of sufficient value to warrant the construction of a dry-cleaning machine of the type found most resistant to corrosion. This machine has been installed in a commercial dry-cleaning establishment near Washington. Periodic inspections were made. This work will continue during the fiscal year 1928–29.

Fastness of Dyes on Textiles.—The measurement of the color changes in dyed textile materials, when subjected to various conditions of service, involves several colorimetric difficulties, owing to the wide range of the colors presented and the varied structure and surface texture of the different materials. The texture and lustre of the fabrics have disturbing effects on the color measurements, so that the results obtained may depend to a considerable extent on the particular colorimetric method and instrument employed. Satisfactory methods and instruments for the colorimetry of nearly white materials, and for the measurement of the luster (or glossiness) factors, are not at present available.

The work on the fastness of dyes is dependent to a considerable extent on the development of simple and practical methods for the above-mentioned measurements. These measurements involve, fundamentally, the various reflective properties of diffusing media (such as textiles, paper, etc.). Consequently, considerable time has been spent in the development of apparatus and methods for the measurement of these optical properties under controlled conditions of illu-

mination and observation, in order that data may be made available for the development of suitable practical routine methods which may be directly applied in the fastness investigation. The new equipment is now completely installed in the colorimetric laboratory of the bureau.

Fastness of Dyes to Dry Cleaning.—It is generally considered that a dry-cleaning solvent will not affect the dye. However, the introduction of new chemicals in dry-cleaning detergents has shown the necessity for more accurate data on this phase. The National Association of Dyers and Cleaners suggested this as one of the problems for their research associate. All of the dye manufacturers were circularized in an endeavor to collect dyeings of all available dyes on silk and wool. About 1,500 samples of dyed fabrics have been submitted. These are now being tested, using dry-cleaning procedures to determine their fastness. This work will be continued during the fiscal year 1928–29.

Investigations on Dyes.—The work on fastness to light (p. 218, 1928 Yearbook) has been completed. A comprehensive report will be published as soon as possible.

The work on fastness to washing resulted in the development of a machine for making laboratory washing tests under controlled conditions. An adaptation of the machine has been in routine use in the Pease Laboratories in New York, N. Y., for several months. A commercial form of the machine, soon to be placed on the market, has been adopted as standard by the American Association of Textile Chemists and Colorists and may be so adopted by the Detergents Committee of the American Oil Chemists' Society.

The preparation of dyes of known purity, for standard measurements of spectral transmission, was resumed. A special study of oil-soluble dyes is being made.

Publications.—A Method for Measuring the Color of Textiles, W. D. Appel, Am. Dyestuff Reporter, p. 49; January 23, 1928.

Report of the Subcommittee on Light Fastness, 2. The Fading of Dyed Textiles in the Light Transmitted by Various Glasses, W. D. Appel and W. C. Smith, Am. Dyestuff Reporter, p. 410; June 25, 1928.

THERAPEUTIC ACCESSORIES

Effect of Solarization on Window Glass for Transmitting the Ultra-Violet Rays of Sunlight.—An extensive investigation of the ultra-violet transmission characteristics of newly developed window materials, noted in the 1928 Yearbook, shows that, as a result of solarization by exposure to the ultra-violet radiation emitted by artificial sources and by the sun, most of these glasses decrease in transmission of those ultra-violet rays of short wave lengths which

are generally recognized by the medical profession as having a therapeutic value.

Further tests show that glasses which transmit 45 to 60 per cent of these rays, when new, transmit only 20 to 35 per cent after complete solarization.

Glass substitutes, consisting of a cellulose product upon a wire mesh, may lose almost entirely their transmitting power of these ultra-violet rays after exposure to the weather.

Publication.—Spectral Characteristics of Light Sources and Window Materials Used in Therapy, W. W. Coblentz, Illuminating Eng. Soc., 23, No. 3, p. 274; March, 1928.

The Effect of Solarization on the Ultra-Violet Transmission of Window Materials, W. W. Coblents and R. Stair, Ill. Eng. Soc., 23, p. 1121, November, 1928.

Summary Data on the Transmissibility of Ultra-Violet Radiation Through Glasses and Glass Substitutes Used for Therapeutic Purposes, W. W. Coblentz, Nat. Tuberculosis Assoc. Jour. (in press).

Transparency of Fabrics to Ultra-Violet Radiation.—An investigation of the transparency of fabrics made of cotton, linen, silk, wool, and rayon shows that all of these materials, especially when dyed, have a relatively low transmission of the ultra-violet rays; hence, to obtain beneficial therapeutic results, an open-weave fabric should be worn.

Publication.—Some Measurements of the Transmission of Ultra-Violet Radiation Through Various Kinds of Fabrics, W. W. Coblentz, R. Stair, and C. W. Schoffstall, B. S. Jour. Research, 1, No. 6, p. 105, August, 1928.

Standardization of Tuning Forks Used in Medical Practice.—It is a common practice among physicians to test the hearing of deaf patients by means of a tuning fork. The less acute the hearing, the sooner the patient fails to hear the sound of the fork. A correct estimate of the patient's hearing loss requires a knowledge of the damping constant of the fork. An increasing number of physicians are availing themselves of the facilities of the bureau's acoustic laboratory for standardization of the tuning forks used by them.

THERMAL EXPANSION

Measurement of Thermal Expansion.—Researches to determine the thermal expansion of the following materials have been completed: Beryllium and beryllium alloys, stainless iron alloys, pure nickel, sand-lime brick, magnesium, and magnesium-aluminum alloys.

Further attention has been given to development of equipment suitable for laboratories wishing to make expansion measurements. The fused silica tube and plunger type of expansion apparatus has proved satisfactory in laboratories in which it has been installed. The interferrometer type has been completed and makes possible

accurate determinations on small specimens. The difficulties of watching and counting fringe shifts in this apparatus make its use rather tedious. It is hoped certain improvements contemplated in this apparatus will eliminate some of these difficulties. An automatic, autographic system of measurement has been developed and the apparatus will be constructed as soon as the completion of other projects will permit.

Publications.—Thermal Expansion of Beryllium and Aluminum-Beryllium Alloys, Peter Hidnert and W. T. Sweeney, B. S. Sci. Paper No. 565.

Thermal Expansion of Alloys of the "Stainless Iron" Type, Peter Hidnert and W. T. Sweeney, B. S. Sci. Paper No. 570.

WASTE-LAND PRODUCTS

Organic Acids from Waste-Land Products.—After devising and perfecting some new chemical methods, cottonseed bran and burs, peanut hulls, bagasse dust, and Texas sunflower were analyzed for moisture, ash, potash, crude fat, crude protein, crude fiber, lignin, total cellulose, alpha cellulose, total sugars, xylose sugar, furfural yield, and aldonic acids. In addition, a few analyses were made on corncobs.

The work has been directed particularly to the determination, separation, and utilization of the most important components, namely, (*a*) the sugars, principally the xylose and the furfural made therefrom; (*b*) the aldonic or sugar acids; (*c*) the crude fiber and cellulose, especially the alpha cellulose suitable for making rayon; and (*d*) the mineral constituents including potash and protein fertilizers.

At the same time, large-scale laboratory studies of miniature factory type and scope, and the plans for suitable semicommercial and industrial equipment, have been investigated in order to place the work promptly on a commercial basis. A practical battery method has been developed for treating the cellulose wastes first with cold dilute acids to remove mineral and protein constituents, and then with hot dilute acids to recover the sugars and sugar acids without unduly injuring the cellulose fiber. The extracted xylose sugar has been purified and oxidized into xylotrioxyglutaric and other acids and has also been changed into furfural by miniature practical methods giving good yields. The possibility of using xylotrioxyglutaric acid as a mordant in dyeing wool, in tanning leather, and as a general acidulent like tartaric acid has been investigated, and range of its usefulness in regulating the p^H of commercial solutions has been measured.

The extracted cellulose fiber from peanut hulls, cottonseed bran, cotton burs, and bagasse has been converted into crude cellulose, and

especially into alpha (except with peanut hulls) cellulose. Both the raw and the extracted cellulose fibers of peanut shells have also been pressed into a tough fiber board and have been studied as a filler to replace wood chips in gypsum blocks.

Tests have been made on the resistance and suitability of chrome-steel and chrome-nickel-steel alloys for fabricating the machinery for handling the nitric acid solutions of these organic materials on a commercial basis.

Plans have been nearly completed for the proper type of equipment and the layout of a semicommercial plant to manufacture xylose, furfural, xylotrioxyglutaric, and crude cellulose products, such as pressboard.

One article has been published, three are in press, and an extensive technical bulletin on xylose is in preparation.

During the coming year complete analyses will be made of these agricultural wastes, various grades of cellulose or pulps made from these wastes will be studied chemically and physically, and the semi-commercial work described above will be undertaken.

Publication.—Notes on Helianthus Argophyllus, K. S. Markley and W. T. Schreiber, J. Ind. and Eng. Chem.; June, 1928.

WEIGHTS AND MEASURES

Testing Standards of Mass.—Since all values on weights certified by the bureau depend on the values of its high-precision laboratory standards, the validity of these latter values is a matter of extreme importance. The two principal sets of these standards have been recalibrated in terms of certain platinum-iridium standards, the values of which were determined by direct comparison with the national standard some time ago. The accuracy of this work has all been between 1 part in 1,000,000 and 1 part in 100,000,000, depending upon the size of the weight involved. Values obtained by comparisons conducted incident to the routine testing of weights had indicated the probability of changes in the values of several of these weights and the approximate size of these changes. The new values confirm this hypothesis. The changes were of the order of a few parts in 10,000,000. While such changes as these are too small to have resulted in any error in corrections reported by the bureau on weights submitted for test, the new values are of very great importance, since not only do they place the work upon a more stable foundation, but they also reduce the number of standards and the number of observations which must be used in order to assure values of a predetermined precision.

Certification of Master Gauges.—Until rather recently there were available no definite or adequate specifications and tolerances for

master gauges used in interchangeable manufacture, and in the absence of such specifications and tolerances the principal work of the bureau in this field was to measure the actual dimensions of the various gauge elements and to report or certify the values found. No information was given as to whether or not a given gauge was acceptable and satisfactory for the purpose intended.

During the past two years, however, there has been an increasing tendency on the part of certain industries to submit all master gauges to the bureau for test and certification as to compliance with definite specifications. This has been particularly marked in the petroleum industry, which is carrying through an active standardization program under the leadership of the American Petroleum Institute. All master gauges for interchangeable parts of oil-well equipment made to American Petroleum Institute specifications, such as well casing, drill pipe, pump rods, and drilling tools, have been submitted to and certified by the bureau. A similar tendency has recently developed among manufacturers of automobile accessories.

Arrangements have been made with the National Physical Laboratory of England and the standardization division of the American Petroleum Institute, whereby oil-well casing gauges may be certified by the National Physical Laboratory as to conformity with the specifications of the institute. The Bureau of Standards being official custodian of the grand masters of these gauges, and comparative measurements on similar gauges having been made by the Bureau of Standards and the National Physical Laboratory, it has been found entirely practicable to have certain of these gauges which were intended for use in England or on the Continent tested and certified by the National Physical Laboratory, with a great saving of time and expense.

Development of New Equipment for Testing Gauges.—Apparatus for determining the lead or pitch of ring-thread gauges in sizes for which no suitable equipment was previously available has been designed and built. This apparatus permits determination of lead of straight or taper ring-thread gauges of 1½ inches and larger to an accuracy of 0.00002 inch. Three projection lanterns incorporating the latest improvements have been built. One of these is for use in the bureau's gauge-testing laboratory and the other two are for the Ordnance Department of the Army. An interferometer of foreign make was rebuilt to overcome the tendency to vibrate and become unreliable in its indications as a result of unavoidable vibrations of the building in which it was used. The reliability and usefulness of the instrument were much improved by the changes made.

American Gauge Design Committee.—The American Gauge Design Committee was organized in November, 1926, at the request of

the Ordnance Department of the Army. The original object of the committee was to standardize the design of plain and thread plug and ring gauges of the sizes most commonly used in interchangeable manufacture, in order to insure the prompt and economical procurement of gauges required by the Ordnance Department in time of national emergency. It was found, however, that the committee as informally organized was so broadly representative of manufacturers and industrial users of gauges that there was reason to believe that the findings of the committee might be of economic value to industry as well as to the Ordnance Department. The work of the committee has, therefore, developed along broader lines than was originally contemplated.

The committee has confined its attention to the design of gauge blanks and has not considered the details of finished gauges, these matters being left to the individual manufacturers and purchasers.

The committee has approved designs and dimensions of gauge blanks for both plain and thread plugs and rings over the size range, 0 to 4½ inches, with the exception of shell-type plugs above 2½ inches, on which a standard locking device between gauge end and handle has not received final approval. Many of the blanks, as approved by the committee, are already being stocked by gauge makers and are in use in industry.

Gauge manufacturers have been very generous in their cooperation with the committee, and gauge users have given the committee the full benefit of their experience.

A complete report of the committee's work is now in preparation, and this will be published by the Department of Commerce as a commercial standard. It is hoped also that it will be approved by the American Standards Association as an American standard, and that the specifications for thread-gauge blanks will be approved by the National Screw Thread Commission and included in its 1928 report.

Weights and Measures Administration.—The bureau has maintained close contacts with the weights and measures offices of the several States, and with the manufacturers of weighing and measuring devices. State and local weights and measures officers have displayed increased readiness to promulgate in their respective jurisdictions the regulations developed or amended by the National Conference on Weights and Measures. Among the manufacturers, the conference recommendations are accepted almost unanimously as the standard basis for the fabrication of their products.

Recent action on the part of the State officials in California, Connecticut, Georgia, Indiana, Michigan, North Carolina, Ohio, Texas, and Virginia and numerous instances of action by individual cities

may be cited as examples of the acceptance, in whole or in part, of the model codes of specifications and tolerances for commercial apparatus, of the national conference, on the part of the State and local supervisory agencies. Moreover, weights and measures statutes, either amendments to existing laws or enactments covering new fields, have been adopted by 1927 State legislatures in Alabama, California, Colorado, Delaware, Georgia, Idaho, Kentucky, Minnesota, Montana, Nebraska, New Jersey, North Carolina, Utah, Washington, and Wisconsin. This new legislation in many instances follows the exact lines laid down in the model law on weights and measures. worked out by the Bureau of Standards and the National Conference on Weights and Measures for the purpose of promoting national uniformity and encouraging adequate supervision throughout all sections of the country. The fact that in several of the States mentioned the statutes in question mark the beginnings of active supervision in one or more branches of weights and measures supervision evidences an awakening appreciation of the economic importance of such control by the State.

The Twenty-First National Conference on Weights and Measures, held in May, 1928, established a record for representation, delegates being in attendance from 29 States and the District of Columbia. Final action was taken on regulations for lubricating-oil bottles and on a series of amendments to the regulations for liquid-measuring devices, tentative regulations for grease-measuring devices were adopted, and codes of specifications and tolerances formerly adopted were clarified in numerous places; in the case of lubricating-oil bottles, liquid-measuring devices, and grease-measuring devices, the conclusions of the conference were based upon special studies made along these lines by the Bureau of Standards. Upon the basis of a report presented by the bureau, giving the results of an investigation of the suitability, from a weights and measures standpoint, of actuating taxicab meters from the transmission drive shaft of the cab, the conference stated its conviction that from a weights and measures standpoint there was no objection to the use of this method of drive. Papers were presented and discussions had upon a wide variety of additional subjects affecting weights and measures supervision.

Cooperation has been extended to State and local officials in many ways, including personal conferences with such officials, either singly or in groups, of the following States: Indiana, Maryland, Michigan, Minnesota, New Jersey, New York, North Carolina, Ohio, and the District of Columbia.

Publication.—Report of the Twentieth National Conference on Weights and Measures, B. S. Misc. Pub., No. 80.

VII. MUNICIPAL, COUNTY, AND STATE PURCHASING AGENCIES

In compiling information relating to the purchasing methods of municipal, county, and State governments a special effort has been made to ascertain to what extent acceptance testing is being employed by these governments. It will be noted that college laboratories are being used rather generally by the public purchasers of municipal, county, and State governments. In the present chapter are given brief outlines of the specifications-using methods of the various governments.

MUNICIPAL PURCHASING AND STANDARDIZING AGENCIES

In the larger cities of the country certain commodities are purchased on contracts based on specifications. In a majority of cases cities that have formulated their own specifications have freely made use of nationally recognized specifications of various technical societies and associations, especially those of the American Society for Testing Materials, American Water Works Association, American Society for Municipal Improvements, and the Federal Government. In almost every case where commodities are purchased on specifications they are checked, either at the sources of supply before delivery or upon arrival at their destination, to determine whether or not the goods comply with the specification requirements. Some cities maintain and operate their own testing laboratories, while others engage the laboratories of colleges and universities, commercial agencies, and those of State highway departments.

The 1928 Yearbook of the International City Managers' Association gives a list of more than 360 municipalities which have the city-manager form of government. A survey of these cities shows, with very few exceptions, that they are making use of the specification method of purchasing. The city-manager plan has given rise to the need for specifications and for centralization of city purchases under one head, in that the city manager is vested with complete authority for the business affairs of the city, and he is, in turn, directly responsible to the city council.

In Detroit, except for the school board, the department of purchases and supplies has full authority to purchase all materials for city, including utilities, such as the water board, public light, and

street railways. A standards committee devotes considerable time to the study of standardization research carried on by numerous technical societies in the endeavor to develop such standards and specifications as are required by the city departments. All commodities are tested physically and chemically in the city's laboratories, and in some cases checks are made at either the Pittsburgh or the Detroit Testing Laboratories. Tests of stone are conducted at the quarries with the assistance of the laboratories of the University of Michigan and the Ohio State University.

The charter of the city of St. Louis provides for the creation of a board of standardization whose function it is to formulate specifications based on a study of existing nationally recognized specifications. The board maintains a well-equipped testing laboratory, and use is made of college laboratories when it is found to be necessary.

The chief buyer of Milwaukee, through the central board of purchases, does the buying for all departments, boards, and commissions upon specifications prepared by him in cooperation with the city chemist and city department engineers. Materials and supplies purchased on specifications are tested either at the sources of supply or by the city chemist.

Purchases made by the city purchasing agent in Norfolk, Va., are subject to approval by the city manager. An attempt is being made to standardize commodities wherever possible, and a laboratory is being established for test work. Another city in Virginia having a city manager is Lynchburg, whose procedure is similar to that of Norfolk regarding purchases of materials and supplies.

Effective use is being made of Federal Government specifications in Newport News, Va., all suppliers being required to furnish certificates guaranteeing compliance with the specifications.

Practically all of the specifications promulgated by the Federal Specifications Board are being used by the city of Knoxville, Tenn.

Deliveries made on specifications in Pawtucket, R. I., are checked in every case. Water pipe is tested at the foundry, and sewer pipe is checked on delivery. Commercial laboratories and those of Brown University are used for testing street-paving materials.

In Pittsburgh the department of supplies has authority to purchase all equipment, machinery, and supplies for the various departments of the city. The city maintains a testing laboratory and also inspectors to carry on its testing and inspection work. Each department of the city of Erie, Pa., prepares its own specifications, deliveries made being checked either by the city laboratory or by a commercial agency.

Under the city charter of Oklahoma City all commodities in excess of $300 must be purchased by the city council on sealed com-

petitive bids. The engineering and city chemist departments maintain laboratories for testing commodities so purchased. Occasional use is made of the testing and research laboratories of Oklahoma State University and those of the State highway department, particularly on the break tests on concrete. The office of purchasing agent of Tulsa, Okla., was created in 1927. The laboratory of the engineering department is equipped to conduct tests of asphalt, stone, and cement.

Among the municipalities, New York City has formulated and utilized the greatest number of purchase specifications, more than 1,600 specifications for 42 different classes of commodities having been prepared. Practically all of the work of standardization is done in the department of purchase. Standards adopted by the board of estimate and apportionment are compulsory on all city departments.

The bureau of engineering prepares specifications for many materials used by the city of Schenectady, N. Y. The engineering testing laboratory of the department of public works conducts all tests for city purchases. In Poughkeepsie the department of purchase buys all supplies and equipment for the city departments except for the board of education.

Each bureau in the city of Newark requisitioning supplies formulates its own specifications for paving materials and office equipment. In Jersey City purchases of $1,000 and over are based on specifications. The city operates its own laboratories for test work.

Large and extensive laboratories are maintained at the city filtration plant of Grand Rapids for examination of all street materials, oil, gas, coal, and gasoline. In addition, it has a 300,000-pound testing machine in charge of a corps of inspectors for use in connection with all street work, and for testing building blocks, gypsum blocks, tile, and other materials.

The purchasing agent and the deputies of the department of streets and engineering of Springfield, Mass., prepare specifications for street-paving materials, tests being made at the city laboratory.

Among the cities operating bureaus of standards are to be noted Baltimore, Md., and Portland, Oreg. The function of the bureau of standards of the city of Baltimore is to formulate standards and specifications. Standards have been prepared for fuel, lubricants, paper, soap, and numerous kinds of building materials. The bureau has a complete system of testing all commodities purchased for the city. The bureau of standards of Portland is conducted under the authority of the department of public works. It cooperates with other city departments in the selection and adoption of specifications, and it checks deliveries of materials purchased under specifi-

cations. With the bureau of building rests the responsibility for the enforcement of the city's "building code" issued by the department of public works.

Both the city laboratories and those of the University of Kentucky are employed for testing commodities purchased on contracts based on specifications by the city of Lexington, Ky. The city buyer for Louisville, Ky., is authorized to purchase supplies for city institutions on specifications prepared by the city engineer. Tests are made in the city laboratory. In Greensboro, N. C., the city purchasing agents employs specifications for the majority of basic commodities and for all contract work which involves standard materials or practices.

The city of Miami, Fla., maintains a testing bureau to check materials for sewer and street work, and it employs commercial laboratories to test other materials and supplies.

Samples are submitted to the city chemist for tests before purchases are made in Hartford, Conn. Building and street-paving materials and other supplies for New London are purchased on United States Government specifications whenever practicable. Departmental heads formulate specifications for Stamford, Conn. This city has used the laboratories of Columbia University for the testing of gasoline.

The procedure adopted under the general law of the city of San Francisco requires that the purchaser of supplies be vested with authority for formulating all standards and specifications. The city maintains physical, chemical, and bacteriological laboratories for testing all foodstuffs, materials, and supplies. Use is made of the California State special laboratories when necessary.

In Los Angeles there are three agencies concerned with the purchase of commodities under specifications—the city purchasing agent, the purchasing agent for the harbor department, and the purchasing agent for the department of water and power. The latter two departments maintain well-equipped laboratories for conducting electrical, mechanical, chemical, and physical research and tests. Fuel, gasoline, and lubricating oils are purchased on Federal Government specifications in Berkeley, Calif. Tests are made in the city's laboratory and, in some cases, in the laboratories of the University of California.

The testing-materials division of Rochester, N. Y., prepares such specifications as are required by the purchasing agent and checks all materials purchased. In Providence, R. I., supplies are purchased by the head of each department except when the amount involved exceeds $500, in which case purchases are based on specifications and made through the board of contract and supply.

Under the city-manager form of government in Cincinnati, the purchasing agent, under the supervision of the city manager, makes all purchases for the various city departments and the rapid-transit board. Specifications are formulated by the departments issuing requisitions in conjunction with the purchasing agent and other interested departments. All testing for the city is conducted at the bureau of city tests located at the University of Cincinnati.

Purchases exceeding in amount of $1,000 in Akron, Ohio, must be recommended to the board of control for final approval. The Municipal University of Akron carries on the test work required by the city.

In Minneapolis each city department draws up its own specifications for purchases to be made by the city purchasing agent, and tests are made either by the city chemist or by the city engineering department.

The city manager and city engineer prepare specifications subject to approval by the city commission in Newton, Kans. All materials bought on specifications by the city of Newton are tested at the laboratories of Kansas State Agricultural College and the building department of Wichita.

Baton Rouge, La., operates under the commission form of government. Purchases to be made by the purchasing agent must be approved by the heads of the departments. Upon the purchasing division of the New Orleans Department of Public Finances falls the duty of selecting specifications and making purchases for the city government.

Supplies and equipment for city offices and public institutions in Philadelphia are purchased on specifications prepared by the director of the department of supplies. It is estimated that specifications are employed in 95 per cent of the purchases made for the municipality of Denver, Colo., by the commissioner of supplies.

Numerous city officials act as purchasing agents in New Bedford, Mass., where in all contracts made by any department competitive bids based on specifications must be obtained when the cost exceeds $200. In Woonsocket, R. I., the method of purchasing employed is similar to that of New Bedford.

Other municipalities using specifications in purchasing materials and supplies and maintaining laboratories for checking deliveries under specifications are Flint, Mich.; Long Beach, Calif.; and Waco, Tex.

AGENCIES FOR COUNTIES AND PUBLIC SCHOOLS

With few exceptions, little or no use is made of specifications by county governments in the purchase of commodities. Where employed, specifications are usually limited to materials pertaining to

the erection of public buildings, public works, and county roads. A forward step has been taken by the American Road Builders' Association to bring about a centralized system of purchasing and a more uniform practice in the use of specifications, especially for materials pertaining to county highway construction. The association has organized a county highway officials division under whose auspices eight standards committees are functioning to study county highway problems and to standardize methods.

Marked progress is to be noted in California, the legislature of which has enacted a law authorizing the purchasing agents of various counties to purchase certain standard supplies for school districts.

In Kern and Alameda Counties, Calif., charters have been revised to include a system for centralized purchasing for school supplies. Specifications for materials are prepared as needed in Riverside County, Calif., and it maintains its own laboratory for testing materials purchased either on specifications or on certification.

A standards committee formulates specifications for Los Angeles County and also makes use of Federal Government specifications. The county health department maintains a well-equipped laboratory to which the county government has access, in addition to its own laboratory.

Both specifications and the guaranty system are employed in Gray Harbors County, Wash., for the purchase of road machinery, trucks, and supplies.

The department of public works of Allegheny County, Pa., maintains a bureau of tests and specifications to develop standards relating to road and building materials. It has a complete chemical and physical testing laboratory which conducts testing an inspection on approximately 30,000 tons of steel annually.

Commodity specifications have been used for many years in Multnoma County, Oreg., and in Herkimer and Monroe Counties, N. Y.

Specifications are in rather general use by the public schools throughout the country whenever the value of the purchases of any commodity exceed a certain definite minimum, usually $500, but often less.

In Cleveland, Ohio, the board of education has established a bureau of standards to secure agreement on standard schedules of equipment and supplies required for the schools and to make recommendations as to the standardization of all articles in the schedules for the approval of the board's committee on housing and supplies. Standards are formulated by the bureau of architecture and construction working in cooperation with the bureau of standards. The board maintains a well-equipped commodity acceptance testing laboratory.

STATE PURCHASING AND STANDARDIZING AGENCIES

A considerable number of State governments have organized centralized purchasing agencies or adopted uniform specifications, in most cases independent of the State highway departments, for the purchase of materials, supplies, and equipment. In 42 of the 48 States some use is made by the State purchasing agencies or State highway commissions of the college laboratories for acceptance testing.

All of the State highway organizations have made provisions for the testing of commodities purchased upon specifications, many having established their own laboratories for this purpose.

The problem of constructing and maintaining a nation-wide system of highways has been intrusted by the several States to State highway departments or commissions. In every State standards and specifications have been prepared for practically every type of material entering into highway construction, the specifications used being in conformity with those formulated by the American Society for Testing Materials, the American Association of State Highway Officials, and the United States Bureau of Public Roads, and formally approved by the United States Secretary of Agriculture for use in connection with Federal-aid road construction.

In the following brief items there are set forth the names and addresses of the State purchasing and standardizing agencies, the names of the individuals in charge, and of the chief officers concerned with the preparation and utilization of specifications, with some indication of the scope and character of their activities. Outlines are given of the methods employed by these agencies in determining whether or not commodities purchased on specifications comply therewith, without reproducing the information concerning the methods employed in preparing the specifications, which information can be found in the Standards Yearbooks, 1927 and 1928.

Where symbols are used after the name and address of the agency or body they have the following significance:

(*b*)=Names and title of officers in charge.
(*c*)=Body appointed by.
(*d*)=Authority of body.
(*e*)=Procedure in formulating specifications.
(*f*)=Types of commodities for which specifications have been prepared.
(*g*)=Arrangements made for testing materials.
(*h*)=Testing laboratory facilities.
(*i*)=Testing for others on a commercial basis.
(*j*)=Use made of college testing and research laboratories.

Alabama State Board of Administration, Montgomery. (*b*) C. A. Moffett, president. (*c*) Governor. (*d*) Formulate specifications and make purchases for all State departments and for smaller State institutions. (*j*) College laboratories are made use of in acceptance testing.

Alabama State Highway Department, Montgomery. (*b*) Woolsey Finnell, highway director. (*c*) Governor. (*g*) and (*h*) The department maintains its own laboratory for testing all materials before they are used.

Arizona Board of Directors of State Institutions, Phoenix. (*b*) C. M. Zander, executive officer, secretary, State purchasing agent. (*c*) Governor. (*d*) The board has control of all State institutions relating to construction and purchases. (*e*) and (*f*) Board does not use specifications but purchases on commercial brands, depending upon experience in use. (*g*) and (*h*) It maintains its own testing laboratory. (*i*) Departments only except in special cases. (*j*) Only when necessary.

Arizona State Highway Department, Phoenix. (*b*) W. C. Lefebvre, State engineer. (*c*) Governor. (*e*) Specifications are prepared by the chief engineer. (*g*) and (*h*) The highway department has a very complete laboratory which is used for testing all materials entering into highway work. (*j*) Not necessary.

Arkansas State Highway Commission, Little Rock. (*b*) Dwight H. Blackwood, chairman; C. S. Christian, State highway engineer; Roy D. Likins, engineer of materials and tests. (*g*) and (*h*) The commission has employed a commercial laboratory for the testing of the materials required in road construction. (*i*) No testing other than for State work. (*j*) No use is made of college testing and research laboratories.

Arkansas State Purchasing Department, Little Rock. (*b*) E. D. Chipman, purchasing agent. (*c*) Governor. (*d*) and (*e*) Purchasing agent has authority to prepare specifications, supervise erection of buildings for State institutions, and purchase supplies for the institutions.

California State Department of Finance, Bureau of Purchases, Capitol Building, Sacramento. (*b*) W. G. McMillin, State purchasing agent. (*c*) Appointed by director of finance, chief of division of service and supply, subject to civil-service procedure. (*d*) Makes rules and regulations for purchasing for all institutions, departments, commissions, State schools, and offices of the State, with the approval of the director and chief of division when desired. (*e*) Specifications and standards are formulated in conjunction with the bureau of pure food and drugs and State testing laboratories and chemists as needed. (*g*) and (*h*) There are five laboratories in connection with the State service—chemical, physical, research, and pure food and drugs. (*j*) Use is made of the State University and the department of agriculture laboratories.

California State Highway Commission and Department of Public Works, Sacramento. (*b*) B. B. Meek, director; C. H. Purcell, State highway engineer. (*c*) Governor. (*d*) The director is the executive officer and has full authority to formulate standards and specifications. (*e*) and (*f*) Standards and specifications are formulated by the State highway engineer and his assistants, and are approved by the director. (*g*) and (*h*) The department maintains a laboratory equipped for making all tests on materials entering into road construction. (*i*) No testing is done on a commercial basis. However, some testing is done for other departments in the State and also for counties when the proper application is made. A nominal charge is made for these tests.

Colorado State Educational Institutions, Associated Purchasing Agents of, Boulder. (*b*) Henry B. Abbett, chairman. (*c*) Body consists of purchasing agents of State-owned institutions. (*d*) Standardize on commodities that are used in common by the State educational institutions; pool the requirements and make purchases for the institutions. (*g*) and (*h*) It maintains its own laboratory, and tests are made regularly of janitor supplies, paints, varnishes, and other purchased commodities. (*i*) The institutional laboratories carry on test work for commercial firms.

Colorado State Highway Department, Denver. (*b*) Louis D. Blauvelt, State highway engineer. (*c*) Governor. (*g*) and (*h*) The highway department maintains no testing laboratory, the testing work being carried on by a commercial laboratory. (*i*) None. (*j*) The department has made use of the testing equipment at the State Agricultural College and the University of Colorado research laboratories in carrying on tests and special research work.

Connecticut State Board of Finance and Control, Hartford. (*b*) Edward F. Hall, commissioner. (*c*) By the governor. Board is composed of the governor, comptroller, secretary, attorney general, tax commissioner, and three citizen members appointed by the governor. (*d*) Prescribe and examine methods of accounting for State departments and State institutions; fix salaries and authorize employment; prepare budget, etc. (*g*) and (*h*) The board does not maintain a testing laboratory. Various departments that find testing necessary maintain their own laboratories. (*j*) When necessary.

Connecticut State Highway Department, Portland. (*b*) John A. MacDonald, commissioner; Frank G. Flood, testing engineer. (*g*) and (*h*) The highway department maintains its own laboratory for making tests on all road-building materials.

Delaware State Board of Supplies, Dover. (*b*) Charles H. Grantland, secretary of board. (*c*) By the governor. (*d*) Formulate specifications, and contract for current stationery, miscellaneous supplies, and printing for all State departments and institutions. (*e*) Questionnaires are submitted annually to each department and institution, requesting quantity, quality, etc., of supplies desired. Specifications are formulated from these questionnaires.

Delaware State Highway Department, Dover. (*b*) C. D. Buck, chief engineer. (*c*) Governor. (*d*) Build and maintain State highways. (*e*) The authority is vested in the chief engineer for the formulation of standards and specifications. (*g*) and (*h*) The highway department maintains a laboratory equipped to make tests on all materials used in State highway work. A commercial laboratory represents the department at the various cement mills, and cement is tested before shipment.

District of Columbia Purchasing Office, Washington, D. C. (*b*) M. C. Hargrove, purchasing officer. (*c*) Commissioners of the District of Columbia. (*d*) Make purchases for all departments and institutions of the District of Columbia as far as possible under the General Supply Committee's schedules, and formulate or select specifications for all items not covered by these schedules. (*e*) and (*f*) Use specifications promulgated by the Federal Specifications Board. United States Department of Agriculture specifications are used for some foodstuffs. (*g*) Visual tests are made of some materials, but other materials, when deemed necessary, are submitted to the National Bureau of Standards for test. (*h*) None in this office; can resort to laboratories of health department and inspector of asphalt and cements of the District.

Florida Board of Commissioners of State Institutions, Tallahassee. (*b*) Bessie Gibbs Porter, secretary. (*c*) By the governor. (*d*) Formulate and adopt specifications and make purchases for all State institutions.

Florida State Roads Department. (*b*) Fons A. Hathaway, chairman, Tallahassee; J. L. Cresap, State highway engineer, Tallahassee; Harvey A. Hall, testing engineer, Gainesville. (*c*) Governor. (*d*) It has authority to acquire rights of way for State roads and let contracts for road construction. (*g*) and (*h*) The department maintains its own testing laboratory. (*i*) Commercial tests are made only in special cases, not officially, but as a convenience. (*j*) To some extent with the University of Florida.

Georgia State Department of Public Printing, State capitol, Atlanta. (*b*) Josephus Camp, superintendent. (*c*) and (*d*) This department awards contracts

for all printing, binding, engraving, etc., and the purchase of all office supplies. All orders not exceeding $500 in cost are awarded on competitive bids. State contract, embracing the laws, journals, tax digests, and tax return blanks, is awarded annually on sealed bids.

Georgia State Highway Board. (*b*) John N. Holder, chairman, Atlanta; J. E. Boyd, testing engineer, East Point. (*g*) and (*h*) The highway department maintains its own testing laboratory, equipped to make practically all tests on road-building materials. (*i*) Commercial testing is not undertaken, but frequently tests are made for county road departments within the State. (*j*) Cooperation in research work with the University of Georgia pertaining to topsoil, subgrade, and asphalt problems.

Idaho State Bureau of Supplies, Boise. (*b*) R. G. Archibald, State purchasing agent. (*c*) By the governor. (*d*) Formulate and adopt specifications for all State departments and State institutions.

Idaho State Department of Public Works, Bureau of Highways, Boise. (*b*) J. D. Wood, commissioner of public works; R. H. Shoemaker, office engineer. (*c*) Governor. (*g*) All materials are tested in the State laboratories. (*h*) Main laboratory located at the bureau of highways headquarters in Boise; branch laboratory at State University at Moscow. Bureau pays portion of testing engineer's salary at branch laboratory and gives supervision of work. (*i*) Both laboratories make tests for individuals, firms, or organizations for fees which cover actual cost of tests in labor and materials. (*j*) As stated above.

Illinois State Department of Public Works and Buildings, Division of Highways, Springfield. (*b*) C. R. Miller, director; Frank T. Sheets, chief highway engineer. (*c*) Governor. (*d*) Locate and construct State highways, public buildings, and parks. (*g*) All materials used in highway and bridge construction and maintenance are tested. (*h*) A completely equipped laboratory is maintained.

Illinois State Division of Purchases and Supplies, Statehouse, Springfield. (*b*) L. H. Becherer, State purchasing agent. (*c*) By the governor. (*d*) and (*e*) Makes purchases in accordance with the laws of the State. (*f*) About 30,000 items purchased. (*g*) and (*h*) Testing is done by the division of highways laboratory, the department of agriculture laboratories, and the chemistry department of the University of Illinois. (*j*) Yes.

Indiana State Highway Commission, Indianapolis. (*b*) John D. Williams, director; William J. Titus, chief engineer; P. D. Miesenhelder, testing engineer. (*c*) By the governor. (*e*) and (*f*) The chief engineer prepares and places on file in the office of the commission standard specifications for three or more distinct types of modern highways, of which at least three shall be hard-surface types. (*g*) Project engineers in charge of construction are supplied with equipment for making such field tests as are practicable, and samples are submitted to the laboratory. (*h*) The commission maintains its own laboratory for testing all materials used in the construction and maintenance of roads and bridges. (*i*) Not permitted to do any commercial testing. (*j*) Liaison is maintained between the laboratory and the engineering experiment station and testing laboratory of Purdue University, which is the State engineering school.

Indiana State Joint Purchasing Committee, Indianapolis. (*b*) Daily E. McCoy, secretary. (*c*) Body selected by the heads of State institutions with the approval of the governor. (*d*) To make purchases for all State institutions. (*e*) Use is made of the specifications formulated by the Federal Specifications Board. (*h*) and (*j*) The committee does not maintain a testing laboratory. All test work is carried on in the State universities.

Iowa Board of Control of State Institutions, Des Moines. (*b*) E. J. Hines, secretary. (*c*) Governor. (*d*) Manage and control State institutions and prepare specifications. (*g*) The State chemist makes arrangements for the testing of purchased commodities. (*j*) To some extent.

Iowa State Highway Commission, Ames. (*b*) C. L. Niles, chairman; F. R. White, chief engineer. (*c*) By the governor. (*g*) and (*h*) The commission maintains its own laboratories for testing of materials purchased or used. (*i*) A limited amount of testing is done as an accommodation to other State highway departments. No other commercial tests are conducted. (*j*) Very little.

Kansas State Board of Administration, Topeka. (*b*) H. E. Shrack, State business manager. (*c*) Composed of governor and three electors appointed by him. (*d*) Formulate specifications and make purchases for all State institutions. (*j*) Yes.

Kansas State Highway Commission. (*b*) John W. Gardner, director, Topeka; C. H. Scholer, engineer of tests, Manhattan. (*c*) Ex officio. (*g*) and (*h*) All testing of road materials is handled through the road materials laboratory of the engineering experiment station of the Kansas State Agricultural College and is supported by the fees charged for tests. (*i*) Although most of the work done is for the State highway commission, testing for private engineers and manufacturers is also handled. (*j*) Only as given above.

Kentucky State Highway Commission, Frankfort. (*b*) Ben Johnson, chairman; J. S. Watkins, State highway engineer; V. P. Ligon, engineer of test. (*c*) Commission is appointed by the governor and confirmed by the State senate. (*g*) and (*h*) The highway department has recently equipped a laboratory at Frankfort to make all tests of highway materials except analysis of steel and paint. This laboratory receives samples of materials from the field and conducts such tests as are required by the specifications. (*i*) The laboratory does no commercial testing. (*j*) For certain research problems use is made of the laboratory of the University of Kentucky at Lexington, which is in charge of D. V. Terrell, professor of civil engineering at the university, who has also been appointed research engineer for the State highway department.

Kentucky State Purchasing Commission, Frankfort. (*b*) E. E. Shannon, State purchasing agent. (*c*) By the governor. (*d*) Purchase supplies of all kinds used by the State. (*e*) and (*f*) Nearly all specifications used are Federal Government specifications, changes having been made where practicable. (*g*) and (*h*) Tests are conducted at the laboratories of the University of Kentucky, National Bureau of Standards, and private concerns. (*i*) None. (*j*) Yes.

Louisiana State Board of Commissioners of the Port of New Orleans, New Orleans. (*b*) Col. Marcel Garsaud, general manager; N. B. Rhoads, supervisor of purchases. (*c*) Commission of five men appointed by the governor. (*d*) Administer the affairs of the port of New Orleans. (*g*) and (*h*) The board maintains a laboratory equipped for testing fuel oil, gasoline, lumber, sand, cement, etc. Use is also made of commercial laboratories at times. (*i*) None. (*j*) On occasions use of laboratories at Tulane University for testing concrete slabs and cylinders, and reinforcing steel.

Louisiana State Highway Commission, Baton Rouge. (*b*) P. M. Atkins, chairman; F. M. Fourmy, State highway engineer; John H. Bateman, testing engineer. (*g*) and (*h*) The highway commission and the Louisiana State University have an arrangement whereby the two organizations operate a complete testing laboratory on a joint basis. The laboratory is under the general supervision of the engineering experiment station of the university. To all

intents and purposes the laboratory operates directly as the laboratory of the commission, rendering reports directly to the commission engineers. (*i*) None. (*j*) The materials laboratory of the engineering experiment station at Louisiana State University, Baton Rouge, is utilized for the conduct of all routine and research laboratory work.

Maine State Highway Commission. (*b*) Clyde H. Smith, chairman, Augusta; H. W. Leavitt, testing engineer, Orono. (*g*) and (*h*) The State highway commission maintains its laboratory at the University of Maine. At this laboratory all highway materials used by the commission are tested. The commission pays approximately 50 per cent of the expenses of the laboratory. (*i*) The technology experiment station of the university conducts tests on a commercial basis. (*j*) The college laboratory and the State highway laboratory are used jointly by the students of the university and for research projects for the technology experiment station and the State highway commission.

Maine State Purchasing Agents' Association, Augusta. (*b*) Samuel N. Tobey, secretary. (*c*) Purchasing agents of State-owned institutions. (*e*) Standardize on commodities that may be used in common by the State institutions and make purchases for the institutions.

Maryland State Central Purchasing Bureau, Whitaker Building, Baltimore. (*b*) Walter N. Kirkman, State purchasing agent. (*c*) By legislative statute. (*d*) Formulate rules and regulations for the conduct of the bureau, including standardization of commodities. (*e*) Meetings are held with the heads of the State agencies to consider commodities to be standardized. (*g*) Tests are made by commercial laboratories. (*h*) None. (*i*) None. (*j*) Use is made of the laboratories of the University of Maryland.

Maryland State Roads Commission, Garrett Building, Baltimore. (*b*) John N. Mackall, chairman and chief engineer; F. C. Rossell, testing engineer. (*c*) By the legislature. (*d*) Formulate specifications and make its own tests. (*g*) and (*h*) The commission maintains its own laboratories for testing the materials used in road construction. (*i*) None. (*j*) The commission uses the laboratories of the University of Maryland for research work.

Massachusetts State Department of Mental Diseases, Statehouse, Boston. (*b*) George M. Kline, M. D., commissioner. (*c*) By the governor. (*d*) Standardize for 15 institutions, hospital construction, equipment, food, and other supplies and administrative procedure. (*e*) Committee of institutions' superintendents or stewards may or may not be appointed to sit with or report to the commissioner. Decision of the commissioner is final. (*g*) Use Massachusetts department of public-health laboratory. (*i*) Occasional.

Massachusetts State Department of Public Works, Statehouse, Boston. (*b*) William F. Williams, commissioner; R. K. Hale and F. E. Lyman, associate commissioners; Arthur W. Dean, chief highway engineer. (*c*) Created by legislative act. (*g*) and (*h*) All tests are made in the department's laboratory. In the case of cement, tests are made at the mills before shipment. (*i*) None. (*j*) To a small extent.

Massachusetts State Purchasing Bureau, Statehouse, Boston. (*b*) George J. Cronin, State purchasing agent. (*c*) Heads of various State departments. (*d*) Recommend to State purchasing agent articles which can be used in common by all State departments. (*g*) and (*h*) Commodities purchased on specifications are tested in the laboratory connected with the purchasing bureau, and by outside agencies when necessary, as in the case of cement which is tested at the mills. Six chemists are constantly occupied in testing materials submitted with bids and testing samples of materials delivered on bids. (*i*) No. (*j*) When the need of a neutral testing agency is apparent, use is made of college laboratories and chemical research laboratories.

Michigan State Administrative Board, Accounting and Purchasing Division, Lansing. (*b*) Charles W. Foster, director of accounting and purchasing. (*c*) By State administrative board organized by legislative action. (*d*) Formulate specifications and make purchases for all State departments and institutions except Michigan State College of Agriculture and Applied Science, and the University of Michigan.

Michigan State Highway Department. (*b*) Frank F. Rogers, commissioner, Lansing; G. C. Dillman, deputy commissioner and chief engineer, Lansing; W. J. Emmons, director, State highway laboratory, Ann Arbor. (*g*) and (*h*) The highway department has two laboratories, one at Ann Arbor in cooperation with the University of Michigan, and the other at the Michigan College of Mines at Houghton. All purchased commodities except steel are tested by the department in its own laboratories. Steel purchased outside of the State is tested by commercial laboratories designated by the State. Cement samplers are located at various mills, and inspectors are maintained at stone and gravel plants and at certain concrete and clay pipe plants. (*i*) Tests are made for counties, cities, and other State government subdivisions, but no other commercial testing is done. (*j*) Cooperative research work and testing are conducted at both the University of Michigan and the Michigan College of Mines.

Minnesota State Department of Highways, St. Paul. (*b*) Charles M. Babcock, commissioner of highways; J. T. Ellison, chief engineer. (*c*) Governor. (*g*) and (*h*) The department of highways maintains central laboratories at the University of Minnesota, Minneapolis, and at Duluth. In addition, there are small field laboratories located on construction projects. (*i*) None. (*j*) The highway laboratory at Minneapolis is located in one of the buildings of the University of Minnesota and is rented from the university. The laboratories are used only by highway employees, although some of the large testing machines are used in common with the university.

Minnesota State Department of Public Institutions, Bureau of Purchases, St. Paul. (*b*) C. J. Swenden, chairman; H. W. Austin, purchasing agent. (*c*) By the governor, through the board of control. (*d*) Establish specifications and make purchases for 18 State charitable and eleemosynary institutions. (*g*) and (*h*) Use is made of the University of Minnesota laboratories to carry on testing whenever necessary.

Mississippi Capitol Commission, Jackson. (*b*) Walker Wood, secretary of state and director in charge. (*c*) By the legislature. (*d*) This commission makes all the purchases for the two State capitol buildings.

Mississippi State Highway Department, Jackson. (*b*) J. C. Roberts, chairman; G. A. Draper, State highway engineer. (*g*) All testing for the State highway department is made by commercial laboratories, except the testing of lumber, which is made by its inspectors. (*h*) None. (*i*) None. (*j*) None.

Missouri State Highway Commission. (*b*) C. D. Matthews, chairman, Sikeston; T. H. Cutler, chief engineer, Jefferson City; F. V. Reagel, engineer of materials, Jefferson City. (*c*) Governor. (*g*) and (*h*) The highway department maintains its own testing laboratory in Jefferson City and also laboratories at cement plants. Plant inspection is also made in the field in case of other road-building materials. Samples which can not be tested in the field are sent to the main laboratory for tests. (*i*) A limited amount of testing of road materials is made for municipal, county, and other agencies. In a few instances materials are tested on a commercial basis, although this work is not solicited. (*j*) Inasmuch as the highway testing laboratories are completely equipped, college testing and research laboratories have been used to only a very limited

extent. However, the Missouri School of Mines and the State University have cooperated fully when requested to do so.

Missouri State Purchasing Agencies, Jefferson City. (*b*) Sam A. Baker, governor. (*c*) With the exception of the eleemosynary institutions, which are under the control of a board, the several departments of the State buy their own supplies separately. The establishment of a centralized purchasing agency for the State departments is now being given consideration.

Montana State Highway Commission, Helena. (*b*) O. S. Warden, chairman, Great Falls; Ralph D. Rader, State highway engineer, Helena. (*c*) Body consists of three members appointed by the governor for four years. (*g*) and (*h*) The commission maintains its own laboratory for the testing of materials except structural steel, which is tested and inspected by the Robert W. Hunt Co. (*i*) None. (*j*) Use is made of Montana Agricultural College, Bozeman, and Montana School of Mines, Butte.

Montana State Purchasing Department, Helena. (*b*) J. E. Murphy, State purchasing agent. (*c*) By the governor. (*d*) Formulate specifications and make purchases for all State departments and institutions. (*e*) Specifications prepared by the State purchasing agent for approval of the governor.

Nebraska State Board of Control, Lincoln. (*b*) W. H. Osborne, secretary. (*c*) By the governor and the senate. (*d*) and (*e*) Formulate specifications for supplies for all penal, charitable, and educational institutions except State university and normal school. (*g*) Compare deliveries with samples.

Nebraska State Department of Public Works, Bureau of Roads and Bridges, Lincoln. (*b*) R. L. Cochran, State engineer; A. T. Lobdell, chief, bureau of roads and bridges. (*c*) Governor, and confirmed by the legislature. (*g*) and (*h*) The department of public works maintains a laboratory at the University of Nebraska for testing the materials used in road construction. (*j*) As shown above.

Nevada State Board of Capitol Commissioners, Carson City. (*b*) Gov. Fred B. Balzar, chairman. (*c*) Board consists of the governor, lieutenant governor, secretary of State, controller, and treasurer, ex officio, and the clerk of the board. (*d*) Purchase all supplies required by the various State offices in the capitol. (The State has no organized purchasing agency.)

Nevada State Department of Highways, Carson City. (*b*) Gov. Fred B. Balzar, chairman; S. C. Durkee, State highway engineer; Franklin Morrison, testing engineer. (*c*) By the State legislature. Board of directors composed of three members, with the governor as chairman. (*g*) and (*h*) All road-surfacing materials used in the construction of highways are tested in the laboratory maintained by department. (*i*) None. (*j*) Two large testing machines installed at the University of Nevada are used by the department at its convenience. These are the only compression or tension machines available and, therefore, all tests of concrete, steel, and similar materials are conducted at the university.

New Hampshire State Highway Department, Concord. (*b*) F. E. Everett, commissioner, appointed by governor; W. F. Purrington, materials engineer, appointed by the commissioner. (*g*) and (*h*) The State highway department maintains a laboratory equipped for testing all the materials used in highway construction.

New Hampshire State Purchasing Department, Concord. (*b*) W. A. Stone, purchasing agent. (*c*) By the governor. (*g*) and (*h*) State laboratory and highway testing laboratory. (*i*) Only to a small extent. (*j*) Largely for instruction.

New Jersey State Highway Commission, Trenton. (*b*) Gen. H. L. Scott, chairman; R. B. Gage, chemical engineer. (*g*) and (*h*) The commission maintains a fully equipped laboratory for the handling of the testing of all materials used in road construction. (*i*) None. (*j*) No use has been made of college testing laboratories, but some work has been done in connection with the United States Bureau of Public Roads. Some research is done with laboratories of producing companies, and those of several States, in connection with the collecting of data for standards and specifications.

New Jersey Statehouse Commission, Trenton. (*b*) A. Harry Moore, Governor of New Jersey; A. C. Middleton, State treasurer; N. A. K. Bugbee, State comptroller; and Edward J. Quigley, State purchasing agent. (*d*) Establish standards, determine the relation thereto of articles furnished, and use State or other public or private laboratories for this purpose. (*g*) and (*h*) Use is made of the various laboratories connected with the State government and, when necessary, of various commercial laboratories for special tests which the State laboratories are not in a position to make. (*j*) College laboratories are sometimes called on for tests of textiles.

New Mexico State Highway Commission. (*b*) Charles Springer, president; Cimarron; W. C. Davidson, State highway engineer, Santa Fe; L. C. Campbell, materials engineer, Las Cruces. (*c*) Governor, with the advice and consent of the Senate. (*g*) and (*h*) Road materials for the highway department are tested in a laboratory which is owned jointly by the highway department and the New Mexico College of Agriculture and Mechanic Arts. The laboratory is located at the college but is maintained and controlled by the highway department. (*i*) The majority of its work is on a commercial basis. (*j*) Only as stated above.

New Mexico State Officials, Santa Fe. (*b*) R. C. Dillon, governor; Miguel A. Otero, jr., State auditor; Warren R. Graham, State treasurer; Lois Randolph, superintendent of public instruction. (*c*) Elected. (*d*) Each elective State official manages his own office. (*g*) and (*h*) Each department of the State government makes arrangements for the testing of commodities. (The State has no organized purchasing agency.)

New York Commission of Highways, Albany. (*b*) Arthur W. Brandt, commissioner; William M. Acheson, chief engineer, in charge of testing laboratory; W. A. Treadwell, engineer of tests. (*g*) and (*h*) The testing of all road materials is done in the laboratory, which functions under the division of engineering. (*j*) A limited use is made of college testing laboratories.

New York State Division of Standards and Purchase, Albany. (*b*) Frank R. Utter, superintendent of standards and purchase. (*c*) By the Governor. (*d*) Make purchases for all State agencies. (*e*) Standards and specifications are formulated by the New York State bureau of standards. (*g*) and (*h*) The division maintains its own laboratory for the testing of all purchased commodities. (*j*) Some use is made of college laboratories.

North Carolina State Budget Bureau, Raleigh. (*b*) Gov. Angus W. McLean, director. (*c*) Ex officio. (*d*) and (*e*) There are about 70 organizations in the State, with a purchasing officer for each organization, who purchases supplies, materials, equipment, and commodities necessary. (*g*) No arrangements are made for testing purchased commodities except coal. (*h*) No. (*j*) The testing laboratory of the State College of Agriculture and Engineering is used for testing coal.

North Carolina State Highway Commission, Raleigh. (*b*) Frank Page, chairman; E. H. Kivett, physical testing engineer. (*c*) By the governor. (*g*) and (*h*) The commission maintains a laboratory equipped for testing all materials

used in road construction. (*i*) No commercial testing done. (*j*) Cooperation from college laboratories on some special work.

North Dakota State Board of Administration, Purchasing Department, Bismarck. (*b*) J. B. Smith, State purchasing agent. (*c*) By the board of administration. (*d*) Formulate specifications and make purchases for State institutions and all office supplies for State departments. (*g*) and (*h*) The department maintains its own laboratory for the testing of all foodstuffs. (*i*) It conducts tests on a commercial basis for concerns and individuals. (*j*) Yes.

North Dakota State Highway Commission, Bismarck. (*b*) Gov. Walter Maddock, chairman; H. C. Frahm, chief engineer; H. G. Groves, engineer of tests. (*c*) Body appointed by the governor. (*f*) All materials entering into highway construction. (*g*) and (*h*) The commission maintains a laboratory in which all road materials are tested. (*i*) Tests made free of charge for contractors and others. (*j*) None.

Ohio State Department of Finance, Purchases and Printing Division, Columbus. (*b*) John P. Brennan, superintendent of purchases and printing. (*c*) By the director of finance, with the approval of the governor. (*d*) Formulate specifications and make purchases for all State departments and institutions except the department of highways and public works, the State courts, and the State university. (*j*) Testing is done at the Ohio State University.

Ohio State Department of Highways, Columbus. (*b*) Harry J. Kirk, director; A. S. Rea, engineer of tests. (*c*) Governor. (*g*) and (*h*) The State highway department makes tests on all classes of road materials. It maintains its own testing laboratory, which is located in the engineering experiment station of the Ohio State University. (*i*) None. (*j*) In addition to its own laboratory, all of the facilities of the engineering college of Ohio State University are available for testing and research work.

Oklahoma State Board of Public Affairs, Oklahoma City. (*b*) G. C. Wollard, chairman; J. Robert Gillam, secretary. (*c*) By the governor, with the consent of the senate. (*d*) Formulate and adopt standard specifications and make purchases for all State departments and institutions except the State highway commission, State fish and game commission, the agricultural schools, and the department of agriculture.

Oklahoma State Highway Commission, Oklahoma City. (*b*) H. W. Leininger, chairman; C. R. Mandigo, State highway engineer; Dudley Wood, testing engineer. (*c*) By the governor and confirmed by the State senate. (*g*) and (*h*) The commission maintains its own testing laboratories, being represented by commercial laboratories only when materials come from outside the State. (*i*) A small amount of work is done for county organizations throughout the State. (*j*) The only testing done in college laboratories is the tensile-strength testing of steel, which work is carried on in the Oklahoma University engineering laboratory.

Oregon State Highway Commission. (*b*) H. B. Van Duzer, chairman, Portland; Roy A. Klein, State highway engineer and secretary; M. M. Finkbiner, engineer of materials, Salem. (*c*) Governor. (*g*) and (*h*) The State highway commission operates a testing laboratory where all materials of construction and all concrete and bituminous mixes are passed upon. (*i*) Commercial testing is not solicited but is undertaken, when requested by counties, cities, or individuals, at nominal prices. (*j*) College research laboratories are employed for making tests for which the highway-commission laboratory is not equipped. The engineering research department of the Oregon Agricultural College has just been organized, and it is anticipated that much good will result from its use along research lines.

Oregon State Purchasing Board, Salem. (*b*) Carle Abrams, secretary and purchasing agent. (*c*) Consists of the governor, secretary of State, and State treasurer, ex officio. (*d*) Formulate specifications and make purchases for State departments and institutions. This board serves as the purchasing department for all State activities. (*g*) Tests have been made by commercial firms when technical analysis was required. (*h*) Some of the departments, including the highway, have their own laboratories. (*i*) None. (*j*) When requested.

Pennsylvania State Bureau of Standards and Purchases, Harrisburg. (*b*) Walter G. Scott, director of standards and purchases. (*c*) Governor and State department of property and supplies. (*d*) Formulate and establish standards and specifications for all articles, materials, and supplies to be approved by the administrative boards, departments, and commissions, and by State institutions before such standards become effective. (*g*) Use is made of the laboratories of the State agriculture and State highway departments, and the National Bureau of Standards. (*h*) None. (*i*) None. (*j*) Research work and testing is carried on at Pennsylvania State College.

Pennsylvania State Department of Health, Harrisburg. (*b*) L. G. Owens, purchasing agent. (*c*) Legislature. (*d*) Purchase all articles required for institutions maintained by this department. (*g*) and (*h*) Sent to laboratory for test when necessary, otherwise physical examination by experienced person, such as engineer or purchasing agent. (*j*) Yes.

Pennsylvania State Department of Highways, Harrisburg. (*b*) James L. Stuart, secretary of highways; Samuel Eckles, chief engineer; H. S. Mattimore, engineer of tests. (*c*) By the governor. (*g*) and (*h*) This department maintains a fully equipped laboratory for testing road materials, and also a force for inspecting and sampling materials at the sources of supply. (*i*) None. (*j*) Occasionally cooperate with university testing laboratories on highway problems and, upon request, suggest research problems which would be of value in the highway field, but all routine testing and practically all research work is done in the laboratory of the department.

Pennsylvania State Stewards' Association, care of Warren State Hospital, Warren. (*b*) H. A. Ross, president. (*c*) Created at the request of the governor. (*d*) Association is composed of the superintendents and stewards of the State institutions, hospitals, and normal schools, organized to discuss problems relating to institutional operation and develop specifications for the approval of the State departments of welfare, public instruction, and properties and supplies, for use by State-owned institutions. United States Government master specifications are adopted when promulgated by the Federal Specifications Board.

Rhode Island State Board of Public Works, Providence. (*b*) Abram L. Atwood, chairman; George H. Henderson, chief engineer; John V. Keily, materials engineer. (*c*) By the governor, with the approval of the senate. (*d*) Administer motor-vehicle laws, collect motor fees, etc., and build and maintain State road system. (*e*) Conferences are held with department heads, and the specifications are made to conform as nearly as possible to those of the American Association of State Highway Officials and the American Society for Testing Materials. (*g*) and (*h*) The board maintains a completely equipped laboratory in which most of the materials are tested. Cement, steel, and iron are tested by commercial laboratories at points of production. (*i*) Occasionally.

Rhode Island State Public Welfare Commission, Purchasing Department, Providence. (*b*) George H. Haines, purchasing agent. (*c*) By the State public welfare commission. (*d*) Formulate specifications and make purchases for

penal, correctional, and charitable institutions under State board and for any department upon request. (*g*) Each commodity is handled on a different basis. Monthly analysis of oleomargarine made by the drug department; quarterly tests of coal by the fuel department; meats bought on hand-to-mouth basis, and the usual method is used to determine freshness, etc.; groceries, canned fruit, etc., are carefully examined and tested. (*h*) State boards, fuel department and drug department make tests for purchasing agent. (*i*) None. (*j*) Occasional tests made by the State college.

South Carolina State Highway Department, Columbia. (*b*) Ben M. Sawyer, chief highway commission; Charles H. Moorefield, State highway engineer; W. H. Mills, jr., testing engineer. (*c*) By the general assembly. (*g*) and (*h*) Most of the testing is done by the department's own testing laboratory, the remainder by commercial laboratories. (*i*) Not customary, but has done so a few times in connection with highway-construction materials. (*j*) Occasionally.

South Carolina State Joint Committee on Printing, Columbia. (*b*) W. T. Walker, secretary. (*c*) Speaker of the house, president of the senate. (*d*) Authority to purchase all printing and office supplies only. (*e*) Specifications prepared for each job of printing.

South Dakota State Department of Finance, Division of Purchasing and Printing, Pierre. (*b*) Jno. P. Biehn, secretary of finance and director of purchasing and printing. (*c*) By the governor, confirmed by the senate. (*d*) Purchase all commodities for all State institutions. (*e*) Standards and specifications formulated in cooperation with the board of charities and corrections, the board of regents, the State engineer, the State chemist, the highway engineers, and the several departments. (*g*) Tests are made by the State chemist at the State university, Vermilion. (*i*) None. (*j*) As referred to above.

South Dakota State Highway Commission, Pierre. (*b*) J. Maughs Brown, State highway engineer; C. J. Loomer, engineer of tests. (*c*) By the governor. (*g*) and (*h*) The commission maintains its own laboratory for the testing of materials entering into highway construction. Use is also made of the laboratories of the State colleges and the United States Bureau of Public Roads. (*i*) Yes; free of charge. (*j*) Occasionally.

Tennessee State Department of Finance and Taxation, Division of Purchasing, Nashville. (*b*) A. D. Curtis, State purchasing agent. (*c*) By the commissioner of finance and taxation. (*d*) Select specifications and make purchases for all State departments and institutions.

Tennessee State Department of Highways and Public Works, Nashville. (*b*) Harry S. Berry, commissioner; T. C. McEwen, chief engineer; D. D. McGuire, engineer of tests. (*c*) By the governor. (*g*) and (*h*) A division of tests has been organized to insure that material used in State construction meets the requirements of standard specifications. The department maintains a very complete laboratory for handling all test work.

Texas State Board of Control, Division of Purchasing, Austin. (*b*) Sumner M. Ramsey, secretary. (*c*) Members of the division are appointed by the board of control. (*d*) Formulate specifications and make purchases for all State departments and institutions except State prisons.

Texas State Highway Commission, Austin. (*b*) R. S. Sterling, chairman; Gibb Gilchrist, State highway engineer; H. T. Brewster, engineer of materials and tests. (*g*) All road materials are tested either in a laboratory maintained by the department or in a commercial laboratory. (*h*) The laboratories of the University of Texas and the Agricultural and Mechanical College of Texas are used by the department, some of the testing machines, the upkeep on machines, and assistants being furnished by the department. (*i*) None. (*j*) Only as stated above.

Utah State Board of Supplies and Purchase, Salt Lake City. (*b*) Lorrie Lambourne, executive secretary. (*c*) By the board of examiners sitting as a board of supplies and purchase, consisting of the governor, secretary of State, and the attorney general. (*d*) Formulate specifications and make purchases for all State departments.

Utah State Road Commission, Salt Lake City. (*b*) Henry H. Blood, chairman; H. S. Kerr, chief engineer; Levi Muir, materials engineer. (*c*) Governor. (*g*) and (*h*) The commission maintains its own laboratory equipped for testing all materials used in road construction except structural steel, which is inspected as fabricated by approved commercial laboratories. (*i*) To some extent. (*j*) No.

Vermont State Department of Finance, Purchasing Department, Montpelier. (*b*) J. L. Wallace, State purchasing agent. (*c*) By the governor. (*d*) Formulate specifications and make purchases for all State departments and institutions except supplies for the military department.

Vermont State Highway Board. (*b*) George Z. Thompson, chairman, Proctor; S. B. Bates, commissioner of highways, Montpelier; R. I. Rowell, materials engineer, Montpelier. (*c*) Governor. (*g*) Road materials for use in Vermont highways are sampled by the department inspectors on the various projects and by inspectors at the various plants where material is purchased. Samples are sent to the State highway laboratory. (*h*) The highway board maintains its own testing laboratory. (*i*) None. (*j*) The department makes use of heavy testing equipment at the University of Vermont for compression tests of over 50,000 pounds load, but its own laboratory is equipped to handle all other types of highway-material testing.

Virginia State Department of Highways, Richmond. (*b*) H. G. Shirley, commissioner; C. S. Mullen, chief engineer; Shreve Clark, assistant engineer, tests. (*c*) By the governor. (*g*) and (*h*) The State department of highways maintains its own division of tests. It is equipped to make both chemical and physical tests of materials for road construction. Steel superstructure, reinforcing steel fabricated outside of the State, creosote, cement, etc., are tested and inspected by commercial firms at the sources of supply. (*i*) None. (*j*) None.

Virginia State Purchasing Commission, Richmond. (*b*) Charles A. Osborne, State purchasing agent. (*c*) By the governor. (*d*) Formulate specifications for all State departments and institutions, but purchases by the purchasing agent are optional with the State departments and institutions.

Washington State Department of Business Control, Division of Purchasing, Olympia. (*b*) H. D. Van Eaton, supervisor of purchasing. (*c*) By the director of business control. (*d*) Formulate specifications, purchase supplies and materials for all State departments and institutions. (*g*) and (*h*) Tests are made by the University of Washington and the State College mechanical engineering and chemical engineering departments; also by the State highway laboratory in Olympia. (*i*) None. (*j*) As stated above.

Washington State Highway Department, Olympia. (*b*) Samuel J. Humes, State highway engineer; O. A. Piper, assistant State highway engineer. (*c*) By statute; consists of the governor, State auditor, and the State treasurer, ex officio. (*g*) and (*h*) Reinforcing and structural steel and some cement are tested by commercial laboratories employed by the highway department. Most of the cement and other materials are tested in the State highway department's own laboratory. (*i*) A very limited number of tests are made at cost for city and county governments. (*j*) College laboratories have been called upon to a very limited extent.

West Virginia State Board of Control, Purchasing Department, Charleston. (*b*) C. A. Jackson, board member; Mrs. Mamie Loy McRa, State purchasing agent. (*c*) By the governor, with the consent of the senate. (*d*) Formulate specifications and make purchases for all State institutions and, upon specific request, for the State departments.

West Virginia State Road Commission, Charleston. (*b*) C. P. Fortney, chairman, Charleston; R. B. Dayton, materials engineer, Morgantown. (*c*) Governor. (*d*) Designate, construct, and maintain State roads and enforce motor-vehicle laws. (*g*) and (*h*) A complete testing laboratory, maintained by the commission, is located in the engineering building of the West Virginia University at Morgantown. Shop work on bridges inspected by commercial laboratories. Special inspectors are sometimes stationed in production plants. (*i*) No, but tests are made on request for counties and occasionally for citizens of the State. (*j*) Heavy testing machinery of the university is used by the road commission.

Wisconsin State Board of Control, Madison. (*b*) A. W. Bayley secretary. (*c*) By the governor, with the consent of the senate. (*d*) Formulate specifications and make purchases for all charitable, curative, and penal institutions. (*g*) and (*h*) The only service available at the present time for testing commodities purchased is through the dairy and food commission of the State, located in the capitol building.

Wisconsin State Highway Commission, Madison. (*b*) R. C. Bretting, chairman; W. C. Buetow, State highway engineer; Al. Hambrecht, construction engineer; C. R. Stokes, materials engineer. (*c*) Three members of commission by the governor; two members ex officio. (*g*) and (*h*) The commission maintains its own laboratory, and practically all types of materials are sampled and tested there. (*i*) A small amount of testing is done on a commercial basis. (*j*) The commission laboratory is adjacent to the University of Wisconsin. Use is made of the larger machines of the university by the commission, and considerable information is obtained from some of the problems worked out in the university laboratories.

Wyoming State Board of Supplies, Cheyenne. (*b*) Vincent Carter, chairman. (*c*) Board composed ex officio of a body of three, State auditor, State treasurer, and State engineer. Auditor and treasurer elected by popular vote; engineer appointed by the governor. (*d*) Formulate specifications and make purchases for all State departments and institutions except the highway department and the State university.

Wyoming State Highway Department, Cheyenne. (*b*) S. W. Conwell, chairman; W. A. Norris, materials engineer. (*g*) and (*h*) All materials entering into Federal-aid, as well as State-aid, construction are tested under the specifications of the United States Bureau of Public Roads. The department maintains its own testing laboratory and staff. (*i*) Sometimes called upon to make tests and investigations for smaller units of government, and in a few cases for individuals. (*j*) Provisions have been made with the State university for a reasonable amount of reciprocity and cooperative testing.

VIII. GENERAL STANDARDIZING AGENCIES

In Chapter V have been given outlines of the standardizing agencies of the Federal Government, including the Federal Specifications Board; in Chapter VI the standardization work of the National Bureau of Standards has been presented briefly, and that of the municipal, county, and State purchasing agencies has been set forth in Chapter VII. Much standardization work is being conducted by trade associations and technical societies in connection with their other activities. Outlines of their standardization activities are given in Chapter IX.

A limited number of organizations have been created for the sole purpose of carrying on the work of standardization, or work directly related thereto, namely, the American Standards Association, which serves as the clearing house for industrial standardization, and the American Marine Standards Committee, the American Society for Testing Materials, and the Central Committee on Lumber Standards, the functions of which are fairly well indicated by their titles.

In the present chapter are given outlines of the standardization activities of these organizations with special reference to their accomplishments during the past year and since being organized, and their programs for future work. Additional information concerning the functions and procedure of their committees engaged in formulating specifications and standards can be found in the 1927 and 1928 issues of the Standards Yearbook.

AMERICAN STANDARDS ASSOCIATION

In the first and second issues of Standards Yearbook were given outlines of the organization, procedure, and accomplishments of the American Engineering Standards Committee, which was formed in 1917 as the national clearing house for engineering and industrial standardization.

In 1928 extensive revisions were made in the rules of procedure of the American Engineering Standards Committee in order to speed industrial standardization work on a national basis, and important administrative changes were made following the changes in procedure. Moreover, the name was changed to American Standards Association, as more accurately descriptive of the remodeled

organization and to obviate misunderstandings and misconceptions which frequently occurred in connection with the words "engineering" and "committee." The scope of the work of the organization is, however, limited "to those fields in which engineering methods apply," and the basic function of approving standards remains completely in the hands of the representatives of the member bodies which remain the fundamental units in the organization.

In accordance with the new constitution, which became effective November 1, 1928, the representatives of the member bodies, formerly referred to as the "main committee," become known as the "standards council," in the hands of which lies the approval of standards and questions of procedure. All administrative and financial matters are in the hands of a "board of directors," a relatively small body of men of the industrial executive type consisting of nine members elected upon nomination by selected member bodies and three ex officio.

Three important changes have been made in the procedure. Heretofore each sectional committee—essentially a joint committee composed of representatives of the various groups interested in the particular work in hand—has acted under the administrative support and direction of one or more of the interested bodies, who are termed sponsors. A sectional committee may now operate autonomously, reporting directly to the association, or it may act under sponsors as before. The second change recognizes "proprietary" standards and makes possible the revision of such standards within a single organization on condition that it be shown that the standard is acceptable to the groups concerned. This method is particularly applicable to highly specialized fields in which the standards of an organization has already achieved a position of recognized eminence. The third change provides for very simple cases in which the approval of standards is based upon the action of a conference followed by written acceptances of the interested groups.

The American Standards Association serves as the agency through which standardization by associations, societies, and governmental agencies is passing to the stage of standardization on a broadly national scale. The association also acts as the official channel of cooperation in international standardization and provides an information service on engineering and industrial standardization matters. It maintains headquarters in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, N. Y. Dr. P. G. Agnew is the secretary.

Work upon a standardization project is undertaken by the A. S. A. only upon a formal request from a responsible body, and then only after the committee has assured itself that it is the desire of industry that the work shall go forward.

Advisory committees have been organized to suggest subjects for standardization and determine the desirability of standardization in several lines of industry, recommend sponsors, define and limit the scope of projects, adjust conflicts, clear up ambiguities, follow up and expedite work in progress in the development of standards, and report from time to time upon progress within their fields of activities. Three such committees are now functioning—the mining standardization correlating committee, the safety-code correlating committee, and the electrical advisory committee. A similar committee to function for the mechanical industries is now being formed.

Complete sets of standards approved by the foreign national standardizing bodies and a good majority of the standards issued by the important organizations in this country are kept on file at the headquarters of the A. S. A., which maintains an information service for the benefit of committees working under its auspices, of members and sustaining members, and of American industry generally. The A. S. A. acts as a central distributing agent for the standards and specifications of the national technical societies and trade associations listed in the National Directory of Commodity Specifications. It issues monthly a mimeographed bulletin for the benefit of sustaining members, giving information concerning activities in foreign standardization work and reviewing proposed and approved American standards and other developments in the American standardization field.

Under the auspices of the A. S. A., 133 standardization projects have been carried forward to completion as approved standards and 152 additional projects are in various stages of progress. In the accompanying table is shown the distribution of these projects among the industrial groups:

Group	Number of projects	Projects approved
Civil engineering and building trades	35	15
Mechanical	77	28
Electrical	53	19
Automotive	5	4
Transportation	10	9
Naval architecture and marine engineering	1	
Ferrous metallurgy	4	3
Nonferrous metallurgy	10	6
Chemical	8	6
Textile	2	
Mining	19	10
Wood	5	4
Pulp and paper	2	1
Miscellaneous	54	28
Total	285	133

The standards approved during 1928 include:

Civil engineering.—Portland cement.

Mechanical engineering.—Round unslotted head bolts; cast-iron flanges and flanged fittings for a maximum pressure of 125 pounds; cast-iron flanges and flanged fittings for maximum pressure of 250 pounds; plow bolts; tinners', coopers', and belt rivets.

Electrical engineering.—Rating of induction motors and induction machines; code for electricity meters; dry cells; 30 per cent rubber insulation for wire and cable for general purposes; cotton-covered, silk-covered, and enameled round copper magnet wire; industrial (electrical) control apparatus; tinned soft or annealed copper wire for rubber insulation; soft or annealed copper wire.

Mining.—Mechanical loading underground in metal mines; ladders and stairs for mines; underground transportation in metal mines; outside coal-handling equipment.

Safety codes.—Code for the prevention of dust explosions in flour and feed mills; code for the prevention of dust explosions in terminal grain elevators.

Miscellaneous.—Mathematical symbols; dimensional standards for cutting, splicing, and perforating motion-picture film, and for the apertures, projection-lens diameters, and sprockets of motion-picture projectors; American recommended practice for the taking and projection of motion pictures; methods of test for petroleum products and lubricants (19 standards).

New projects given official status by or proposed to the A. S. A. since January 1, 1928, include:

Civil engineering and building trades.—Recommended practice for brick masonry; finishing hydrated-lime plaster.

Mechanical engineering.—Spindle noses and collets; punch and die holders; circular forming tools and holders; drill sizes; drill bushings; chucks and chuck jaws; designations and working ranges of machine tools; splined shafts and splines; pressure and vacuum gauges; stock sizes, shapes, and lengths for iron and steel bars, including flats, squares, round, and other shapes; leather belting.

Electrical engineering.—Railway motors; railway control and mine-locomotive control apparatus; oil circuit breakers; disconnecting and horn-gap switches; electrical measuring instruments; storage batteries; panel and distribution boards; electrical definitions; overhead trolley-line material; rolled threads for screw shells of electric sockets and lamp bases.

Miscellaneous.—Letter symbols for electrical quantities.

One of the most important of the new projects is that for the establishment of specifications for leather belting. Belting standards have been effectively used by the American Petroleum Institute, the Federal Government, and other bodies. The American Society of Mechanical Engineers, in making the request for this project, asked that the standards for leather belting should cover quality, capacity, weight, and methods for care and maintenance.

Two important projects, which mark the entrance of the A. S. A. into a field of great general interest, are well under way. Work on these projects—the establishment of standard specifications for bed sheets and for domestic refrigerators—is being done by large sectional committees representing all the groups substantially concerned.

The American Standards Association is composed of official representatives of member bodies, of which there are now 30, comprising 37 separate national organizations, including 9 national engineering societies, 21 national industrial associations, and 7 departments of the Federal Government.

The membership of the A. S. A. has been augmented during recent months by the admission of the National Automatic Sprinkler Association and the National Machine Tool Builders Association, both of which organizations have important interests in standardization work.

Participating in the work, through some 2,200 officially accredited representatives, are 350 national organizations—technical, industrial, and governmental. Of these nearly 200 are trade associations. Subscribing directly to its support are 350 organizations and firms interested in its work and listed as sustaining members.

AMERICAN MARINE STANDARDS COMMITTEE

This committee maintains its headquarters in the Department of Commerce Building, Washington, D. C. A. V. Bouillon is the secretary. Its primary object is to encourage simplification of practice in shipbuilding and ship operation by promoting the formulation and use of such standards of design and practice as are of economic importance.

The work of the committee is coordinated with that of other national standarizing bodies through representation on committees of the American Standards Association and representation on its executive board, as advisory members, by official appointees of the following organizations: American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, National Bureau of Standards, and National Fire Protection Association.

The American Marine Standards Committee now comprises 338 member bodies, including shipbuilding firms, ship operators, naval architects, marine engineers, manufacturers, and, generally, educational, commercial, and Government interests related to the marine industry. The total number of approved standards of the committee is now 74.

Marine standards that have been promulgated during the year 1928 are as follows:

Hull Details.—Scupper valves, sizes 3, 4, 5, and 6 inch; boom steps, bracket type, for 5, 10, and 15 ton booms; boom steps, deck type, for 15, 20, and 30 ton booms; heel fittings; cap of double-pin type and caps of single-pin type for 5, 10, 15, 20, and 30 ton booms.

Engineering (Machinery) Details.—Specifications for insulation of piping and machinery on ships; magnesia molded pipe covering and

blocks; magnesia asbestos plaster; asbestos millboard; hair felt for insulation; cotton duck for insulation coverings; metallic packing for condenser tubes; hubs for built-up propellers, with flush facings; fair-water caps for flush-faced propeller hubs.

Ship Operation Details.—Specifications for marine glue for seams of ship decks; rubber air hose; rubber steam hose; 1½-inch water hose, rubber covered; 2½-inch water suction hose, smooth bore; oil suction and discharge hose, rubber covered.

During the year special committees were organized to deal with problems relating to international standarization of shipbuilding details and to the promotion of American Marine standards.

AMERICAN SOCIETY FOR TESTING MATERIALS

Practically all of the society's committees are actively engaged in work involving, directly or indirectly, standardization and the preparation of specifications. Its headquarters are at 1315 Spruce Street, Philadelphia, Pa. C. L. Warwick is the secretary-treasurer.

Among the current activities of the society there may be cited as of outstanding importance, in addition to those referred to in the Standards Yearbook, 1927 and 1928, the following standards: Metallographic testing of metals; iron-chromium-nickel alloys; lime and gypsum; timber and timber preservatives; coal and coke; shipping containers; rubber products; and thermometers.

In the following table are shown the number of standards and tentative standards adopted in the year 1928 and the total number adopted to date, the standards being classified in accordance with the five main heads under which the society's standardization activities are conducted:

	Adopted in 1928			Total adopted to date	
	Standards	Revisions to standards	Tentative standards	Standards	Tentative standards
A. Ferrous metals	5	13	7	91	22
B. Nonferrous metals	8	5	5	57	17
C. Cement, lime, gypsum, concrete, and clay products	9	5	2	49	24
D. Miscellaneous materials	19	13	25	158	116
E. Miscellaneous subjects				8	6
Total	41	36	39	363	185

The following standards and tentative standards were adopted in 1928:

A. Ferrous Metals.—Standard specifications for carbon-steel and alloy-steel forgings; carbon-steel forgings for locomotives; forged or rolled steel pipe flanges for high-temperature service; and alloy

tool steel. Standard methods of test for magnetic properties of iron and steel.

Tentative specifications for iron and steel chain; electric cast-steel anchor chain; structural steel for locomotives and cars; marine-boiler steel plates; carbon-steel castings for valves, flanges and fittings for high-temperature service; lap-welded and seamless steel pipe, black and galvanized for ordinary uses; lap-welded and seamless steel pipe for high-temperature service; zinc (hot-galvanized) coatings on structural steel shapes, plates and bars and their products; zinc-coated (galvanized) barb wire; zinc-coated (galvanized) steel wire strand; and arbitration test bar and tension test specimen for cast iron.

Tentative methods of sampling rolled and forged steel products for check analysis.

Tentative definitions of terms relating to heat-treatment operations (especially as related to ferrous alloys).

B. Nonferrous Metals.—Standard specifications for aluminum bronze castings; sand castings of the 88—8—4 per cent copper, tin and zinc alloy; steam or valve bronze sand castings; composition brass or ounce metal sand castings; yellow brass sand castings for general purposes; bronze castings in the rough for locomotive wearing parts; car and tender journal bearings, lined; and brazing solder.

Tentative specifications for fire-refined copper other than lake; sand castings of the 80—10—10 per cent, copper, tin, and lead alloy; brass ingot metal, graded and ungraded, for sand castings; silver solders; and seamless copper tubes.

Tentative methods of chemical analysis of aluminum and light aluminum alloys, and metallic materials for electrical heating.

C. Cement, Lime, Gypsum, Concrete, and Clay Products.—Standard specifications for clay fire brick for malleable furnaces with removable bungs and for annealing ovens; clay fire brick for stationary-boiler service; and clay fire brick for marine-boiler service; standard method of test for softening point of fire-clay brick; standard definitions of terms relating to the gypsum industry; lime; refractories; the term "sand"; and for clay refractories.

Tentative specifications for Keene's cement; calcined gypsum for use in the preparation of dental plasters; concrete aggregates; building brick (made from clay or shale); concrete building brick; sand-lime building brick; paving brick; hollow burned-clay fire-proofing, partition, and furring tile. Tentative methods of test for field determination of approximate apparent specific gravity of fine aggregate; field determination of approximate percentage of voids in fine aggregate; field determination of surface moisture in fine aggregate;

testing brick. Tentative definitions of terms relating to the gypsum industry; refractories; and the term "aggregate."

D. Miscellaneous Materials.—Standard specifications for raw linseed oil; prussian blue; ultramarine blue; chrome oxide green; commercial para red; friction tape for general use for electrical purposes.

Standard methods of test for determination of wax in shellac ("machine-made" and dry-bleached refined shellac); oleo-resinous varnishes; carbon residue of petroleum products (Conradson carbon residue); cloud and pour points of petroleum products; saponification number; steam emulsion of lubricating oils; water in petroleum products and other bituminous materials; water and sediment in petroleum products by means of centrifuge; gas oils (gravity, distillation, sulphur, carbon, residue, pour point, viscosity, water); decantation test for sand and other fine aggregates; distillation of creosote oil; steam distillation of bituminous protective coatings; and routine analysis of dry red lead.

Tentative specifications for boiled linseed oil; aluminum powder for paints (aluminum bronze powder); gold bronze powder; toxic ingredients in antifouling paints; high-carbon tar cement for use cold in repair work (cut-back product); low-carbon tar cement for use cold in repair work (cut-back product); insulated wire and cable; 30 per cent hevea rubber; cotton rubber-lined fire hose for public and private fire-department use; rubber insulating tape; tolerances and test methods for asbestos yarns; tolerances and test methods for knit goods; tolerances for 23/5/3 carded American tire cord; and thermometers for Angler viscosimeters.

Tentative methods of test for coarse particles in dry pigments and coarse particles and skins in mixtures of pigments and vehicles; alkalinity or acidity of pigments; bleeding of pigments; hygroscopic moisture (and other matter volatile under the test conditions) in pigments; oil absorption of pigments; mass color and tinting strength of pigments; routine analyses of white linseed-oil paints; dry cuprous oxide; dry mercuric oxide; determination of autogenous ignition temperatures; distillation of crude petroleum; gravity of petroleum and petroleum products by means of the hydrometer; melting point of petrolatum; abrasion of gravel; distillation of bituminous materials suitable for road treatment; residue of specified penetration; bituminous emulsions; cubic-foot weight of crushed bituminous coal; cubic-foot weight of coke; sieve analysis of coke; tumbler test of coke; insulating varnishes; electrical porcelain; untreated insulating paper; laminated sheet insulating materials; insulating materials for resistance to impact; varnished cloth tapes; chemical analysis of rubber products.

Tentative definitions of terms relating to petroleum.

Tentative recommended practice for bituminous paving-plant inspection.

E. Miscellaneous Subjects.—Tentative definition of the term "screen" (sieve).

Cooperation with American Standards Association.—As one of the five technical societies which united in the founding of the American Engineering Standards Committee, (now American Standards Association), the A. S. T. M. has been especially active in the work of the A. S. A., to which it has submitted many of its standards for approval. It is sponsor or joint sponsor for 35 standardization projects or sectional committees functioning under A. S. A., and 80 of its standards have been approved or are under consideration for approval by the A. S. A. The standardization projects and A. S. T. M. standards may be classified as follows:

	Projects under way	Approved standards
A. Ferrous metals	6	15
B. Nonferrous metals	14	22
C. Cement, lime, gypsum, and clay products	3	3
D. Miscellaneous materials	12	38
E. Miscellaneous subjects		2

Means of Encouraging or Facilitating the Use of Standards.—For ease of reference the standards of the society are published in both separate pamphlet form and collectively in a book of standards and a book of tentative standards. In this way the standards reach those who are principally interested in the use of specifications. In addition, special pamphlets containing the standards applying to a specific field are given widespread distribution.

The bound publications are furnished with complete subject indexes. The society has now planned to issue as a separate pamphlet a combined subject index of all the standards and tentative standards, which will be available for use by its members, purchasing agents, building officials, Government officials, and others.

Permission is freely granted to reprint any of the standards of the society. In this way the standards have been reprinted in full in many textbooks, and a number of specifications have received widespread distribution, sometimes totaling many thousands of copies.

A committee has recently been organized to give consideration to the possibility of using A. S. T. M. standards in connection with quotations given in trade papers in the belief that these standards can serve a very useful purpose as the basis of quotations, bringing specifications into play at the inception of commercial transactions.

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CENTRAL COMMITTEE ON LUMBER STANDARDS

In cooperation with the United States Departments of Agriculture and Commerce, this committee makes recommendations for the simplification of sizes, grades, nomenclature, and trade practices in the lumber industries. Its headquarters are in the Transportation Building, Washington, D. C. Arthur T. Upson is the secretary.

The central committee itself consists of 11 representatives of lumber manufacturers, wholesalers, retailers, and consumers. Associated with it in an advisory capacity are the Consulting Committee on Lumber Standards and the Hardwood Consulting Committee, each having about 30 members. Its findings are recognized as "American lumber standards" and published by the division of simplified practice. Thus far there have been published, in Simplified Practice Recommendation No. 16, lumber classifications; nomenclature of commercial softwoods; yard lumber grades, sizes, and tally; basic provisions for structural material; softwood factory and shop lumber; lumber shipping practices and inspection provisions; lumber abbreviations; American standard moldings; uniform patterns for worked lumber; and standards for red-cedar shingles.

The central committee has also approved American standards of nomenclature for domestic hardwoods and certain basic grading provisions for hardwood lumber, formulated by the National Hardwood Inspection Rules Committee largely, and by the Hardwood Manufacturers Institute, the National Lumber Manufacturers Association, and the Central Committee on Lumber Standards, with the assistance of the Forest Products Laboratory of the United States Forest Service, and of the Department of Commerce.

During the past year the central committee has completed work on uniform patterns for worked lumber and further refinements of standards for shop lumber, incorporating suitable provisions thereon in the American lumber standards, and is now engaged on the following projects: The establishment of moisture contents as bases for the measurement of American standard lumber sizes and for definitions of lumber dryness, revision in the American standards for structural material, supply and demand survey of American standard lumber, and further work on hardwood standardization.

The principal channels employed to encourage the adoption of its standards are Simplified Practice Recommendation No. 16, widely distributed by the Department of Commerce, letters to various branches of the lumber industry, the members of the central committee and its advisory bodies—the Consulting Committee on Lumber Standards and the Hardwood Consulting Committee—and the associations and organizations representing the various branches of the industry.

IX. STANDARDIZING ACTIVITIES OF TECHNICAL SOCIETIES AND TRADE ASSOCIATIONS

A large percentage of the national technical societies, trade associations, and similar organizations make standardization one of the important activities in their services to their members.

In compiling data for the following outlines of the standardization activities of these organzations, particular attention has been paid to the current standardization programs, the accomplishments to date, with special reference to the year just past, and the methods employed by each organization to encourage or facilitate the use of its standards, specifications, and codes, and to determine whether or not the requirements have been complied with, without reproducing the information concerning their methods of appointing standardizing committees, authority bestowed on these committees, and their functions and procedure, which can be found in the Standards Yearbooks, 1927 and 1928.

Note has been made of the standardization programs of certain organizations having little or no progress to report during the past year. Thus there is presented a fairly complete picture of the standardization activities in various lines, rather than merely a report of progress in the standardization field.

So far as the number of items relating to associations and societies is concerned, there are reproduced herein 33 more sketches than were in the 1928 edition of the Standards Yearbook and 113 more than in the 1927 edition, the increase having been about 40 per cent in 1928 and about 15 per cent additional in 1929.

In the following items relating to the standardization activities of 319 associations and societies references are made incidentally to 51 additional organizations that are cooperating to a certain limited extent in the general standardization movement.

Notwithstanding the widespread standardization activities of the technical societies and trade associations covered by the sketches in this chapter and those of the general standardizing agencies in Chapter VIII, a very considerable percentage of the commercial organizations in this country are taking no active part in the standardization movement. Many of the trade associations have not over 100 firm members, and few indeed have as many as 1,000. It will be appreciated, therefore, that a great majority of the corporations, firms, etc., now doing business in the United States—about

430,000 in number, according to reports of the United States Bureau of Internal Revenue—are without representation in the associations and do not participate in standardization activities.

ALPHABETICAL LIST OF SOCIETIES AND ASSOCIATIONS

Abrasive Paper and Cloth Manufacturers Exchange, W. H. Chafe, chairman, standardization committee, care of American Glue Co., 121 Beverly Street, Boston, Mass. Among the primary objects of this organization are the standardization of sizes and testing methods for raw materials, grain, or finished products, and the simplification of finished products for the purpose of promoting economy in manufacturing methods. Its standardization committee has established specifications relating to grits, backings, coatings, and packing. It has set up standards for sizes of grain and has submitted samples to the members of the organization for checking factory production in order that all abrasive-coated products produced in this country will be of a uniform grade. Standards for weights of paper, combination, and cloth used in the production of abrasive-coated material and standard-size packages containing a specified number of sheets or reams have also been established.

Aeronautical Chamber of Commerce of America (Inc.), Luther K. Bell, secretary, 300 Madison Avenue, New York, N. Y. This organization is cooperating very closely with the Society of Automotive Engineers in the standardization of materials and parts for aircraft construction. Although it has not as yet formulated any standards, the commercial airplane manufacturers' section and the motor manufacturers' section are engaged upon various problems relating to standards.

Agricultural Insecticide and Fungicide Manufacturers' Association, G. B. Heckel, secretary, Public Ledger Building, Philadelphia, Pa. This association has adopted a standard for commercial Bordeaux mixture which is now in general use throughout the industry. In addition, it has also adopted a standard for lime-sulphur solution originated by the California Department of Agriculture. The association initiated the movement which resulted in the formulation of simplified practice recommendation relating to standard package sizes for insecticides and fungicides.

American Association for the Advancement of Science and Associated Societies, Burton E. Livingston, permanent secretary, Smithsonian Institution Building, Washington, D. C. The only standardization activity of the association is in connection with the survey of scientific and engineering symbols and abbreviations. The association is joint sponsor, with four other organizations, for the

sectional committee handling this project, which is functioning under the American Standards Association.

American Association of Cereal Chemists, M. D. Mize, secretary-treasurer, 836 Omaha Grain Exchange, Omaha, Nebr. This association was organized in 1915 for the purpose of studying analytical methods used in cereal chemistry and to develop standard methods of examination and analysis. In 1928 it published a book entitled "Methods of Analysis of Cereals and Cereal Products," containing standard methods for cereal chemists. The committee on standardization of laboratory baking and the committee on methods of testing cake and biscuit flour are engaged in standardizing various methods now in use in laboratory baking tests.

American Association of Engineers, M. E. McIver, secretary, 63 East Adams Street, Chicago, Ill. This association has organized a committee to study standard proposals and contracts for engineers' services and other work of like character. It has published minimum specifications for highway engineering positions and has appointed a committee to compile minimum specifications for railroad engineering positions.

American Association of State Highway Officials, W. C. Markham, secretary, National Press Building, Washington, D. C. Subcommittees of the committee on standards are actively engaged in formulating and promoting the use of standardized specifications for materials used in constructing highways and for the design and construction of steel, concrete, and timber bridges. The association has adopted 35 standards and specifications relating to highway construction. Of these, the following were adopted in 1928: Corrugated metal-pipe culverts (revised); highway accounting; marking pavement at railroad crossings; standard width for each traffic lane; minimum thickness of concrete pavement; standard shoulder width; longitudinal joints to divide pavement into traffic lanes; high early-strength concrete for repair and emergency work; crown of 2-lane concrete pavement; white traffic paint for brick, bituminous, and concrete pavements; standard methods of sampling and testing highway materials (revised); tentative standard specifications for road materials (revised); motor-vehicle accident-report card; and uniform symbols and conditions symbols for making State road maps. All specifications adopted by this association have been approved by the United States Secretary of Agriculture as adequate standards for use in connection with Federal-aid highway construction. A majority of these specifications have also been approved by all State highway departments, thereby securing a very high degree of uniformity in the use of the standards. The association, through its various committees, cooperated with the American

Society for Testing Materials and other interested bodies on materials pertaining to highway construction. The association is officially represented on the joint concrete culvert pipe committee (with six other organizations). It is joint sponsor for two sectional committees functioning under the American Standards Association, as follows: Method of test for penetration of bituminous materials (with three other organizations), and safety code for colors for traffic signals (with the National Bureau of Standards and the National Safety Council).

American Association of Textile Chemists and Colorists, Walter E. Hadley, secretary, 5 Mountain Avenue, Maplewood, N. J. This organization concerns itself with research work on chemical processes and application of dyes and chemicals to materials manufactured in the textile industry. Work is also going forward on methods of fastness to perspiration, to light, to dry and wet heat, to acids and alkalies, carbonizing, and sea water. Its research committee is engaged in the formulation of standard methods of dye testing. Progress has been made in the endeavor to establish international standard methods of dye testing in cooperation with the British Society of Dyers and Colourists. The association maintains contact with the National Bureau of Standards in research work on chemicals applied to textiles.

American Association of Woolen and Worsted Manufacturers, J. J. Nevins, secretary, 45 East Seventeenth Street, New York, N. Y. All standardization work of this organization is conducted through a joint committee on research and standardization composed of representatives of this association, the National Association of Wool Manufacturers, and the National Association of Woolen and Worsted Spinners.

American Automobile Association, Ernest N. Smith, general manager, national headquarters, Pennsylvania Avenue at Seventeenth Street, Washington, D. C. This association served as joint sponsor, with the National Bureau of Standards, for the sectional committee on safety code for automobile brakes and brake testing and is officially represented on the sectional committee on colors for traffic signals, functioning under the American Standards Association. It is a founder member and one of the financial backers of the National Conference on Street and Highway Safety, concerned with the adoption of a standard traffic and safety code by States and a standard traffic and safety ordinance for cities. In connection with its 1,054 affiliated motor clubs, this organization has completed a standardization of touring maps and tour books covering the United States, thereby eliminating the individual publications formerly issued by each club. In addition, it is now carrying through to

completion a standardized system of handling emergency road-service calls, and cost accounting in connection therewith. It is also supporting and assisting the American Engineering Council in its study of standardization of highway signs and markers.

American Boiler Manufacturers Association, A. C. Baker, secretary, 801 Rockefeller Building, Cleveland, Ohio. This association has adopted various standards at different times which have been published in its proceedings and recently assembled in a single document. It has adopted the standards formulated by the Boiler Code Committee of the American Society of Mechanical Engineers and has issued definitions for "setting height" for different types of boilers and charts for determining stack dimensions.

American Brush Manufacturers Association, George A. Fernley, secretary, 505 Arch Street, Philadelphia, Pa. This asociation cooperated with the division of simplified practice of the Department of Commerce in securing the acceptance of simplified practice recommendation No. 43 covering paint and varnish brushes, and also in securing the adoption during the past year of revisions and amplifications of this recommendation. The association is also cooperating in securing the acceptance of a simplfication program covering floor sweeps. It is planning to extend this work to other lines including various cleaning brushes.

American Bureau of Welding, William Spraragen, secretary, division of engineering, National Research Council, 33 West Thirty-ninth Street, New York, N. Y. This bureau acts as an advisory board on welding of the American Welding Society and of the division of engineering and industrial research of the National Research Council. The following committees have completed their work: Electric arc welding, gas welding, and thermit welding. Continuing committees are handling the following subjects: Welded rail joints, fundamental research in welding, welding wire specifications, pressure vessels, and structural steel. The committee on welded rail joints maintains a research associate at the National Bureau of Standards doing research on welded rail joints. Its approved standards and specifications are published by the American Welding Society. The reports of the committee on welded rail joints have been published also by the American Electric Railway Association.

American Ceramic Society, Ross C. Purdy, secretary, 2525 North High Street, Columbus, Ohio. In formulating standards the society has cooperated with the American Society for Testing Materials and the National Bureau of Standards, full advantage being taken of the specifications of the former and the research work of the latter. It has taken an active part in the industrial waste elimination program and in the simplified practice work of the Department

of Commerce in all matters relating to ceramics. In the past year the society published the standard specifications which it has adopted during the last five years as follows: Ceramic whiting, limestone, quicklime and hydrated lime, fire clay, plastic fire-clay refractories, building brick, paving brick, clay sewer pipe, hollow fired-clay load-bearing wall tile, hollow fired-clay floor tile, and draintile. It has also adopted tentative specifications for clay fire brick for malleable furnaces and annealing ovens, clay fire brick for marine boilers, and clay fire brick for stationary boilers. In addition, the society has also published various standards and tentative test methods and definitions, and methods of chemical analysis.

American Chemical Society, Charles L. Parsons, secretary, Mills Building, Washington, D. C. Among the committees of the society organized for cooperative activities or to carry on work having a bearing on standardization are the following: Cooperation with the Chemical Warfare Service; hazardous chemicals and explosives (to cooperate with the National Fire Protection Association), standard apparatus, standard methods for the examination of water and sewage (to cooperate with the American Public Health Association), standardization of biological stains, standardized methods for vitamin research, supervisory on standard methods of analysis, metric committee (to cooperate with the American Metric Association, World Trade Club, London and Manchester Metric Association). The committee on guaranteed reagents of the society published specifications for 14 analytical reagents in 1925, 23 in 1926, 26 in 1927, and 12 in 1928. The work is still going on. In 1920 and 1921 the committee suggested certain metric unit weights for packages of reagent chemicals. The society committee on the metric system has advocated the use of these unit weights, and they have been adopted by several manufacturers of fine chemicals. The soap and soap products committee cooperated in the preparation of the United States Government specifications for soap. The committee on standard apparatus published in 1921 and 1922 reports on elimination of sizes and shapes of chemical laboratory apparatus. These reports were prepared in cooperation with the committee on standardization of the Association of Scientific Apparatus Makers of the United States of America (now the Scientific Apparatus Makers of America), and have been followed almost completely in the preparation of some recent catalogues of dealers in chemical apparatus. In 1928 the committee made additional recommendations on elimination and is continuing work on the standardization of dimensions of some types of laboratory apparatus. The society committees on revision of methods of coal sampling and analysis, standard methods for the examination of water and sewage to cooperate with a com-

mittee of American Public Health Association, standardization of biological stains, and standardized methods for vitamin research, cooperate with committees of other organizations on the subjects designated, and the supervisory committee on standard methods of analysis is responsible for the uniformity of standards for methods of analysis proposed by all committees of the society.

American College of Surgeons, 40 East Erie Street, Chicago, Ill. (associate director, Malcolm T. MacEachern, M. D.). This association, which functions as a professional and scientific organization, has devoted much of its energies to hospital standardization, including planning and construction, equipment, organization, personnel, and procedures. It has established a minimum standard of requirements for adoption of hospitals throughout the United States and Canada, and publishes annually a list of hospitals which have accepted the minimum requirements and have been approved. Notable progress has been made in the development of standards pertaining to clinical laboratories, X ray, treatment of fractures, traumatic surgery, nursing, dietetics, etc.

American Concrete Institute, Harvey Whipple, secretary, 2970 West Grand Boulevard, Detroit, Mich. The institute is officially represented on the following joint committees engaged in standardization activities: Concrete culvert pipe, concrete and reinforced concrete, technical problems in cement manufacture, and cement. The institute has 15 committees of its own carrying on standardization work. The joint committee on concrete culvert pipe has prepared and submitted to the institute a progress report which will probably be followed by a revised report at the twenty-fifth annual convention, February, 1929. The committee on reinforced-concrete building design and specifications has submitted a report embodying a building code for reinforced-concrete building design and specifications. Committees of the institute have prepared reports for adoption as standards, tentative standards, or revisions to be presented at the next convention, relating to a purchase specification for concrete aggregates; methods of finishing floors; treatment of concrete surfaces with reference to the exteriors of reinforced-concrete buildings and to Portland cement stucco; concrete block, brick, and building tiles; and concrete sewer pipe. The institute has formulated and published 12 standard specifications and 10 tentative specifications. Of these, the following were issued in 1928: 1-course concrete pavement for highways; 2-course Portland cement concrete pavement for highways; 1-course and 2-course Portland cement concrete street pavement; concrete building block and concrete building tile; concrete sewer manhole and catch-basin block; and building regulations for reinforced concrete.

American Concrete Pipe Association, M. W. Loving, secretary, 33 West Grand Avenue, Chicago, Ill. Although the association has not officially established any standards or adopted any specifications, it cooperates to the fullest extent with the organizations represented on the joint concrete culvert pipe committee in the preparation of specifications for concrete pipe, including draintile, cement-concrete sewer pipe, reinforced-concrete sewer pipe, and reinforced-concrete culvert pipe.

American Construction Council, The, Dwight L. Hoopingarner, executive, 28 West Forty-fourth Street, New York, N. Y. The council has taken active steps to bring the construction industry and its problems before the business interests of the country and the public. In cooperation with the Institute for Research in Land Economics and Public Utilities affiliated with Northwestern University, the council's general committee on economic relationships and construction is now engaged in the work of developing constructive standards relating to land taxation both as to existing structures and new construction, commercial and residential. It is conducting an exhaustive survey of plans and methods being followed by industry and other organizations for securing adequate housing of proper standards at a fair cost in industrial communities and centers. It has issued many pamphlets on methods of reconditioning homes and the various steps to be taken in building or buying homes. It advocates the use of materials nationally recognized as standard and standard sizes and weights of materials, in order to keep the costs at a minimum consistent with good construction. The council also concerns itself with making more uniform the use of arbitration of commercial disputes.

American Corn Millers Federation, L. H. Dieckman, secretary, 6 West Tenth Street, Kansas City, Mo. Standards and specifications for cream meal have been adopted by the federation. It has also adopted a symbol to be licensed by the federation to all millers who will agree to conform to the specifications. It is now cooperating with the Association of Feed Control Officials of the United States in the formulation of proper definitions for feeds made exclusively from corn.

American Dental Trade Association, John M. Clauser, chairman, simplification and standardization committee, 315 North Tenth Street, St. Louis, Mo. The chairmen of the various manufacturers sections of the association are members of a committee to bring about simplifications and standards desired by manufacturers and dealers. The following standards and simplifications have been adopted: Finishes for dental equipment, or furniture; holes for abrasive or grinding wheels for lathes; shades of powders for crown and bridge

cement; classes of plaster and investment containers; lengths of gold shells; sizes of brush wheels; sizes of flat and knife-edge felt wheels; sizes of felt cones; sizes of chamois wheels; mechanical saws, including spiral twist; flat round and one-half round gold files; sizes for each of the double-end and round vulcanite files; and standard electrical receptacles. The association has under consideration for future standardization and simplification 25 other items for use in the dental trade. At the present time the association is working under the auspices of the division of simplified practice of the Department of Commerce in eliminating excess sizes and varieties of hypodermic needles, mounted carborundum points, grinding wheels for engine mandrels, and abrasive wheels for lathes. The organization keeps in active touch with all of the dealers and manufacturers, both by correspondence and through representatives at trade meetings, to ascertain whether or not the requirements are being complied with.

American Drop Forging Institute, Donald McKaig, secretary, 1608 Law and Finance Building, Pittsburgh, Pa. This organization has formulated recommendations concerning good practice in manufacturing processes and quotation forms. It is serving as joint sponsor with the National Safety Council for the sectional committee on safety code for forging and hot-metal stamping functioning under the American Standards Association procedure.

American Drug Manufacturers Association, Carson P. Frailey, secretary, Albee Building, Washington, D. C. Standardization of methods for testing antiseptics and various other drugs comprises the principal work of this association. Under the auspices of the scientific section, the association has organized a number of committees to establish standards. The scientific section is cooperating with the national formulary committee of the American Pharmaceutical Association in developing better standards and methods for pharmaceuticals appearing in the National Formulary which have been found to be unsatisfactory in the trade. Among these are committees dealing with alkaloid and drug standards, analytical and assay methods, and chemical tests and standards. The association has also organized a committee on catalogue simplification to unify and standardize that part of pharmaceutical catalogues which cover standard preparations, and a committee on standardization of glass containers.

American Dry Milk Institute (Inc.), H. E. Van Norman, president, 160 North La Salle Street, Chicago, Ill. The institute has adopted tentative definitions of a standard grade of dry skim milk. Working in cooperation with commercial testing laboratories, its standards committee is formulating standard methods of analysis

for the determination of moisture, butterfat, solubility, titratable acidity, and bacteria count, which, when approved and adopted by the institute, will be published and recommended for use in the dry-milk and related industries.

American Electric Railway Association, J. W. Welsh, general secretary, 292 Madison Avenue, New York, N. Y. Affiliated with the parent association are certain dependent associations, each interested in certain special phases of the electro-railway industry. Of these the American Electric Railway Engineering Association is the one which deals with standards and specifications which, after adoption, are published in the association's Engineering Manual. During the past year 42 committees of the purchases and stores, power, rolling stock, and way and structures divisions were engaged in the revision of various existing specifications and in the formulation of standard specifications on numerous subjects. In 1928 the association issued a supplement to the Engineering Manual (1926) containing revisions of 11 specifications and 12 new standards on the following items: Specifications for use by electric railways following steam-road practice; car-lighting principles; limits of wear for parts affecting gear centers; car-lighting equipment and layouts; method for the disposal of unused inactive materials; routine methods to be followed in the purchase and stores departments; design for 103-pound light section girder grooved rail; design of solid manganese-steel crossings, steam railroad over electric railway for 7 and 9 inch girder rails—angles 90° to 60° and 60° to 40°, inclusive; minimum dimensions for center plates for single and middle frogs; welding rods; and rules to be observed in arc welding. The organization has cooperated with the National Fire Protection Association in the work on regulation for motor-bus garages to minimize the fire hazard. The association is a member of the American Standards Association and through it takes active part in the consideration of all proposed standardization and code work affecting the electric-railway industry. It is sponsor or joint sponsor for 13 sectional committees functioning under the American Standards Association, as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations); tubular steel poles; 600-volt direct-current overhead-trolly construction; designs for joint plates for 7 and 9 inch girder grooved and girder guard rails; designs for 7-inch, 80-pound, 91-pound, and 102-pound plain girder rail for use in paved streets; special track-work material.

American Electrochemical Society, Colin G. Fink, secretary, Columbia University, New York, N. Y. The society's radio-battery committee has formulated standard tests for dry cells used in radio receiving sets, in cooperation with the National Bureau of Stand-

ards and the National Electrical Manufacturers Association, supply division. The corrosion committee of the society is determining the best procedure for ascertaining the resistance to corrosion of various metals and alloys. The electrodeposition division of the society is promoting investigation in standardization of specifications for the electrodeposition of copper, chromium, and nickel.

American Electro-Platers' Society, George Gehling, secretary, 5001 Edmund Street, Philadelphia, Pa. Although this society has not formulated any standards, it maintains two research associates at the National Bureau of Standards, one investigating the "spotting out" of electroplated and oxidized finishes, and one doing research work on chromium plating.

American Engineering Standards Committee (now American Standards Association). (See Ch. VIII, p. 275.)

American Face Brick Association, R. D. T. Hollowell, secretary, 130 North Wells Street, Chicago, Ill. In 1926 the association reaffirmed the resolution adopted at the conference held in 1923 relating to face-brick sizes set forth in Department of Commerce Simplified Practice Recommendation No. 7. The association maintains a research associate at the National Bureau of Standards, investigating interior wet walls.

American Forestry Association, The, O. M. Butler, executive secretary, 1523 L Street NW., Washington, D. C. This association has cooperated in the standardization movement by official representation on the sectional committees on safety code for logging and sawmill machinery, and specifications for wood poles, functioning under the American Standards Association procedure.

American Foundrymen's Association, R. E. Kennedy, technical secretary, 222 West Adams Street, Chicago, Ill. In the past year this association has developed five standard and seven tentative methods for testing foundry sands and tentative classifications of grain fineness and clay content of foundry sands. The association is represented on all A. S. T. M. committees dealing with specifications of interest to its members. It is sponsoring the joint committee on pattern equipment, which is formulating recommended practices. It is also joint sponsor with the American Ceramic Society for the joint committee whose endeavor is to standardize tests for foundry refractories and to simplify the number of shapes of refractories for steel, malleable, and gray iron foundry furnaces. It is represented on the joint committee on the investigation of the effect of phosphorus and sulphur in steel (with 10 other organizations). The association is joint sponsor for two sectional committees functioning under the American Standards Association, as follows: Safety code for the protection of industrial workers in foundries (with the National Founders' Association); outside dimensions of plumbago crucibles

for nontilting furnaces in nonferrous foundry practice (with the Plumbago Crucible Association). All standardization work of this association, except that relating to foundry sands, is done in cooperation with the American Society for Testing Materials and under the auspices of the American Standards Association.

American Fruit and Vegetable Shippers Association, E. S. Briggs, manager-secretary, 1425 South Racine Avenue, Chicago, Ill. This association has 15 standing committees to bring to the attention of the membership the container standards set up by the Interstate Commerce Commission and the Freight Container Bureau, and the food grades and standards of the United States Department of Agriculture. It maintains a potato and a brokers' division, each division appointing its own committees to handle the problems which arise within that division. In cooperation with the International Apple Shippers' Association, this organization compiled, approved, and recommended for use standard rules and definitions of trade terms for the fruit and vegetable industry. It has also adopted a standard code of business ethics.

American Gas Association (Inc.), Alexander Forward, managing director, 420 Lexington Avenue, New York, N. Y. Research activities of this association are carried on by committees organized to deal with problems affecting the production, distribution, sale, and utilization of gas. One of these projects is being conducted under the direction of the National Bureau of Standards and the United States Bureau of Mines of the Department of Commerce. Laboratories of the American Institute of Baking, department of engineering research of the University of Michigan, and those of the association are being utilized for testing and research purposes. The association has adopted the following standards: Requirements for central house-heating gas appliances, house piping and appliance installation, flexible gas tubing, gas ranges, gas water heaters, space heaters, cast-iron pipe and special castings, and safety code for gas. Work is now nearing completion on the requirements for hot plates and laundry stoves and on the utilization of mixed gases. In the association's laboratory at Cleveland, domestic gas-burning appliances are tested and certified as to economy in accordance with basic specifications covering safety performance, efficiency, and construction. The association is joint sponsor for three sectional committees functioning under the American Standards Association, as follows: Cast-iron pipe and special castings (with three other organizations), pipe thread (with the American Society of Mechanical Engineers), and safety code for gas (with the National Bureau of Standards). It maintains a research associate at the National Bureau of Standards investigating the methods of testing gas appliances to determine their safety.

American Gear Manufacturers Association, T. W. Owens, secretary, 3608 Euclid Avenue, Cleveland, Ohio. This association is serving as joint sponsor for two sectional committees, as follows: Gears (with the American Society of Mechanical Engineers), transmission chains and sprockets (with the American Society of Mechanical Engineers and the Society of Automotive Engineers), functioning under the procedure of the American Standards Association.

American Grocery Specialty Manufacturers' Association, H. F. Thunhorst, secretary, 53 Park Place, New York, N. Y. This association's technical committee on soaps cooperated with the Federal Specifications Board in formulating the specifications for soap, which have been adopted for use by the various Government departments. The association has been active in the work of standardizing the order books of its members and is now working on standard invoice forms.

American Hardware Manufacturers Association, Charles F. Rockwell, secretary, 342 Madison Avenue, New York, N. Y. Such standardization and simplification work as is conducted by this association is carried forward under the auspices of the American Standards Association and the division of simplified practice of the United States Department of Commerce. In cooperation with the National Hardware Association of the United States it has been instrumental in reducing the number of commercial sizes for steel sheets under the auspices of the division of simplified practice, and it is officially represented on the sectional committee on bolt, nut, and rivet proportions functioning under A. S. A. procedure.

American Home Economics Association, Alice L. Edwards, executive secretary, Mills Building, Washington, D. C. This association is carrying on a program to develop increased cooperation in movements intended to further the interests of the consumer on questions of production and distribution. It has a special committee on commercial standardization and simplification to deal with problems affecting household goods. This committee has cooperated with the division of simplified practice in the simplification of a variety of products, and it has initiated two standardization projects under the auspices of the American Standards Association, one dealing with refrigerators and the other relating to sheeting.

American Hospital Association, Bert W. Caldwell, M. D., executive secretary, 18 East Division Street, Chicago, Ill. This association has organized a committee on simplification and standardization of general furnishings, supplies, and equipment, and a committee on dietary service and equipment, the functions of which are indicated by their names. The sizes of hospital beds and hospital chinaware have already been simplified, and the standardized sizes have been

widely adopted by the hospitals of the country. A statistical study has been made of hospital linen to establish standard sizes.

American Hotel Association of the United States and Canada, Augustus Nulle, chairman, committee on standardization and waste elimination, 221 West Fifty-seventh Street, New York, N. Y. This association, in cooperation with the American Ceramic Society and the American Vitrified China Manufacturers Association, has been instrumental in launching a program of standardization in table chinaware under the auspices of the division of simplified practice, which has resulted in the formulation of recommendations relating to hotel, restaurant, dining car, and hospital tableware. It has issued a list of specifications for soaps and cleaning compounds in which are incorporated the standard methods of test developed by the National Bureau of Standards.

American Institute of Architects, Structural Service Department, Le Roy E. Kern, technical secretary, 19 West Forty-fourth Street, New York, N. Y. The institute's standardization work is conducted almost entirely in cooperation with other national bodies through its structural-service department. The institute has been instrumental in the formulation of recommendations as to size and character of advertising matter intended for architects and the development of a standard filing system for trade literature which is now in fairly general use. It has issued the following standard-contract documents with the object of improving contract practice in the building industry: Standard form of agreement between contractor and owner for construction of buildings, general conditions of the contract for the construction of buildings, standard form of subcontract, standard form of bond, and standard form of acceptance of subcontractor's proposal. These documents are now in the fourth edition. The institute is represented officially on the National Committee on Wood Utilization, and the Building-Code Committee of the United States Department of Commerce; on committees of the division of simplified practice of the department dealing with building materials and appliances; and on committees of the National Fire Protection Association and the American Construction Council. The structural-service committee is cooperating with the Refrigerating Machinery Association on standardized specifications for refrigerating equipment. The institute is joint sponsor for five sectional committees functioning under the American Standards Association, as follows: Elevators (with the American Institute of Electrical Engineers and the American Society of Mechanical Engineers); safety code for elevators and escalators (with the American Society of Mechanical Engineers and the National Bureau of Standards); safety code for lighting of school buildings (with the Illuminating Engineering

Society); symbols for electrical equipment of buildings (with the American Institute of Electrical Engineers and the Association of Electragists, International); safety code for walkway surfaces (with the National Safety Council).

American Institute of Baking, Henry Stude, president, 1135 Fullerton Avenue, Chicago, Ill. The institute is conducted by the American Bakers' Association for scientific research and education. It has organized an advisory board for the National Research Council. Its present work consists in making a study of the principal basic raw materials of both bread and cake and seeking to arrive at a better definition of standards. By cooperation with the producers of the principal raw materials it has eliminated most of the variations in character and kind of these materials. Through its school, laboratories, and service bureaus the institute is teaching the baker to produce a product of higher standard of value.

American Institute of Chemical Engineers, H. C. Parmelee, secretary, Tenth Avenue at Thirty-sixth Street, New York, N. Y. The institute cooperated with the American Society of Mechanical Engineers in developing an evaporator test code which has been printed by the A. S. M. E.

American Institute of Electrical Engineers, F. L. Hutchinson, national secretary, 33 West Thirty-ninth Street, New York, N. Y. The revised standards of the institute are being published in the form of individual sections, each section dealing with standards for a specific subject, and 27 of over 40 proposed sections have been completed, as follows: No. 1, general principles upon which temperature limits are based in the rating of electrical machinery; No. 4, measurement of test voltage in dielectric tests; No. 5, direct-current generators and motors and direct-current commutator machines in general; No. 7, alternators, synchronous motors, and synchronous machines in general; No. 8, synchronous converters; No. 9, induction motors and induction machines in general; No. 10, direct-current and alternating-current fractional horsepower motors; No. 11, railway motors; No. 13, transformers, induction regulators and reactors; No. 14, instrument transformers; No. 15, industrial control apparatus; No. 16, railway control and mine-locomotive control apparatus; No. 17f, mathematical symbols; No. 19, oil circuit breakers; No. 22, disconnecting and horn-gap switches; No. 26, automatic stations; No. 30, wires and cables; No. 33, electrical measuring instruments; No. 34, telegraphy and telephony; No. 36, storage batteries; No. 37, illumination; No. 38, electric-arc welding apparatus; No. 39, electric resistance welding apparatus; No. 41, insulators; No. 42, symbols for electrical equipment of buildings; No. 45, recommended practice for electrical installations on shipboard (marine

rules); and No. 46, hard-drawn aluminum conductors. Of these 27 standards, 7 have been approved as American standards under American Standards Association procedure (Nos. 8, 14, 15, 17f, 37, 42, and 46). In cooperation with the Bureau of Foreign and Domestic Commerce, Spanish translations of the A. I. E. E. standards Nos. 1, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 19, 22, 30, 33, 37, and 41 have been published as United States Government documents. The institute is a member body of the American Standards Association and is represented on the electrical advisory committee. The institute is sponsor or joint sponsor for 20 sectional committees functioning under A. S. A. procedure. Of these it is joint sponsor with the National Electrical Manufacturers' Association for the following nine projects: Industrial electrical control apparatus; alternators, synchronous motors, and synchronous machines in general; direct and alternating current fractional horsepower motors; induction motors and induction machines in general; direct-current rotating machines; power-line insulators for voltages exceeding 750; power-line insulators for voltages not exceeding 750; electric-arc welding apparatus; and electric resistance welding apparatus. It is also sponsor or joint sponsor for rating of electrical machinery; instrument transformers; hard-drawn aluminum conductors; electrical installations on shipboard; mercury-arc rectifiers; synchronous converters; insulted wires and cables for other than telephone and telegraph use (with nine other organizations); symbols for electrical equipment of buildings (with the American Institute of Architects and the Association of Electragists, International); radio (with the Institute of Radio Engineers); scientific and engineering symbols and abbreviations (with four other organizations); code on protection against lightning (with the National Bureau of Standards). Committees of the institute are now at work on the following standardization topics: Rearrangement of rules, Spanish translation, lightning arresters, telegraphy and telephony definitions, definitions and symbols, graphical symbols, general principles upon which temperature limits are based in the rating of electrical machinery and apparatus, switchboards for power and light, definition of substation and related matters, air circuit breakers, rule for altitude correction, lightning arresters, telegraphy and telephony, prime-mover generator units, and transformers. The standards committee of the institute cooperated during the past year with the American Society of Mechanical Engineers in the development of the electrical section of the A. S. M. E. power-test codes. The institute also has been engaged for many years in safety-code work through its technical committee on safety codes.

American Institute of Mining and Metallurgical Engineers, H. Foster Bain, secretary, 29 West Thirty-ninth Street, New York, N. Y. All standardization work of the institute is conducted through the cooperation of the mining standardization correlating committee functioning under the American Standards Association. It is serving as sponsor for two sectional committees, as follows: Screening of ores and recommended practice for rock dusting of coal mines. The institute is also officially represented on the National Committee on Wood Utilization and is cooperating with the coal division of the Bureau of Mines of the Department of Commerce in the work relating to various industrial and trade problems of the industries producing, marketing, and distributing coal, and its fuel by-products. The board of the institute has adopted a report entitled "Dangers from Oil and Gas Wells to Coal-Mining Operations and Draft of a Model Law for Use of the Legislature of Any State."

American Institute of Refrigeration, J. F. Nickerson, general secretary, 5707 West Lake Street, Chicago, Ill. This institute is a federation of several National and State associations interested in refrigeration, who join forces on certain subjects, including the American Fruit & Vegetable Shippers' Association; American Society of Refrigerating Engineers; American Warehousemen's Association, cold-storage division; Eastern Ice Association; International Apple Shippers' Association; National Association of Ice Industries; National Association of Practical Refrigerating Engineers; National League of Commission Merchants; New York State Cold Storage Association; Pacific States Cold Storage Warehousemen's Association; Refrigerating Machinery Association; United States Fisheries Association; and Western Fruit Jobbers Association. It has a standing committee on standards, to study various subjects referred to it. Its special committee on standardization of ice cans is cooperating with similar committees of other organizations. It is interested in the standardization of household and commercial refrigerators and is also cooperating with other organizations on this subject. It has been instrumental in securing the adoption of some international standards through the Institut International du Froid and the international congresses on refrigeration that are held periodically.

American Institute of Steel Construction (Inc.), C. F. Abbott, executive director, 285 Madison Avenue, New York, N. Y.; Lee H. Miller, chief engineer, 1050 Leader Building, Cleveland, Ohio. The institute has published and issued a Standard Handbook of Steel Construction, which contains, among other important data, the following standards: A code of standard practice governing all contracts between buyer and seller, standard specification for structural steel for buildings, and standard specification for fire proofing struc-

tural steel buildings. These latter two specifications are in harmony with those of the American Society for Testing Materials. The institute has established fellowships in several technical schools and is cooperating in the furtherance of research in connection with the development of a practical and economical system of wind bracing. The institute is conducting educational meetings throughout the United States and Canada with architects, engineers, technical schools, colleges, and others interested in building construction in furtherance of its program of standardization. It is also carrying on an extensive educational publicity campaign which is supported by the personal work of 10 district engineers located in 10 districts in the United States. The institute is cooperating with the American Welding Society in establishing standards of welding in bridge and building construction. The institute is officially represented on sectional committees on specifications for fire tests of materials and construction, and on specifications for zinc coating of iron and steel functioning under the American Standards Association. Members who adhere to the institute's code of standard practice are permitted to use the institute's symbol as a label for their commodities.

American Institute of Weights and Measures, William E. Bullock, secretary, 115 Broadway, New York, N. Y. Although not a standards making body, the institute is concerned with education in the importance of weights and measures units and standards and with the collection and classification of records relating to weights and measures.

American Leather Belting Association, J. L. Nelson, secretary, 41 Park Row, New York, N. Y. This association, formerly the Leather Belting Exchange, collaborated in the preparation of and has officially approved the specifications for leather belting promulgated by the Federal Specifications Board. Unnecessary sizes of belting have been eliminated by this organization. It maintains a research laboratory at Cornell University to develop better methods for manufacturing leather belting.

American Marine Standards Committee. (See Ch. VIII, p. 279.)

American Medical Association, Chemical Laboratory, Paul Nicholas Leech, director, 535 North Dearborn Street, Chicago, Ill. Through its chemical laboratory the association determines whether the chemical claims made for proprietary and unofficial medicinal preparations are correctly stated and looks after the establishment of standards whereby the identity and purity of such products may be determined and controlled. The investigations conducted by the chemical laboratory have aided considerably in determining the standards as set out in the book entitled "New and Nonofficial Remedies," which is published by the Council on Pharmacy and Chemistry of this association, and revised annually.

American Medical Association, Council on Medical Education and Hospitals, Nathan P. Colwell, M. D., secretary, 535 North Dearborn Street, Chicago, Ill. Through this council the association has set up a list of the following standards or essentials by which graduate and undergraduate medical schools, hospitals, and clinical, and radiological laboratories are classified as approved by the council: Acceptable medical college, graduate medical schools, registered hospitals, hospitals approved for internes, hospitals approved for residencies in specialties, and approved clinical and radiological laboratories. The institutions which have been standardized are induced to seek admission to the various approved lists of the council. Only approved institutions are permitted to advertise in the journal of the association.

American Medical Association, Council on Pharmacy and Chemistry, W. A. Puckner, secretary, 535 North Dearborn Street, Chicago, Ill. Through its council on pharmacy and chemistry the association investigates and reports on medicinal preparations that are put on the market for physicians' prescription use. It publishes each year New and Nonofficial Remedies, in which are listed and described all articles that stand accepted by the council on January 1 of the year of publication.

American Mining Congress, The, J. F. Callbreath, secretary, Munsey Building, Washington, D. C. This organization has adopted the following standards, which have been approved by the American Standards Association: Underground transportation in metal mines; mechanical loading in metal mines; underground power transmission and power equipment (coal); coal-mine drainage; wire rope for mines; coal-mine tracks, signals, and switches; miscellaneous outside coal-handling equipment; and ladders and stairs for coal mines. A committee of the national standardization division of the organization has completed work for the first draft of a code on ventilation in coal mines. Another committee has confined its activities to the collection and dissemination of information pertaining to the successful methods of mining with mechanical loading machines, conveyors, and scrapers. Other committees are engaged in the following projects: Mine timbering, mine-timber preservatives, concrete in mine timbering, the use of structural steel in mine timbering, reforestation, development of a standard system of metal-mine cost accounting, and drilling machines and drill steel. The organization has a standard code now in general use throughout the industry for methods of mine sampling, methods of recording underground geological data, and methods of estimation of ore reserves for low, medium, and high grade ore bodies. A standard code covering underground power transmission and power equipment in

metal mines is nearing completion. For promoting the use of standards the committees of this organization have given wide circulation to a handbook containing all completed recommendations. Extensive publicity is also being given through the medium of the organization's official organ. The committees are also making a practice of undertaking periodic resurveys of the field covered and hold annual conferences to promote the standardization movement in the industry. The American Mining Congress is sponsor or joint sponsor for 11 sectional committees functioning under the rules of procedure of the American Standards Association, as follows: Drainage of coal mines, outside coal-handling equipment, wire rope for mines, ladders and stairs for mines, underground transportation in coal mines, underground transportation in metal mines, underground mechanical loading in metal mines, safety code for transportation in coal mines, fire-fighting equipment in metal mines (with the National Fire Protection Association), ventilation in metal mines (with the U. S. Bureau of Mines), and safety rules for installing and using electrical equipment in coal mines (with the U. S. Bureau of Mines).

American Oil Burner Association (Inc.), Leod D. Becker, managing director, 420 Madison Avenue, New York, N. Y. The association has adopted standards of general trade practices, uniform oil specifications, and a code of ethics. A model ordinance covering the installation of oil-burning equipment has been prepared for use by municipal authorities having jurisdiction over such installations. A committee of the association has now in process of completion a report for the formulation of specifications relating to standard design and installation of oil burners. The association is inaugurating a technical research program which will extend over a period of three years.

American Oil Chemists' Society, J. C. P. Helm, secretary, 705 Tchoupitoulas Street, New Orleans, La. This society has cooperated actively in the standardization work of the Interstate Cottonseed Crushers' Association. A committee of five well-known competent chemists of the society meets with the rules committee of the Interstate Cottonseed Crushers' Association and formulates official methods of analysis for adoption by the association.

American Paint and Varnish Manufacturers' Association (Inc.), G. B. Heckel, secretary, 1002 Public Ledger Building, Philadelphia, Pa. This association is a consolidation of the National Varnish Manufacturers Association and the Paint Manufacturers Association of the United States. Standardizing activities are carried on by a committee on simplification organized jointly by the National Paint, Oil, and Varnish Association (Inc.), and the American Paint and Varnish Manufacturers Association (Inc.), to minimize the number of varieties of paints and varnishes and sizes of containers.

American Paper and Pulp Association, Oliver M. Porter, secretary-treasurer, 18 East Forty-first Street, New York, N. Y. This national association, representing the pulp and paper industry, has cooperated actively in the development of recommendations relating to the standardization and simplification of paper as issued by the division of simplified practice. It has advisory committees cooperating with the National Bureau of Standards and the Forest Products Laboratory of the United States Department of Agriculture in technical matters relating to the manufacture of pulp and paper.

American Petroleum Institute, C. A. Young, director of division of standardization, 1508 Kirby Building, Dallas, Tex. Special committees of the institute have formulated standards and specifications for belting (fourth edition); oil-field boilers, locomotive type (fourth edition); cable drilling-tool joints (fourth edition); standard rigs and derricks (second edition); specifications on casing, drill pipe, and tubing (fourth edition); line pipe specifications; rig-iron standards (fourth edition); dimensional standards for transmission, covering shafting, keys, and chains (second edition); miscellaneous rotary standards (second edition); rotary drilling taper joints; dimensional standards for line shafts for rotary drilling (second edition); wire rope (sixth edition); manila cordage (second edition); cold-drawn and machined working barrels; working-barrel pump parts; sucker rods; internal-combustion engines and clutches for oil-field service; miscellaneous pumping equipment; steel storage tanks; and bolted tanks. In addition, the institute has adopted codes on recommended field practice for the proper care and use of boilers, cable drilling tools, rigs and derricks, pipe, and rig irons. The institute is actively cooperating with national organizations in carrying out its standardization program. It grants to manufacturers the right to place its official monogram on certain standardized equipment upon certifying that the material so marked complies with all of the conditions and specifications contained in the official publication of the institute relating thereto. The institute reserves the right to revoke the use of its monogram for any reason satisfactory to the board of directors. The institute is also encouraging the use of its standards by means of special posters designed to give instructions as to the proper care and use of materials purchased under the institute's specifications. Work is nearing completion in the establishment of a code for the proper measuring of field storage and production tanks, and in the formulation of standard gauge tables used to compute the quantity of oil contained therein.

American Pharmaceutical Association, E. F. Kelly, secretary, 10 West Chase Street, Baltimore, Md. An important standardization activity of this association has been the preparation of an authorita-

tive formulary, extra to the United States Pharmacopœia, containing preparations of a nonsecret character which are used by physicians. The fifth edition of the National Formulary was published in 1926. The passage of the national food and drugs act on June 30, 1906, made a Formulary a legal standard and placed it on a par with the United States Pharmacopœia in legal standing. This association has six committees working on standardization besides the committee on National Formulary and the committee on United States Pharmacopœia above mentioned, as follows: Horticultural nomenclature, physiological testing, weights and measures, international pharmaceutical nomenclature, committee to cooperate with committees from the American Association of Colleges of Pharmacy and the National Association Boards of Pharmacy to obtain prerequisite legislation, and a committee to investigate the light-protecting properties of various colored-glass containers and to determine the amount of protection afforded or deterioration produced by light from the ultra-violet and infra-red regions of the spectrum. It is expected that the investigations of the last-named committee will result in the preparation of specifications for colored-glass containers for the protection of medicaments.

American Public Health Association, Homer N. Calver, secretary, 370 Seventh Avenue, New York, N. Y. In cooperation with the American Water Works Association, the association formulated standard methods for the examination of water and sewage, the sixth edition of which was issued in 1925. The association has revised its standard methods of milk analysis, the fifth edition of which was issued in 1927. These two publications have recently been incorporated into one volume. The standardization programs of the association cover standard record forms for health departments, standard forms for the tabulation of vital statistics, and similar matters. The general direction of its activities is toward the standardization of methods rather than of materials.

American Railway Association, H. J. Forster, secretary, 30 Vesey Street, New York, N. Y. Activities of the association are conducted under seven divisions, the names of which indicate their scope, as follows: I, operating; II, transportation; III, traffic; IV, engineering; V, mechanical; VI, purchases and stores; VII, freight claims. Four of these divisions are vitally concerned with standards and specifications, namely, operating, which deals with problems of operation; engineering, which deals with the location, construction, and maintenance of railroads; mechanical, which deals with the construction and maintenance of rolling stock; and purchases and stores, which deals with the purchasing, storing, distribution, and selling of materials and supplies. (See sketches of the operating, mechani-

cal, and purchases and stores divisions, and the American Railway Engineering Association, which functions as the engineering division.)

American Railway Association, Freight Container Bureau, Edward Dahill, chief engineer, 30 Vesey Street, New York, N. Y. The function of this bureau is to develop and prepare recommended standard specifications for the packing of, and containers for, all commodities other than explosives and dangerous articles. This work is carried on in close cooperation with the shippers national traffic and industrial associations, governmental agencies, and associations of container and material manufacturers. Twenty-three recommended standard specifications for containers have already been issued. The bureau has now in the process of completion recommended standard specifications for the following types of containers: Straight-side, flat-bottom bushel basket for fresh fruits and vegetables; hampers for fresh fruits and vegetables; crates for strawberries, dewberries, etc., holding thirty-two 1-quart till baskets; ventilated crates for onions; crates for cantaloupes, chairs, tables, radios, and sanitary pottery; and crates and inside packing for electric refrigerators, mirrors, metallic office furniture, and commercial store fixtures. It will shortly issue a dictionary of standard terms to be used in describing loading and bracing of cars carrying fresh fruits and vegetables.

American Railway Association, Mechanical Division, V. R. Hawthorne, secretary, 431 South Dearborn Street, Chicago, Ill. This division has published and keeps under constant revision its manual of standard specifications and recommended practices. The manual is divided into 12 sections and contains 108 standard specifications and 115 recommended practices relating to railroad materials and equipment. In addition, it has adopted codes and rules governing the condition of, and repairs to, freight and passenger cars for the interchange of traffic, loading materials, maintenance of brake and train air-signal equipment, safety appliances, wheel manual, and fuel economy. The specifications for safety appliances for cars and locomotives are in conformity with those of the Interstate Commerce Commission adopted in accordance with the act of Congress of April 14, 1910. Observance of these standards and those relating to inspection and testing of locomotive boilers are policed respectively by the Bureau of Safety and the Bureau of Locomotive Inspection of the Interstate Commerce Commission through permanent inspection forces. Future work of the division will consist in the standardization of detail parts of car construction; refrigerator, hopper, and gondola cars; fundamental details of locomotive design; and the formulation of new specifications for railroad materials. The asso-

ciation enforces the use of its standards by making mandatory by agreement of car owners the interchange rules relating to freight-car construction details, which rules were formulated and adopted by the former Master Car Builders' Association and the mechanical division of this association. These rules prohibit the interchange of cars unless standard details are used. The rules also provide for the rejection for movement of tank cars not built or tested in accordance with the tank-car specifications. Standards for many passenger-car details are made mandatory through a passenger-car interchange rules agreement, similar to the one covering freight cars.

American Railway Association, Operating Division, J. C. Caviston, secretary, 30 Vesey Street, New York, N. Y. The division carries on the activities of the operating committees of the American Railway Association and, in addition, includes the activities of the former Association of Railway Telegraph Superintendents, American Association of Local Freight Agents, American Railway Chief Special Agents and Chiefs of Police Association, and the American Railway Chief Surgeons' Association. The division keeps up to date and handles all questions pertaining to the interpretation of the standard code of train rules, the standard code of interlocking rules, and the standard code of block-signal rules, which codes are the basis for all such rules on American railways. Specifications for torpedoes and recommended standards for flags and crossing-gate lanterns, grade-crossing warning approach signs, etc., have been adopted.

American Railway Association, Purchases and Stores Division, W. J. Farrell, secretary, 30 Vesey Street, New York, N. Y. The more important recommendations of the division include standard rules for railroad stores department operation (standard stock book and master stock book), standard rules for railroad purchasing department operation, standard material classification, standard scrap classification, standard reclamation practices, unit piling of material (a standard practice for storing and caring for materials and supplies), distribution of materials (standard plan for efficient handling and distribution of material to the users), standard types of stores, department buildings, and facilities, and standardization and simplification of stores stock.

American Railway Association, Signal Section, H. S. Balliet, secretary, 30 Vesey Street, New York, N. Y. The membership of this organization comprises railroad officials who are connected in an official or supervisory capacity with the design, construction, maintenance, or operation of railway-signaling devices. Reports of its committees are analyzed and voted upon by the railroad representatives before they are published as specifications and drawings in the section's Manual of Recommended Practice. There are committees

on mechanical and power interlocking, direct-current automatic block signaling, maintenance rules and instructions, designs, alternating-current automatic block signaling, wires and cables, signaling practice, batteries, contracts, electrical testing, lightning protection, oils, pole lines, direct-current track circuits, electric-railway track circuits, electric-railway signaling, economics of railway signaling, and highway-crossing protection.

American Railway Association, Telegraph and Telephone Section, W. A. Fairbanks, secretary, 30 Vesey Street, New York, N. Y. This section functions as a part of the operating division, American Railway Association. Consideration is being given to over 100 subjects, including the following important groups: Outside plant, inside plant, protection against electrolysis, electrical protection, message traffic, inductive interference, education and training communication employees, communication transmission, accident prevention and first aid for communication employees, and radio and wire carrier systems. A loose-leaf manual and pocket handbook have been provided for use by engineering and supervisory forces and field forces. These publications contain 140 recommendations and specifications.

American Railway Car Institute, W. C. Tabbert, secretary, 61 Broadway, New York, N. Y. This institute has representatives on a number of standardizing committees, several of which are cooperating actively with the American Standards Association, the American Society of Mechanical Engineers, and the Central Committee on Lumber Standards.

American Railway Engineering Association, E. H. Fritch, secretary, 431 South Dearborn Street, Chicago, Ill. This association functions also as the engineering division of the American Railway Association. As such it is divided into three sections—construction and maintenance, electrical, and signal. In the construction and maintenance section are committees on roadway; ballast; ties; rails; track; buildings; wooden bridges and trestles; masonry; grade crossings; records and accounts; rules and organizations; water service and sanitation; yards and terminals; iron and steel structures; economics of railway location, wood preservation, uniform general contract forms; economics of railway operation; economics of railway labor; shops and locomotive terminals; a special committee on stresses in railroad track; a special committee on standardization, on clearances, and on rivers and harbors. In the electrical section are committees on electricity, overhead and third-rail working conductors, and crossings of power and other service wires. (For the activities of the signal section, see American Railway Association, Signal Section.) The association is represented on the joint com-

mittee on standard specifications for concrete and reinforced concrete (with four other organizations), on the joint committee on studies of boiler feed-water problems (with four other organizations), and on the joint committee on concrete culvert pipe (with six other organizations). It is joint sponsor for two sectional committees functioning under the American Standards Association as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations) and specifications for railroad ties (with the United States Forest Service).

American Refractories Institute, Dorothy A. Texter, secretary, Oliver Buildling, Pittsburgh, Pa. This institute has cooperated in the development of simplification and standardization of refractories in the malleable-iron industry. It maintains a fellowship at the Mellon Institute of Industrial Research. In 1927, its committee on classification of fire-clay shapes other than straight tile issued a code of rules and formulas covering this subject which has been adopted by the institute. Tentative specifications for boiler refractories have been prepared, and surveys relating to other commodities are in progress.

American Road Builders' Association, C. M. Upham, secretary-director, National Press Building, Washington, D. C. This association was organized over 25 years ago for the purpose of acquiring and disseminating information concerning highway construction and maintenance in the United States and Canada, to stimulate interest in the subject of good roads, and to promote educational, legislative, and other measures on behalf of highway development. There are seven divisions, each carrying on a different phase of work relating to good roads. The county highway officials' division has for its purpose the stimulation and standardization of county-road construction and maintenance. During the past year committees of this division have submitted reports on standards for equipment and maintenance of county roads. The city officials' division, recently organized, is engaged in the standardization of city street and highway construction, maintenance, and operation, including traffic regulation. Several committees of this division have prepared reports on contracts and specifications for design and construction of highways and streets to be submitted at the association's annual convention in 1929.

American Sanatorium Association, Walter L. Rathburn, secretary, Newton Memorial Hospital, Cassadaga, N. Y. The committee on standardization of this association has formulated certain standards now being used by the National Tuberculosis Association in rating the tuberculosis sanatoriums and hospitals in the United States.

American Short Line Railroad Association, T. F. Whittelsey, secretary, 401 Union Trust Building, Washington, D. C. The association

is cooperating in the preparation of standards and specifications through official representation on sectional committees on specifications for track work and on specifications for railroad ties, functioning under the American Standards Association.

American Shovel Institute, George D. McIlvaine, secretary, Oliver Building, Pittsburgh, Pa. This institute, which took active part in the movement which resulted in the standardization of shovels, spades, and scoops set forth in Simplified Practice Recommendation No. 48, is now working on a revision of this recommendation.

American Society of Agricultural Engineers, Raymond Olney, secretary, St. Joseph, Mich. The society has developed a standard testing and rating code for farm tractors that has been adopted by the farm-equipment industry. It has also adopted standards for the power take-off for farm tractors and is developing standards for disk blades for disk plows, disk harrows, and rolling coulters; detachable link belting for farm machinery; and a standard method of rating ensilage cutters. The standards committee of the society has formulated a very comprehensive program, involving all phases of the application of engineering to agriculture, including farm power and machinery, farm structures, land reclamation, and rural electrification.

American Society of Civil Engineers, George T. Seabury, secretary, 33 West Thirty-ninth Street, New York, N. Y. Committees have been organized to deal with the following subjects: Stresses in railroad track, bridge design and construction, standard construction contracts, flood-protection data, hydraulics phenomena, impact in highway bridges, irrigation hydraulics, concrete and reinforced-concrete arches, steel columns, cement, city planning of Washington, D. C., charges and method of making charges for professional services, Mississippi River flood control, and soils. The society is represented on the joint committee on standard specifications for concrete and reinforced concrete (with four other organizations), and on the joint concrete culvert pipe committee (with six other organizations). It is joint sponsor for three sectional committees functioning under the American Standards Association, as follows: Structural steel shapes (with the Association of American Steel Manufacturers and the Society of Naval Architects and Marine Engineers), manhole frames and covers (with the telephone group of the A. S. A.), and scientific and engineering symbols and abbreviations (with four other organizations).

American Society of Heating and Ventilating Engineers, A. V. Hutchinson, secretary, 29 West Thirty-ninth Street, New York, N. Y. The society has developed and adopted codes for the testing of heating boilers and ventilating fans and has established a method

for testing ventilation. Its most recent work is the development of a code for rating low-pressure heating boilers, at the request of the United States Bureau of Mines. Another important project is a standard code for heat transmission of walls to determine the effectiveness of insulating materials in building wall constructions. A recent code is that for testing air filters. Work is also under way on standards for heating and ventilating garages, prepared by a committee cooperating with the National Fire Protection Association. It has received the cooperation of the American Society of Mechanical Engineers and the Heating and Piping Contractors National Association in the revision of its code for testing low-pressure boilers. Its research program is carried out at its own laboratory conducted at the Pittsburgh Experiment Station of the United States Bureau of Mines. In cooperation with the United States Department of Commerce the society has been able to eliminate the steam type of radiator in favor of the water type, which has been found to be thoroughly satisfactory for steam heating. In cooperation with the National Association of Fan Manufacturers and the American Society of Mechanical Engineers it has developed a standard test code for disk and propeller fans, centrifugal fans, and blowers. It cooperated with the National Education Association in the preparation of a code on schoolhouse planning. It has also approved a standard code for the installation of warm-air furnaces in residences, sponsored by the National Warm Air Heating and Ventilating Association. The society is sponsor for two sectional committees functioning under the American Standards Association, as follows: Ventilation safety code and safety code for exhaust systems. Work is going forward in the development of a code of minimum requirements for the heating and ventilation of buildings, on a code for testing building insulation, and on standard rating for low-pressure boilers.

American Society of Mechanical Engineers, Calvin W. Rice, secretary, 29 West Thirty-ninth Street, New York, N. Y. Sixteen professional divisions of the society have been organized on aeronautics, applied mechanics, fuels, hydraulics, iron and steel, machine-shop practice, management, materials handling, national defense, oil and gas power, petroleum, power, printing machinery, railroad, textiles, and wood industries. Since January, 1928, each professional division has had its own quarterly publication. The technical committee activity of the society has grown very rapidly during the past 10 years, until now 1,200 engineers and others are serving on the 275 committees for which the society is sponsor or joint sponsor. Under the main research committee 35 special research committees have been organized. Some of these projects have grown out of the activities

of standards committees. At the present time some 50 research workers are engaged on a variety of projects, as follows: Boiler-furnace refractories, fluid meters, lubrication, saws and knives, steam tables, elevator safety devices, strength of gear teeth, existing supplies of hardwoods, effect of temperature on properties of metals, boiler feed-water studies, welding of pressure vessels, fuels, etc. Six research fellows at the National Bureau of Standards are working on the experimental program of these research committees. New projects in the Diesel engine, machine-shop practice, textile, printing, and hydraulic fields are being formulated. The dimensional standardization and safety activities of the society are carried forward under the procedure of the American Standards Association. At the present time the society is sponsor or joint sponsor for 25 sectional committees on standards and 5 sectional committees preparing safety codes. The projects covered by the standards committees are: Transmission chains and sprockets; shafting; plain limit gauges for general engineering; ball bearings; elevators; gears; standardization and unification of screw threads; pipe flanges and fittings; bolt, nut, and rivet proportions; scheme for the identification of piping systems; small tools and machine-tool elements; scientific and engineering symbols and abbreviations; screw threads for fire-hose couplings; plain and lock washers; machine pins; standards for drawings and drafting-room practice; code for pressure piping; standards for graphic presentation; pipe threads; wire and sheet-metal gauges; wrought-iron and wrought-steel pipe and tubing; electric-motor frame dimensions; screw threads for small hose couplings; speeds of driven machines; and plumbing equipment. The safety code committees are drafting national codes on mechanical power-transmission apparatus; elevators; conveyors and conveying machinery; machinery for compressing air; and cranes, derricks, and hoists. One of the society's most notable technical committee accomplishments is the development of the A. S. M. E. Boiler Construction Code and its eight supplementary codes and interpretations. The code has been officially adopted by 19 States and 16 cities in this country. These codes cover rules for the construction of power boilers; boilers of locomotives; heating boilers; material specifications; miniature boilers; rules for inspection; unfired pressure vessels; and for the care of power boilers and other pressure vessels in service. The preparation of the society's standard tests of power-plant and heat apparatus, such as are most commonly undertaken in connection with commercial transactions, is in the hands of a group of 20 committees guided by the main committee on power-test codes. Each of these "individual committees" was organized to undertake the revision or formulation of a test code for such apparatus as boilers; steam en-

gines; steam and hydraulic turbines; pumping machinery; compressors, blowers, and fans; locomotives; gas producers; and gas and oil engines. This group of codes covers also such general topics as general instructions; definitions and values; fuels; stationary steam boilers; reciprocating steam engines; steam turbines; reciprocating steam-driven displacement pumps; centrifugal and rotary pumps; displacement compressors and blowers; centrifugal and turbo compressors and blowers; complete steam-power plants; condenser, water heating and cooling equipment; refrigerating systems; evaporating apparatus; steam locomotives; gas producers; internal-combustion engines; hydraulic power plants; instruments and apparatus; and speed-responsive governors. The society has published in pamphlet form 21 dimensional standards, 2 safety codes, 5 research reports, and 18 power-test codes. The standards and technical publications of the society are broadly advertised in the technical and daily press during their development by technical committees, and page-proof copies are sent in quantity to interested societies, firms, and individuals. As a result, when the final pamphlet copies are available a reasonably broad distribution is immediately assured. Each of these copies in turn serves as a silent salesman for others. The A. S. M. E. standardization committee plans to make a canvass of the extent of the adoption of a given standard on the second, third, and fourth anniversaries of its approval by the American Standards Association. In its 1928–29 Mechanical Equipment Directory special notations are employed to indicate those firms supplying equipment in conformity with standards approved by the A. S. A.

American Society for Municipal Improvements, C. W. S. Sammelman, secretary, Commercial Building, St. Louis, Mo. Nine committees of the society are at work revising the existing specifications relating to bituminous, brick, concrete, cement, stone-block, and wood-block pavements; also sidewalks and curbs. They have prepared specifications for broken-stone and gravel roads, for sewers, subgrades and foundations for pavements, and for girder rails. A standard municipal contract form has also been prepared. The society's specifications, which are used as guides for municipal engineers, are kept in harmony with the current specifications of the American Society for Testing Materials. These two societies and the American Association of State Highway Officials and the United States Bureau of Public Roads are joint sponsors for the sectional committee on method of test for penetration of bituminous materials, functioning under the American Standards Association.

American Society of Refrigerating Engineers, David L. Fiske, secretary, 37 West Thirty-ninth Street, New York, N. Y. The society considers standardization as one of its primary functions. Its procedure is definitely identified with that of the American Standards Association. The society has adopted a standard measurement for refrigeration performance known as the "standard ton" and has formulated a standard test code for refrigerating systems. Both of these standards are in harmony with those of the American Society of Mechanical Engineers. It has adopted specifications for synchronous motors for direct-connected refrigerating compressors, and a test code for steam-driven ice plants. In the line of research standards it has been sponsor for three notable research projects devoted to the physical properties of refrigerants and treatment of corrosion. It has cooperated with other organizations in the refrigerating field in one general standards project devoted to the subject of ice cans. The society adopted a safety code for mechanical refrigeration in 1924, which was revised in 1928. It is serving as sponsor for the sectional committee on safety code for mechanical refrigeration, and as joint sponsor, with the Bureau of Home Economics, on the standardization of refrigerators functioning under the rules of the A. S. A.

American Society of Safety Engineers. (See National Safety Council.)

American Society of Sanitary Engineering, John Heinkel, secretary, 5601 Lisette Avenue, St. Louis, Mo. The aims of this organization are research and publication in sanitary lines, promotion of standardization, adoption of a national plumbing code, and education of the sanitary engineer, the plumbing inspector, the plumber, and the public in its use and benefit. It maintains a special committee working on the sufficiency of sanitary safeguards in the construction of plumbing fixtures as differentiated from the mechanical features coming under the American Standards Association. The society is serving as joint sponsor with the American Society of Mechanical Engineers under A. S. A. procedure for a sectional committee working on the standardization of plumbing equipment.

American Society for Steel Treating, W. H. Eisenman, secretary, 7016 Euclid Avenue, Cleveland, Ohio. Technical committees of the society are now at work on the following subjects: Tool steel; measuring case depth; heat treatment of carbon-steel gears; hardness testing of metals; mechanism of cementation; steel castings; relation of design to heat treatment; heat treatment of spring steels; heat treatment of spline shafts; heat treatment, heading and roll threading of bolts and nuts; cold-drawing of steel; and macro etching. The society is represented on the joint committee on defini-

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tions of terms relating to heat treatment (with the American Society for Testing Materials and the Society of Automotive Engineers), and other cooperative committees of these societies and the American Society of Mechanical Engineers, National Research Council, United States Bureau of Mines, the National Bureau of Standards, the War Department, and the institute of metals division of the American Institute of Mining and Metallurgical Engineers.

American Society for Testing Materials. (See Ch. VIII, p. 280.)

American Specification Institute, Gardner C. Coughlen, acting executive secretary, 160 North La Salle Street, Chicago, Ill. As an important step in the development of standardized specifications to accompany drawings for building construction and equipment, the institute issues the Specification Record, comprising bulletins, specifications, outlines of specifications, and other correlated data. Specifications and information collected by the institute from other organizations and sources are made available for the use of institute members by actual distribution in the form of bulletins and the Specification Record.

American Standards Association. (See Ch. VIII, p. 275.)

American Surgical Trade Association (Inc.), F. B. Hovey, secretary, 38 South Dearborn Street, Chicago, Ill. Although this association has not adopted any standards, it has inaugurated a standardization program by appointing a committee on simplified practice.

American Veneer Package Association, Robert W. Davis, secretary, 900 F Street, NW., Washington, D. C. This association was active in the enactment of the hamper and basket law passed at the last session of Congress. This law established standard sizes of fruit and vegetable hampers and baskets.

American Vitrified China Manufacturers' Association, Arthur E. Mayer, president, care of Mayer China Co., Beaver Falls, Pa. This association has taken an active part in the elimination of excess sizes and varieties of chinaware under the auspices of the division of simplified practice, having cooperated in the initiation and formulation of simplified practice recommendations relating to chinaware for hotels, dining cars, hospitals, cafeterias, and restaurants.

American Walnut Manufacturers' Association, George N. Lamb, secretary, 616 South Michigan Boulevard, Chicago, Ill. The association's inspection rules committee is studying the effects upon the products of the members of the industry of the proposed new method of grading hardwood lumber. Its veneer committee is investigating the possibilities of standardizing methods of manufacture and classification of walnut veneers.

American Warehousemen's Association, W. M. O'Keefe, executive secretary, cold-storage division, 222 West Adams Street, Chicago,

Ill. Through its committee on simplification of forms and methods the association initiated the movement which resulted in the preparation of the simplified practice recommendation relating to warehouse forms. It is now conducting a survey which will probably result in the revision of certain forms that have heretofore been recommended for use in the cold-storage industry.

American Water Works Association, Malcolm Pirnie, chairman, committee on waterworks practice, 25 West Forty-third Street, New York, N. Y. The association has organized committees to deal with private fire-protection services, standard specifications for water meters, standard brass fittings and standard form of contract, and is officially represented on the American Committee of Electrolysis. Eleven committees are now functioning in preparing material for a revised edition of the Manual of Waterworks Practice, as follows: Methods of water analysis, practicable loadings for purification processes, industrial wastes in relation to water supply, pumping stations, distribution, standard specifications for cast-iron pipe and specials, service connection practice, filter-sand testing and recording, boiler feed-water studies, steel standpipes and water towers, and steel pipe lines. In cooperation with the American Public Health Association, the American Water Works Association publishes Standard Methods of Water Analyses, the sixth edition of which was issued in 1925. In cooperation with four other organizations, the association is making a study of boiler feed-water problems. The association is joint sponsor for two standardization projects under the American Standards Association, as follows: Specifications for cast-iron pipe and special castings (with three other organizations), and screw threads for fire-hose couplings (with the American Society of Mechanical Engineers and the National Board of Fire Underwriters).

American Waxed Paper Association, Paul S. Hanway, manager, 342 Madison Avenue, New York, N. Y. This association is developing a program of standardization and simplification relating to sizes, weights, and quality of paper for bread wrappers, lunch rolls, and other commodities produced by waxed-paper manufacturers. It has adopted standard schedules for packaging, thereby eliminating a great many odd and off sizes.

American Welding Society, M. M. Kelly, secretary, 29 West Thirty-ninth Street, New York, N. Y. This society has organized the American Bureau of Welding to carry out its activities in the field of welding. The bureau controls all research and standardization, and also acts as the welding research department of the National Research Council. The society is cooperating with the American Society of Mechanical Engineers in the preparation of a code for pressure vessels and is serving as a conference committee on weld-

ing to the boiler code committee. It is also cooperating with the American Electric Railway Engineering Association in the preparation of welding-wire specifications and with the American Society for Testing Materials in the preparation of specifications for fusion welding. Committees of the society are now engaged in the work of standardization of nomenclature, definitions and symbols, and on building codes.

American Wood-Preservers' Association, H. L. Dawson, secretary, 228 North La Salle Street, Chicago, Ill. All standards and specifications approved by the association, which now number 41, are published in a Manual of Recommended Practice. Reports relating directly or indirectly to the revisions of old material in, and the addition of new material to, the manual will be presented by committees at the 1929 annual meeting, on the following subjects: Preservatives, preservative treatments, inspection, tie-service records, pole-service records, posts, and research. The association is represented on the National Committee on Wood Utilization, and on the joint committee to determine the strength of Douglas fir with relation to moisture content (with the American Railway Engineering Association, the United States Forest Products Laboratory, and the west-coast lumber producers).

American Zinc Institute, Stephen S. Tuthill, secretary, 27 Cedar Street, New York, N. Y. Standardization activities of the institute are confined to cooperation with other organizations, especially the American Standards Association and the American Society for Testing Materials. It is joint sponsor with the A. S. T. M. for the A. S. A. sectional committee on zinc and zinc ores and is officially represented on the A. S. A. zinc-coating sectional committee under A. S. T. M. sponsorship.

Arkansas Soft Pine Bureau, B. Greaves, assistant secretary, Boyle Building, Little Rock, Ark. This association's rules for soft-pine lumber conform to the American lumber standards for yard and finishing lumber. It has adopted the wood moldings and universal sizes formulated under the auspices of the Central Committee on Lumber Standards. All stock shipped by the member mills of this association is trade-marked with the registered symbol of the bureau, and grade marked in accordance with the recommendations of the United States Department of Commerce.

Artistic Lighting Equipment Association, Granville P. Rogers, managing director, 420 Lexington Avenue, New York, N. Y. The association's standardization committee is now considering the advisability of standardizing wiring devices in use in the lighting-equipment industry; also the standardization of outlet boxes in accordance with the new national electrical code. A special committee

is beginning work on standard specifications for architects' use in connection with lighting equipment.

Ash Handle Association, C. E. Bell, secretary, care of La Fontaine Handle Co., Decatur, Ind. This association has adopted grading rules for ash handles for forks, hoes, rakes, shovels, and similar implements. Its cooperative work with other organizations is carried out under the auspices of the National Association of Wood Turners.

Asphalt Association, The, J. E. Pennybacker, secretary, 441 Lexington Avenue, New York, N. Y. Practically all of the standardization work of this association is carried on in cooperation with interested organizations, principally the American Society for Testing Materials, the American Society for Municipal Improvements, and the division of simplified practice of the United States Department of Commerce in connection with the elimination of unnecessary grades of asphalt. Through its technical advisory committee the association has issued and recommended for general use among State, county, and city officials the following standards: Asphalt macadam surface course, asphaltic concrete surface course (coarse and fine graded aggregate types), sheet-asphalt binder and surface course, asphaltic base, and asphaltic concrete base. In addition it has also prepared and issued 10 tentative specifications relating to asphalt materials and methods of construction. In cooperation with the Association of Asphalt Paving Technologists the association is conducting research which will tend toward standardization of certain details of paving-mixture design. Work is going forward on the development of a standard test for measuring and controlling the stability of asphalt paving mixtures.

Asphalt Shingle and Roofing Institute, J. S. Bryant, manager, 2 West Forty-fifth Street, New York, N. Y. Although the institute has formulated no specifications, members of the institute have cooperated actively with the Underwriters' Laboratories, the Federal Specifications Board, and the American Society for Testing Materials in the preparation of specifications for roofing products. All of the members of the institute, by official unanimous resolution, have signified their willingness to supply asphalt and roofing materials complying with United States Government master specifications.

Associated Cooperage Industries of America, The, C. G. Hirt, secretary-treasurer, B–20 Railway Exchange Building, St. Louis, Mo. Included among the various activities of the association are the establishment and maintenance of uniform grades for barrel material and standard specifications for various types of cooperage. It has been cooperating with the Freight Container Bureau regard-

ing the standardization of slack barrels for packing glass tableware, and the recommendations submitted have been approved. It has also cooperated with the Bureau of Explosives on tight barrels. The traffic department of the association handles all matters pertaining to the transportation of cooperage and takes necessary steps in protecting the traffic interests of its members. An inspection service is maintained to pass upon the quality of cooperage material, in accordance with the established grade rules and specifications, at either the mill yard or destination. It is furnished on the request of members when made in compliance with the association's inspection rules. At the present time the association is undertaking the standardization of tight barrels and kegs, and it is cooperating in the formulation of simplified practice recommendations for sizes of tierces for the packing of vegetable shortening.

Associated Factory Mutual Fire Insurance Companies, Inspection Department, H. O. Lacount, consulting engineer, 184 High Street, Boston (9), Mass. The association has formulated and published a large number of specifications for hazardous-process safeguards, water-supply equipment, sprinkler systems, fire-protective appliances, etc. Manufacturing firms are permitted to use the association's identification mark of approval on devices specifically approved by the association as to both design and construction. The inspection department also issues a semiannual list of its approved appliances and a monthly publication covering the loss experience of the Factory Mutual Companies and matters of special interest from the standpoint of fire safety. The association cooperates with the American Society for Testing Materials and the National Bureau of Standards in standardization in fire-protection engineering. As a member of the fire-protection group the association is joint sponsor (with the American Society for Testing Materials) for a sectional committee on rubber-lined fire hose, functioning under the American Standards Association.

Associated General Contractors of America (Inc.), D. A. Garber, general manager, Munsey Building, Washington, D. C. This association conducts its standardization work principally in cooperation with various groups, including manufacturers, engineering and architectural societies, and such agencies as the American Standards Association, Federal Specifications Board, United States Department of Commerce, and the Joint Conference on Construction Practices. It has developed or approved the following list of standards: Concrete mixers; contracts for engineering, building, and municipal construction; cost plus a fee contract; proposal form for private building; equipment rental agreement; depreciation of construction machines; highway estimate forms; building estimate

forms; equipment accounting forms; questionnaires for investigating bidders; and contractors financial statement. Standard concrete mixers carry a name plate designating that they comply with A. G. C. standards, which assures the purchaser of definite capacity and a satisfactory degree of performance. The manufacturers enter into agreement with the association to abide by the standards and, if they fail to do so, may be denied the use of the plates. Other lines of equipment under consideration for standardization are hoists and derricks, steam shovels, and wheelbarrows. The association has given its approval to practically all of the recommended practices of the United States Department of Commerce pertaining to construction materials. It is working in cooperation with the Bureau of Internal Revenue of the United States Treasury Department to establish standard methods of handling depreciation on construction equipment. Tentative recommendations have been formulated, and the adoption of the standard in the near future is expected.

Associated Knit Underwear Manufacturers of America, Roy A. Cheney, secretary, Union Station, Utica, N. Y. The association has adopted a standard method of testing the breaking strength of knitted fabrics and washing instructions for knit rayon underwear and knit wool and wool-cotton underwear. A committee of the association cooperating with the Federal Specifications Board recommended certain specifications for men's undershirts and men's underdrawers. The most important project of the association has been the development of standard sizes and methods of measuring for the various types of knit underwear. Up to the present time it has adopted 34 size specifications covering types of men's, boys', and women's knit underwear. It has also tentatively adopted certain symbols for designating different models of knit underwear, and it is investigating the effect of twist in cotton yarn upon shrinkage of knitted fabrics made of this yarn. The association has adopted a standard mark protected by law, to be used by manufacturers on garments made to measurements certified to conform to tables compiled by the National Bureau of Standards under license from the association. A committee composed of jobbers, retailers, and manufacturers has the right to revoke the license upon due proof that the use of the standard mark has been willfully abused. Its future work will consist in the elimination of unnecessary sizes of boxes used in packing underwear, and it is expected shortly to adopt five or six sizes of boxes for all types of men's and boys' knit underwear.

Associated Metal Lath Manufacturers, Wharton Clay, commissioner, 1821 Engineering Building, Chicago, Ill. Standardization activities of the association have been confined largely to the elim-

ination of excess varieties and sizes of metal lath through the division of simplified practice of the United States Department of Commerce. It has published a pamphlet dealing with safety from fire, in which are included certain recommended building ordinances. It has also published specifications for metal-lath construction, a solid-partition handbook, and a number of pamphlets regarding plaster and stucco.

Associated Tile Manufacturers, M. A. Illing, secretary, 420 Lexington Avenue, New York, N. Y. This association initiated the movement which resulted in the development of the simplified practice recommendation relating to white glazed tiles and unglazed ceramic mosaic, including a color scheme for grade marking and the issuing of package grade or master grade certificates. It has issued a publication having the title Basic Specifications for Tiles and Tile Work.

Associates for Government Service (Inc.), E. Stagg Whitin, president, 730 Fifth Avenue, New York, N. Y. One of the important functions of the organization is to assist State and city governments in coordinating their purchases under selected-commodity specifications. It is formulating specifications for commodities manufactured in the prisons of one State and sold to purchasing departments of other States. These specifications are developed as a result of actual durability tests made in institutions and guided by committees of institutional experts, practical housekeepers, and representatives of manufacturers. To supplement prison-made goods, the Associates for Government Service has compiled a list of manufacturers whose quality of merchandise and ability to deliver in conformity with specified requirements make them eligible to receive the association's certification. This certification is granted with conditions for inspection at the source of production and is subject to cancellation for failure in any way to live up to the specified requirements.

Association of American Soap and Glycerine Producers (Inc.), Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. The standardization activities of this organization are conducted by its glycerine group under the auspices of the Glycerine Producers' Association, one of the parts of the Association of American Soap and Glycerine Producers (Inc.).

Association of American Steel Manufacturers, J. O. Leech, secretary, care of Carnegie Steel Co., Pittsburgh, Pa. For 30 years the activities of this association have been devoted to standardization. It has issued specifications for structural and boiler steel, concrete reinforcement bars, rails, tie-plates, and bar steels. It has formulated standards of sampling and permissible variations for check

analysis and established permissible rolling variations for hot-rolled bars and bar sizes of angles, tees, zees, and channels. The association is represented on the joint committee on investigation of the effect of phosphorus and sulphur in steel (with 10 other organizations). It is a member of the American Society for Testing Materials and the American Standards Association, and has cooperated with these and other national standardizing bodies in promoting standard specifications.

Association of American Wood Pulp Importers, The, Edwin B. Ericksen, secretary, 347 Madison Avenue, New York, N. Y. This association is represented officially (with the American Paper and Pulp Association and the Technical Association of the Pulp and Paper Industry) on a joint committee to approve and govern the actions of commercial chemists engaged in the testing of wood pulp for the paper industry in the United States. This committee formulates rules for the weighing, sampling, and testing of wood pulp which is handled by chemists approved by the joint committee. The association is endeavoring to secure a uniform selling contract for wood pulp imported from Finland, Norway, Germany, and Sweden, which contract, upon proper ratification, will be used by all members of the association. A panel of six members has been selected from the association by the American Arbitration Association, to be drawn from in case of dispute within the trade. The association also maintains a traffic committee to seek the cooperation of various railroads, steamship companies, and storage warehouses in the establishment of a uniform procedure and uniform set of storage and rail freight rates from the seaboard to interior points where the pulp is consumed.

Association of Asphalt Paving Technologists, Charles A. Mullen, secretary-treasurer, 84 St. Antoine Street, Montreal, Canada. This organization, which is international in scope, has committees on present practice, research problems, subgrade problems, and professional practice. No recommendations for definite standards have as yet been formulated.

Association of Dairy, Food, and Drug Officials of the United States, W. C. Geagley, secretary, Lansing, Mich. The membership of this organization, which is usually called "The Association of Food Officials," is restricted to individuals officially attached to Federal, State, county, or municipal departments or units legally responsible for the enforcement of regulatory dairy, food, and drug laws. It has made recommendations for definite standards to serve as guides for legislative action and proposals for sanitation in the production, manufacture, and distribution and sale of dairy, food, and drug products.

Association of Edison Illuminating Companies, Preston S. Millar, secretary, Eightieth and East End Avenue, New York, N. Y. This organization is joint sponsor for two sectional committees functioning under the American Standards Association, as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations) and rules for electricity meters (Code for Electricity Meters) (with the National Bureau of Standards and National Electric Light Association). It has recently revised a storage-battery manual which is in effect a code of storage-battery practice, and, in cooperation with the Illuminating Engineering Society, it is preparing specifications for residence-lighting luminaries. In cooperation with the National Electric Light Association and the National Bureau of Standards, it has revised during the past year the third edition of the Code for Electricity Meters. As a member of the electric light and power group it is sponsor for the sectional committee on miscellaneous line materials.

Association of Electragists, International, Laurence W. Davis, general manager, 15 West Thirty-seventh Street, New York, N. Y. This association's standards committee has undertaken the compilation of complete standards for electric-wiring installations, about one-half of which has been completed. It is joint sponsor with the American Institute of Architects and the American Institute of Electrical Engineers for a sectional committee on symbols for electrical equipment of buildings, functioning under the American Standards Association.

Association of Feed Control Officials of the United States, L. E. Bopst, secretary-treasurer, College Park, Md. This association has adopted a uniform feed law which is being used as a model for adoption by the various States. Its yearbook contains the definitions and standards, uniform registration forms, uniform labels for different types of feeding stuffs, recommendations for labeling, and registration of mineral mixture feeds that have been adopted by the association, as well as other information relating to the work of the association. It cooperates with the Federal Specifications Board in the formulation of the United States Government master specifications for feeds and forage.

Association of Governmental Labor Officials of the United States and Canada, Louise E. Schutz, secretary, 612 Bremer Arcade, St. Paul, Minn. Standardization activities of this association have been confined largely to the formulation and promulgation of industrial safety codes. It has organized a standing committee, with the United States Commissioner of Labor Statistics as chairman, to formulate a standard plan for compiling industrial statistics to

assist in accident prevention. It has urged the adoption by the State departments of the safety codes developed in cooperation with the American Standards Association. The association is joint sponsor, with the Laundryowners' National Association of the United States and Canada and the National Association of Mutual Casualty Companies, for the sectional committee on safety code for laundries functioning under A. S. A. procedure.

Association of Iron and Steel Electrical Engineers, John F. Kelly, business manager, Empire Building, Pittsburgh, Pa. This association has formulated and adopted rules for the safe operation of electric overhead traveling cranes and engine stops. It also has adopted standard specifications for electric overhead traveling cranes, main roll drive motors, and mill-type motors for driving steel-mill auxiliaries. Standard dimensions for ball and roller bearings, used in steel-mill motors, have also been adopted, making it possible to interchange any of the several makes of antifriction bearings in a standard motor. The safety committee of the association will develop rules for the installation and safe handling of high-tension switches and transmission lines.

Association of Manufacturers of Chilled Car Wheels, G. E. Doke, president and secretary, McCormick Building, Chicago, Ill. This association has adopted specifications for chilled-tread wheels for standard railway and industrial service and has cooperated with the American Railway Association, mechanical division, in the formulation of specifications for chilled-tread wheels for locomotives, tenders, and cars. It has adopted specifications for foundry standard, inspection, and tests for chilled-tread wheels; a uniform cost-accounting system; and a uniform guaranty for 33-inch chilled-tread car wheels. The association is cooperating with the American Railway Association in the development of standards for railway chilled-tread wheels. The association maintains a corps of inspectors who make semiannual inspections of its 58 member foundries to encourage and facilitate the use of the specification for foundry standard, inspection, and tests for chilled-tread wheels.

Association of Official Agricultural Chemists, The, W. W. Skinner, secretary, P. O. box 290, Pennsylvania Avenue Station, Washington, D. C. One of the important functions of this association is the formulation of standards and methods of analysis for agricultural products and other materials used in the agricultural industry. Representatives serve, with members of the Association of Dairy, Food, and Drug Officials of the United States and of the United States Department of Agriculture, on the Joint Committee on Definitions and Standards for Food Products. The association

cooperates with the American Public Health Association in the preparation of standard methods of milk analysis, and with the committee on revision of the United States Pharmacopœia on methods of tests for medicinal products. This association has published a book of methods of analysis, and these methods are accepted as authoritative in matters at issue before the Federal and State courts.

Association of Railway Electrical Engineers, J. A. Andreucetti, secretary, Chicago & North Western Terminal, Chicago, Ill. The association has adopted performance specifications for short-time-duty electric motors and has prepared recommendations concerning the operation of train lighting, locomotive lighting, train-control equipment, manual on standard illumination for railway buildings and standardization of electric construction and maintenance practice, and electric welding and heating practice. It is joint sponsor, with nine other organizations, for the sectional committee on insulated wires and cables for other than telephone and telegraph use functioning under American Standards Association procedure.

Better Bedding Alliance of America, S. J. Mills, secretary, 608 South Dearborn Street, Chicago, Ill. Among the stated objects of this association is the encouragement of exact, truthful labeling of the filling contents of bedding and the discouragement of any misrepresentation of the product. It is engaged in eliminating the use of secondhand, unsanitary filling materials in bedding. To prevent public deception and unfair competition, it is promoting the passage of sanitary bedding laws which empower State inspectors to inspect bedding factories to insure that each article of bedding is correctly labeled as to the kind of filling material used and as to whether it is new or previously used. The sanitary bedding laws have already been passed in 31 States. It cooperated in the establishment of recognized types and sizes of beds, springs, and mattresses under the auspices of the division of simplified practice. This organization has recently appointed a committee to establish a standard name for each material used to fill mattresses, or put them in groups with standard names. It will also put mattress and pillow filling materials into two groups, under the headings of "new materials" and "previously used materials."

Biscuit and Cracker Manufacturers' Association of America, Technical Bureau, A. A. Schaal, director, Dunwoody Institute, Minneapolis, Minn. Through its technical bureau, and committees of various other associations, this organization is engaged in standardization work relating to high-quality raw materials and delivered products.

Bolt, Nut, and Rivet Manufacturers' Association, Evans Ward, chairman, standardization committee, care of Russell, Burdsall &

Ward Bolt & Nut Co., Port Chester, N. Y. This association has adopted dimensional standards covering the heads of rivets, machine bolts, and plow bolts, and also standards for both square and hex nuts. In addition, it initiated the movement which resulted in the formulation of the Simplified Practice Recommendation No. 60 relating to the packing of carriage, machine, and lag bolts.

Building Officials' Conference of America, Robert Knight, president, 702 City Hall, Chicago, Ill. The membership of this organization includes the building officials of the principal cities throughout the country. The interest of the organization in standardization is in connection with materials used in building construction, devices and appliances used in connection with building operations, matters of workmanship or manufacture, the safety of workmen and of the public in and about buildings under construction, the sufficiency of exits from buildings, and building requirements or regulations in general. It has been active in connection with the standardization requirements for lime, stucco, and hollow and solid building units. In 1926 reports were prepared on wall board and on steel joists. Plans have been formulated for the preparation of a standard building code covering the fundamentals of building regulations.

Bureau of Envelope Manufacturers of America, Charles R. Stevenson, secretary-treasurer, 19 West Forty-fourth Street, New York, N. Y. This association has functioned from time to time as a committee of the whole industry, in cooperation with nonmember companies, to establish standard substance number bases for paper for envelopes, standard nomenclature and sizes of envelopes, and standard tolerances for overruns and underruns on customers' orders.

Bureau of Explosives, Col. B. W. Dunn, chief inspector, 30 Vesey Street, New York, N. Y. This bureau functions as an agency for cooperation between the Interstate Commerce Commission and the American Railway Association so far as concerns the standardization of containers for explosives and other dangerous articles. The bureau maintains a chemical laboratory for the study of explosives and containers, and a force of traveling inspectors to insure compliance with the requirements of the specifications.

Bureau of Railway Economics, J. H. Parmelee, director, Transportation Building, Washington, D. C. The bureau is an organization maintained by the railways for the scientific study of transportation problems. It carries on no standardization work of its own, but, as a fact-finding body, it cooperates with the American Railway Association and the various railway committees charged with the specific duty of investigating, reporting, and recommending standardized materials and practices.

California Redwood Association, R. F. Hammatt, secretary-manager, 24 California Street, San Francisco, Calif. Standardiza-

tion work of this association is carried on in cooperation with the Central Committee on Lumber Standards and the National Lumber Manufacturers Association. It has issued grading rules which conform in essential particulars with American lumber standards.

California White and Sugar Pine Manufacturers Association, C. Stowell Smith, secretary, 600 Call Building, San Francisco, Calif. The grading and inspection rules adopted by this association for white and sugar pine, white and Douglas fir, and incense cedar are in conformity with the American lumber standards, which are maintained through the activities of the association's grading bureau. It has employed a corps of traveling inspectors to visit plants of the association members for the purpose of checking the grades and of instructing graders in standard grading practice.

Canners League of California, Preston McKinney, vice president and secretary, 215 Market Street, San Francisco, Calif. Fruit and vegetable standards formulated by committees of this organization have been widely adopted. The association has issued a new standards booklet which contains a list of the standards and additional information covering standard methods used by the members of the organization. During 1928 the association adopted standards relating to the following items: Fancy and choice fruits for salad, prepared prunes in sirup, and counts for fruit in the so-called 8-ounce cans. Pie fruit has been subdivided into pie and solid-pack pie, and the minimum drained weight for pie fruit has been indicated.

It has also added to the specifications for apricots special definitions to cover ripe apricots. Its standard contract for canned goods has been formally approved by the National Wholesale Grocers Association of the United States. During the past year the association has worked in cooperation with the National Canners Association in the adoption of tomato standards which are national in character but specifically cover the special features of California tomatoes.

Cast Iron Pipe Research Association, H. L. Campbell, chairman, 122 South Michigan Avenue, Chicago, Ill. Standardization work of this association is confined largely to its cooperation in the activities of the sectional committee on specifications for cast-iron pipe and special castings under the auspices of the American Standards Association, the compilation and publishing of existing standards and specifications of cast-iron pipe and the investigation, through its technical committee, of changes in the standardization and improvement in laying dimensions of various pipe and fittings, and the maintenance of a research associate on soil corrosion and electrolysis at the National Bureau of Standards.

Central Committee on Lumber Standards. (See Ch. VIII, p. 284.)

Certified Milk Producers Association of America (Inc.), Harris Moak, secretary, 360 Park Place, Brooklyn, N. Y. This association

makes use of methods and standards for the production and distribution of "certified milk," formulated and officially adopted by the American Association of Medical Milk Commissions (Inc.).

Chamber of Commerce of the United States of America, E. W McCullough, manager, department of manufacture, Washington, D. C. During the eight years of its existence this department has been cooperating actively with the United States Department of Commerce in the movement toward the elimination of waste in industry through standardization and simplification. Because of its friendly relations with business, the chamber of commerce has maintained contact with nearly 900,000 firms, corporations, and others engaged in business covering practically every avenue of industry. Through these relations with industry it has been able to act in a liaison capacity in bringing forward from time to time trade groups, both organized and unorganized, in which it has stimulated interest in the program for waste elimination. Many of these groups had arrived at the point where they were ready to reach a determination as to a simplified practice program. In the course of the past eight years many such groups have been brought in contact with the division of simplified practice and the work taken up from that point and carried on in many instances to successful consummation. The chamber of commerce has assisted the United States Department of Commerce in explaining to industry the service which it is rendering and has urged the need for cooperation in many lines of industry in order to carry on the work. It has suggested to many manufacturing groups concerned in the establishment of definite standards, both as to their materials and products, the advisability of maintaining contact with the National Bureau of Standards. In the past year the chamber of commerce has formed a trade-association department whose function is to assist in the organization of trade associations, trade institutes, and industrial concerns. The chamber of commerce is officially represented on the planning committee acting in an advisory capacity to the division of simplified practice.

Clay Products Association, George C. D. Lenth, secretary, 111 West Washington Street, Chicago, Ill. The association maintains a fellowship at Mellon Institute of Industrial Research, where studies are being made for improving processes of manufacturing vitrified salt-glazed clay sewer pipe, draintile, wall coping, segmental block, and flue lining. The association's committee on standardization has been in close cooperation with the National Bureau of Standards. In addition to having membership in technical organizations of various kinds, the association is a member of the American Society for Testing Materials and has adopted that society's specifications for clay sewer pipe and draintile.

Coal Mining Institute of America, H. D. Mason, jr., secretary, Ebensburg, Pa. This organization takes an active part in the mining standardization work going forward under the American Standards Association. It inaugurated the movement which resulted in the calling of the conference of coal producers, dealers, and consumers which recommended the formation of a sectional committee on the classification of coal based upon chemical and physical characteristics.

Commission on Standardization of Biological Stains, H. J. Conn, chairman, Agricultural Experiment Station, Geneva, N. Y. The commission is a cooperative organization (noncommercial) affiliated with the National Research Council and receives financial support from the Chemical Foundation. The following societies have official connection with it and are cooperating through its agency: American Association of Anatomists, Society of American Bacteriologists, Botanical Society of America, American Chemical Society, International Associaton of Medical Museums, American Association of Pathologists and Bacteriologists, and the American Society of Zoologists. It has formulated 43 specifications for biological stains. For batches of stains submitted to it and found satisfactory it issues certificates in the form of labels to be attached to bottles containing the stains.

Common Brick Manufacturers' Association of America, Ralph P. Stoddard, secretary, Guarantee Title Building, Cleveland, Ohio. In cooperation with the American Face Brick Association, this association submitted to the division of simplified practice the resolution which resulted in the conference at which the industry adopted a standard size for face brick and common brick. It also cooperated in the initiation of the work on the building-code committee of the United States Department of Commerce. It maintains a research associate at the National Bureau of Standards investigating the physical properties of different grades of brick and brick masonry. The association is also conducting tests of brickwork at other laboratories. When compiled, the data will be used by the American Standards Association in the preparation of a national code of good practice in brick masonry.

Compressed Gas Manufacturers' Association, Franklin R. Fetherston, secretary, 120 West Forty-second Street, New York, N. Y. Many standardization activities of this association are conducted under the auspices of the American Standards Association. With the International Acetylene Association, it forms the gas group of the A. S. A. The association also cooperates with the Bureau of Explosives in assisting the Interstate Commerce Commission in the preparation of specifications covering gas-transportation equipment.

Other standards for equipment used in the compressed-gas industry are also developed from time to time as association standards. It has formulated tentative rules for the safe handling and use of compressed-gas cylinders, and its executive board has recommended that the members adopt as standard practice the stenciling on each cylinder of the name of the gas contained therein. At the present time the association is developing standard threads for gas-cylinder valves.

Concrete Products Association, F. O. Matthiessen, executive secretary, 644 Drexel Building, Philadelphia, Pa. This association issues certificates of quality to its members when it is found that their products meet the requirements of the American Concrete Institute standards. Before a member can receive a certificate of quality, his product is tested by a representative of the association to ascertain whether or not it meets the requirements. These certificates are good for only the balance of the membership year, and renewals can be obtained only upon tests made of new specimens.

Concrete Reinforcing Steel Institute, M. A. Beeman, secretary, Tribune Tower, Chicago, Ill. This organization initiated the movement which resulted in the establishment of a simplified list of sizes of steel reinforcing bars and spiral rods under the auspices of the division of simplified practice of the Department of Commerce. It also has adopted one standard grade of billet steel for concrete reinforcement bars—the current intermediate grade of the American Society for Testing Materials. Standard forms for proposals and contracts have been adopted by the members of the institute to eliminate misunderstandings due to widely varying forms formerly used by the members. In cooperation with the American Concrete Institute it has prepared a joint building code for reinforced-concrete construction and has published a handbook for architects and engineers. It has five committees on the following subjects: Grades of steel and standard sizes, standard State mechanics' lien act, engineering practice, standard practice, and building code. It is working on the standardization of widths and depths of steel floor forms for use in ribbed-floor construction, in cooperation with various manufacturers of steel floor forms not members of the institute, and on the preparation of standard diagrams, tables, and explanatory matter for use in simplifying and standardizing the methods of design under the composite building code, in cooperation with the Portland Cement Association and the Rail Steel Bar Association.

Consolidated Classification Committee, R. C. Fyfe, chairman, 404 Chicago Union Station, Chicago, Ill. This committee is composed of the chairman of the official classification committee, the southern classification committee, and the western classification committee.

Under its auspices is prepared and published Consolidated Freight Classification, covering the ratings, rules, and regulations of the official, southern, and western freight classifications which are filed with the Interstate Commerce Commission, the Board of Railway Commissioners of Canada, and various State railway and public-service commissions. Included among the rules are specifications for freight-shipping containers, marking and packing of freight, and penalties for noncompliance therewith.

Converters' Association, Samuel M. Fisher, secretary, 291 Broadway, New York, N. Y. The association is endeavoring to eliminate the practice of misbranding merchandise by selling cotton goods as of fast color when in fact they are not fast, and to compile universal and standard definitions of the term "fast color" in its general application to different degrees of fastness and to fastness for different purposes, such as light, washing, etc., and making recommendations as to the best procedure to be adopted for the purpose of making the standards universal. It published a report classifying the various degrees of fastness of colors to light and washing, with simple tests for application in the event of controversy. The association has organized a gray-goods committee to clarify certain phases of trade practices and minimize the possibility of misunderstanding arising between representatives of the two branches of the cotton-goods trade. It is attempting to set more accurate limitations on the use of the word "seconds" as applied to cotton goods, so that the uncertainty now existing may be minimized as far as possible; to establish a more common practice in connection with the proper relationship of the amount of "seconds," if any, which should be permitted on a delivery under an order for "firsts"; and to establish a uniform gray-goods sales note which would prove equitable to buyer and seller alike. In cooperation with the National Association of Finishers of Cotton Fabrics, this association is engaged in the standardization of the methods employed by the finishers of cotton fabrics in connection with the return by the finishers to the converter of all stretch as well as damaged goods, and remnants of finished merchandise over 1 yard in length, and the establishment of this principle as a standard of conduct for the trade.

Copper and Brass Research Association, W. A. Willis, manager, 25 Broadway, New York, N. Y. The members of this association consist of copper-mining companies and copper and brass fabricating and distributing companies. The association and industrial units are represented on committees of the American Society for Testing Materials and are influenced by specifications adopted by that society. It is also represented on various committees of the American Society of Mechanical Engineers, American Society of

Civil Engineers, American Institute of Electrical Engineers, and many others interested in standardization. The association maintains two research associates at the National Bureau of Standards investigating copper roofing. Assistance is rendered by this association to private companies in the use of existing specifications.

Cordage Institute, J. S. McDaniel, secretary, 350 Madison Avenue, New York, N. Y. This organization has formulated and adopted standards for footage, nomenclature, and tensile strength of sisal, manila, java sisal, and other hard-fiber ply and yarn goods. It cooperated with the division of simplified practice in the simplification of sizes and put-ups of hard-fiber twines, resulting in the formulation of Simplified Practice Recommendation No. 92 relating to ply and yarn goods of hard fibers. A committee of the institute is working with the American Petroleum Institute in preparing standards of cordage used in oil-well production. Another committee is cooperating with the American Society for Testing Materials in the standardization of methods of tensile-strength testing and nomenclature of all hard-fiber products.

Cotton-Textile Institute (Inc.), The, E. C. Morse, in charge, new uses section, 320 Broadway, New York, N. Y. Practically all of the standardization and simplification work of this organization is conducted by the new uses section, whose function it is to develop and extend the use of standards. The institute has taken over the standardization and simplification activities of the National Council of American Cotton Manufacturers. Its work on standards is carried on chiefly in cooperation with other interested organizations. It cooperates with the Federal Specifications Board in the formulation of specifications for cotton and textile commodities. Members of the institute served on a committee composed of representatives of the American Hospital Association and the Association of Cotton Textile Merchants of New York, which selected the sizes of cotton textiles for beds, cribs, and bassinets set forth in Simplified Practice Recommendation No. 74 of the United States Department of Commerce. Consideration is being given to the adoption and acceptance of specifications for cotton cloths now in use by the Association of Pyroxylin Coated Fabrics Manufacturers. In cooperation with the Department of Commerce and the National Tent and Awning Manufacturers Association, preliminary plans have been formulated for the development of standards of performance and utility of tents, awnings, and tarpaulins. The institute has published a booklet advocating a standard length of bed sheet for the standard lengths of mattresses and beds. It maintains a research associate at the National Bureau of Standards developing standards for some of the many uses of cotton cloth.

Cover Paper Manufacturers Association, E. H. Naylor, secretary, 44 Vernon Street, Springfield, Mass. This association has adopted and promulgated certain trade customs relating to cover paper, including standard sizes and weights.

Douglas Fir Plywood Institute, William L. Rawn, secretary, 520 Washington Building, Tacoma, Wash. This institute, which was organized in 1928, is composed of manufacturers of Douglas fir plywood in the Pacific Northwest. Among its stated objects is the establishment of uniform grades and standards of products. Standard grading rules have been adopted by the institute and member mills, and an official inspection service is maintained to determine whether or not member manufacturers are adhering to the requirements of the grading rules adopted. Plans are being formulated by the institute for the establishment of a research laboratory to improve the product and methods of the industry.

Drill and Reamer Society, The, Herbert S. Blake, secretary-counsel, 120 Broadway, New York, N. Y. The standing committee on simplification and standardization is actively engaged in establishing proper standard basic mechanical sizes of drills and reamers to be listed in revised catalogues.

Eastern Clay Products Association, Henry T. Shelley, secretary, Colonial Building, Philadelphia, Pa. Two committess of the association deal with standardization matters—the standards committee and the Mellon Institute committee. It has published the following pamphlets: Standards of Manufacture of Salt-Glazed Vitrified Sewer Pipe and Fittings, Fire-Clay Flue Lining and Fittings, Stove Pipe and Fittings, and Wall Coping and Fittings; Comparative Tests Between Salt-Glazed Vitrified Sewer Pipe and Machine-Made Concrete Pipe; Sewage Disposal for Farms and Suburban Homes; Tests of Jointing Materials for Vitrified Clay Pipe; and Choice of Materials for Construction of Sewers. The association works in close harmony with the American Society for Testing Materials and has adopted that society's dimensions for sewer pipe, crushing strength, and methods of test. It has so standardized the product of its members that all of them produce sewer pipe or chimney flue lining which meet standard definite requirements.

Eastern Supply Association, Frank S. Hanley, secretary, 261 Broadway, New York, N. Y. This association, composed of plumbing and heating manufacturers and wholesalers, has actively cooperated with the division of simplified practice in the formulation of simplified practice recommendations relating to range boilers; brass lavatory and sink traps; hot-water storage tanks; staple vitreous-china plumbing fixtures; wrought-iron and wrought-steel pipe,

valves, and fittings; wrought-iron pipe nipples; and steel pipe nipples.

Electric Hoist Manufacturers Association, E. Donald Tolles, secretary, 165 Broadway, New York, N. Y. Specifications for portable overhead hoists so formulated as to be in harmony with the specifications of the American Institute of Electrical Engineers, the American Society for Testing Materials, and the former Electric Power Club (now the apparatus division of the National Electrical Manufacturers' Association) have been formally approved and promulgated by this association.

Electric Steel Founders' Research Group, R. A. Bull, director, 541 Diversey Parkway, Chicago, Ill. This group was organized in 1920 to carry on systematic, cooperative research work related to the most effective manufacture of small and medium sized steel castings made by the companies belonging to this group. The organization has, to a large extent, standardized more as to principles than as to equipment, and in so doing has for its own benefit adopted many procedures to the observance of which the members are committed. Among these are inspection standards governing the manufacture of group company products.

Elevator Manufacturers Association of the United States, John W. Ogren, commissioner, 100 West Monroe Street, Chicago, Ill. This association has adopted a uniform form of contract and forms for temporary and final acceptance of elevators. It has adopted as its standard the safety code for elevators, dumb-waiters, and escalators approved by the American Standards Association, and it assists in maintaining a research associate at the National Bureau of Standards, operating for the sectional committee on elevators. It maintains permanent committees for standardizing elevator engineering, for the standardization of manufacturing procedure, and the study of elevator-traffic problems.

Empire State Forest Products Association, A. B. Recknagel, secretary, State Bank Building, Albany, N. Y. This association has assisted in the formulation of and in obtaining adherence to the lumber standards as promulgated by the Central Committee on Lumber Standards.

Employing Bookbinders of America, general offices, 141 Broadway, New York, N. Y. (counsel, Alfred E. Ommen). In cooperation with the Binders' Board Manufacturers Association, this organization was instrumental in the adoption of standard sizes for binder's board set forth in simplified practice recommendation No. 81.

Fire Equipment Institute, Charles H. Meigs, commissioner, 17 East Forty-ninth Street, New York, N. Y. The institute is an international organization. Among its stated objects are the establishment

and maintenance of proper standards of materials, workmanship, sizes, efficiency, and high quality of all apparatus, equipment, and supplies manufactured by the industry; the promotion and protection to industry by using all just and legal methods for obtaining and enforcing fair and reasonable laws, ordinances, and regulations, and to oppose the passage of unfair and unreasonable regulations; and to cooperate with the National Bureau of Standards, the National Board of Fire Underwriters, the National Fire Protection Association, and other official bodies and individuals of recognized standing whose purpose is the reduction of fire losses. The institute is cooperating with the division of simplified practice in reducing the number of capacities of motor fire pumps. Manufacturers of fire-fighting equipment comprise the personnel of the institute, and their membership is contingent upon their compliance with the standards for fire-fighting equipment approved by the Underwriters' Laboratories and the National Board of Fire Underwriters.

Forged Tool Society, R. Kennedy Hanson, manager, Oliver Building, Pittsburgh, Pa. The society has adopted standard sizes of forged tools, established at a general conference called by the division of simplified practice at the request of this society. At the present time it is cooperating with the American Railway Engineering Association in the standardization of railroad-track tools.

Gas Products Association, Stuart Plumley, secretary and treasurer, 333 North Michigan Avenue, Chicago, Ill. The principal activity of the standardization committee of this association is to define the existing threads used upon oxygen and acetylene cylinder outlet valves and to set forth the details of each type of valve so that the design and the threading will be a matter of record for the entire industry.

Glass Container Association, H. L. Hunter, secretary of the standardization committee, 19 West Forty-fourth Street, New York, N. Y. This association's standardization committee sets up standards for the various types of finishes for glass containers in cooperation with the cap and closure and glass manufacturers. It has adopted 21 standard specifications. Its future work will consist in cleaning up on the few remaining types and finishes for closures being manufactured and reviewing the standards that have been set up from time to time to make them conform with present-day operations.

Glycerine Producers' Association, Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. A glycerin research committee and a glycerin trade practice committee have been organized by the association. The glycerin research committee, composed of chemists representing the principal producers, adopted specifications for all grades of refined glycerin which have been

approved by the board of directors and agreed to by the glycerin trade practice committee. Steps are being taken to insure that the specifications as finally approved will be in agreement with the United States Government master specification for glycerin now under preparation. Specifications for crude glycerin are to be considered later. Members of the association that follow the association's formula in manufacturing radiator glycerin are permitted to use the association's seal as a label to indicate the quality of their radiator glycerin. Periodic tests of the radiator glycerin manufactured by member companies using the association seal are made by the association's laboratories in order to assure the public that the association's formula is being followed.

Grain Dealers National Association, Charles Quinn, secretary, 321 Gardner Building, Toledo, Ohio. This association has adopted a standard set of trade rules governing all transactions between members of the association, both direct and affiliated which is used as a basis for the arbitration of differences arising among the members. The standard grades of grain advocated by this organization are those prepared by the United States Department of Agriculture in accordance with the grain standards act passed by Congress. In its effort to insure adherence to these standards by its members, the association has written into its by-laws a clause according to which any member found guilty by the Department of Agriculture of a violation of this act stands expelled automatically from the association, and notice of the expulsion is published in the association's official organ.

Gray Iron Institute, Arthur J. Tuscany, manager, Terminal Tower Building, Cleveland, Ohio. This institute, which was organized in 1928, is planning to standardize gray-iron castings, moldings, shapes, and foundry machinery.

Grinding Wheel Manufacturers Association of the United States and Canada, F. R. Henry, secretary, Summit Street and Negley Place, Dayton, Ohio. The association has adopted standard shapes for grinding wheels and attachments established at a general conference called by the division of simplified practice at the request of this association. It is joint sponsor with the International Association of Industrial Accident Boards and Commisions for the sectional committee on safety code for abrasive wheels, functioning under American Standards Association procedure.

Gypsum Institute, The, W. J. Fitzgerald, secretary, 110 West Fortieth Street, New York, N. Y. This organization, formerly known as the Gypsum Industries, cooperated in the initiation of the work of the Building-Code Committee of the Department of Commerce. In cooperation with the American Society for Testing

Materials' committee on gypsum, this organization has adopted nine standard specifications. A subcommittee on stresses in gypsum is having tests conducted at the National Bureau of Standards on gypsum fiber concrete and neat material with a view to having these stresses standardized.

Hack Saw Manufacturers Association of America (Inc.), William P. Jeffery, managing director, 14 Wall Street, New York, N. Y. In cooperation with the division of simplified practice, this organization has been instrumental in the formulation of the simplified practice recommendation relating to sizes of standard tungsten-steel and carbon-steel hack-saw blades. It has also established standard sizes of high-speed steel blades which have been adopted by the industry.

Hardwood Interior Trim Manufacturers Association, William R. Friedel, secretary, 63 South Third Street, Memphis, Tenn. This association has promulgated standard grading rules for hardwood interior trim and molding in cooperation with the National Hardwood Lumber Association. It maintains an inspection service covering hardwood interior trim and molding. The association has adopted the American standard designs and sizes of moldings, prepared under the auspices of the Central Committee on Lumber Standards.

Hardwood Manufacturers Institute, J. H. Townshend, executive vice president, Bank of Commerce Building, Memphis, Tenn. This organization, which is composed of producers of hardwood lumber, is officially represented on the National Committee on Wood Utilization, the Central Committee on Lumber Standards, and the Consulting Committee on Lumber Standards. It has advocated the adoption of a uniform sales code to govern differences arising in all lumber transactions, and its provisions are being generally observed by the member mills of the institute. In cooperation with the National Hardwood Lumber Association, it has formulated grading rules covering specifications for the measurement and inspection of hardwood lumber.

Heating and Piping Contractors National Association, Henry B. Gombers, secretary, 50 Union Square east, New York, N. Y. The association has adopted the following engineering standards: Method of figuring radiation, method of selecting boilers, and sizes of pipe for various types of steam-heating systems. This latter standard was formulated in cooperation with the American Society of Heating and Ventilating Engineers. It has developed a standard method for determining the output of boilers and has published data on the selection of boilers. The special committee on certified heating has developed a national program for certified heating to replace the purely local programs formerly in use. For the purpose of indicating to the purchaser that his heating plant has been designed and

installed in compliance with recognized engineering standards, the association has adopted a national insignia and certificate, and also a boiler plate for the identification of certified heating plants. At the present time a special committee is engaged in standardizing the practice of welding in the heating industry. A committee, composed of representatives of this association and the American Society of Heating and Ventilating Engineers, is carrying on work relating to pipe sizes for hot-water heating systems. This organization has cooperated with the division of simplified practice in the elimination of the steam-pipe radiator, surplus pipe sizes, and the simplification of hack-saw blades. It has completed work for the determination of roughing-in dimensions for radiator supply valves (angle type), for modulating radiator valves (angle type), and for return-line vacuum valves (one-half-inch angle type). Dimensional standardization has also received considerable attention. It is a joint sponsor (with the American Society of Mechanical Engineers and the Manufacturers Standardization Society of the Valve and Fittings Industry) for the sectional committee on standardization of pipe flanges and fittings functioning under the American Standards Association.

Hickory Handle Association, Guy E. Basye, secretary, care of W. E. Bruner & Sons, Heber Springs, Ark. This association and the National Association of Wood Turners (Inc.), with which it is affiliated, have been active in standardizing the grading of hickory handles under the auspices of the division of simplified practice. It has employed a traveling inspector for the purpose of helping each plant to grade hickory handles strictly in accordance with the recommendation. During the past year, at the request of this association, the Federal Trade Commission called a conference composed of manufacturers of handles to consider the establishment of standard rules which could be regarded as fair trade practice in grading.

Hollow Building Tile Association, The, Edward C. Kerth, secretary, Engineering Building, Chicago, Ill. In cooperation with the National Bureau of Standards this association has conducted research work relating to hollow tile and its uses and research on manufacturing problems, the results of which are embodied in the reports and publications issued by the association. Three research associates maintained at the National Bureau of Standards have completed an elaborate program of fire tests on load-bearing tile walls in a series of tests extended over seven years and involving experiments on 168 test panels. The association also maintains contacts at the ceramic plant and engineering experiment station at the Ohio State University, for research on clays. The association has arranged with laboratories throughout the country to make tests

on hollow building tile in accordance with the standard method recommended by the National Bureau of Standards. It has assisted in the work of the Building-Code Committee of the Department of Commerce on the following reports: Recommended Minimum Requirements for Small-Dwelling Construction and Recommended Minimum Requirements for Masonry-Wall Construction. Its standards committee has been active in the formulation and adoption of minimum standard sizes for hollow building tile contained in the division of simplified practice recommendation for this commodity. It has also issued the following standards: Compressive and transverse strength of hollow-tile walls, transmission and absorption of sound by some building materials, recommended practice for arrangement of building codes, and tests of hollow tile and concrete slabs reinforced in one direction. The association has cooperated with committees of the American Society for Testing Materials in the formulation of standards for tile.

Hollow Metal Door and Trim Manufacturers' Association, Charles F. Burt, secretary, Union Trust Building, Cleveland, Ohio. This association has worked out the standardization of cylinder locks for hollow metal doors in cooperation with the builders' hardware manufacturers, the American Institute of Architects, and the United States Department of Commerce, while a project for standardization of door sizes and types is just being undertaken in cooperation with The National Fireproof Door Manufacturers' Association and the Department of Commerce. A project for standardization of template procedure has practically been completed in cooperation with the builders' hardware manufacturers and the Department of Commerce, while a project for standardization of symbols and schedules is just getting under way in cooperation with the builders' hardware manufacturers, The National Fireproof Door Manufacturers' Association, the Department of Commerce, and other interested organizations.

Horological Institute of America (Inc.), Paul Moore, executive secretary, care of National Research Council, Washington, D. C. Among the stated objects of the institute, which was organized by the National Reasearch Council, are the development of standards for horological schools and the establishment of a system of varying attainments for watchmakers. It gives examinations to watchmakers in both the theory and practice of watch repairing and grants certificates to those passing its requirements.

Horse Association of America, Wayne Dinsmore, secretary, Union Stock Yards, Chicago, Ill. In connection with its work to encourage the use of horses and mules, this association has developed certain standard hitches for 4, 6, 8, 10, and 12 animals, designed along

sound engineering lines for obtaining maximum results at the lowest possible cost.

Hydraulic Society, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. As a trade association representing the principal manufacturers of pumps in the United States, the society cooperates with all trade associations and technical and commercial organizations with which the pump industry has problems in common. The society recommends standard definitions, terms, and practices where such action appears to be feasible. The recommended standards are published in a "standards" pamphlet, which is now in its fourth edition.

Illuminating Engineering Society, A. B. Oday, general secretary, 29 West Thirty-ninth Street, New York, N. Y. The standardization work of the society is carried on by four committees functioning as sectional committees under the American Standards Association, with the society serving as sponsor or joint sponsor, as follows: Code of lighting factories, mills, and other work places; code of lighting school buildings (with the American Institute of Architects); automobile headlighting specifications—laboratory tests for approval of electric headlighting devices for motor vehicles (with the Society of Automotive Engineers); and illuminating engineering nomenclature and photometric standards. All of these codes, specifications, and standards have been officially approved as American standards. The various sponsoring committees are at the present time conducting a program to assist in the adoption and use of the standards approved by the society. By questionnaires issued from time to time efforts are made to learn whether or not the requirements are being complied with in various localities. The society is serving as joint sponsor (with the Association of Edison Illuminating Companies) for specifications for residence-lighting luminaries.

Institute of American Meat Packers, W. W. Woods, executive vice president, 506 South Wabash Avenue, Chicago, Ill. Through its committee on packing-house practice and research, the following commodities have already been standardized by the institute: Lard cans; sausage, lard, and sliced-bacon cartons; cheesecloth and muslin; paper; nailed wooden crates and boxes; hand trucks; beef and pork trolleys; woodenware and cooperage; truck bodies; ropes and twines; 6-pound tins for jellied products; sizes of paper for wrapping smoked meats of various weights; brushes; containers for 1-pound lard cartons; 37-pound square export lard cans; 1,500-pound curing vats; and standard packs for sliced bacon. The institute conducts a central research laboratory which is supported by the member companies. Its department of scientific research is now engaged in the problem concerning, among other subjects, the curing

and conservation of meats. It is planning to standardize scrapple pans.

Institute of Paint and Varnish Research, Henry A. Gardner, director of laboratory 2201 New York Avenue, NW., Washington, D. C. The institute has issued nearly 400 articles on the subject of paint, varnish, color, and lacquers. It has also issued several textbooks, including one entitled "Physical and Chemical Examination of Paints, Varnishes, Lacquers, and Colors." This book contains all modern methods of testing the above-named products and includes all the latest United States Government master specifications for paint and varnish materials. The institute conducts the research work for the American Paint and Varnish Manufacturers' Association, works in harmony with the National Bureau of Standards on research problems, and cooperates with the Federal Specifications Board in preparing specifications for paint and varnish.

Institute of Radio Engineers, Alfred N. Goldsmith, secretary, 37 West Thirty-ninth Street, New York, N. Y. This institute has adopted standard terms and graphical symbols used in radio engineering. Its committee on standardization is undertaking the formulation of standard methods of testing radio apparatus, particularly those used in radio-broadcast reception. The committee is conducting its work through five subcommittees covering the following subjects: Vacuum tubes, circuit elements, receiving sets, electroacoustic devices, and power supply. The institute is joint sponsor with the American Institute of Electrical Engineers for a sectional committee on radio under American Standards Association procedure. It is a member of the National Fire Protection Association and is represented on the radio advisory committee of the National Bureau of Standards.

International Acetylene Association, A. C. Morrison, secretary, 30 East Forty-second Street, New York, N. Y. This organization cooperates with the Underwriters' Laboratories in the formulation of standards for the construction of acetylene generators and consuming equipment, and with the National Board of Fire Underwriters in the preparation of regulations for the installation and operation of such equipment. This association and the Compressed Gas Manufacturers' Association form the gas group of the American Standards Association.

International Apple Shippers' Association, R. G. Phillips, secretary, 1108 Mercantile Building, Rochester, N. Y. In cooperation with the National League of Commission Merchants of the United States, the Western Fruit Jobbers' Association of America, the American Fruit and Vegetable Shippers' Association, and other groups, this association has formulated standard rules and definitions of trade terms for the fruit and vegetable industry. It was

particularly active in connection with the enactment of the United States apple grading law approved August, 1912; the national standard barrel law in effect July 1, 1916; the United States standard container act approved August 31, 1916; the standard hamper and basket act in effect May 21, 1928; the New York State apple grading law enacted in 1915; other State grading laws, Federal grades, and other pioneer measures relating to the standardization of fruits and vegetables.

International Association of Electrotypers of America, George C. Stock, field secretary, Leader Building, Cleveland, Ohio. Two of the main activities of this association lead directly to standardization. One is a uniform method of determining the cost of producing electrotypes, and the other is research to establish the best methods of making electrotypes.

International Association of Garment Manufacturers, A. F. Allison, secretary, 395 Broadway, New York, N. Y. This organization represents 17 associations or groups actively engaged in standardization work. In cooperation with the Federal Specifications Board, a committee of this association is endeavoring to establish specifications for measurements for dress and work shirts. Another committee is cooperating with the National Bureau of Standards on standard specifications for work-clothing fabrics. The association has also undertaken the work of standardizing cutting, sewing, pressing, and packing operations; measurements of boys' blouses and shirts; cost methods; pocketing fabrics; and cotton thread for factory-made work pants. It maintains a research associate at the National Bureau of Standards for the purpose of establishing commercial standards relating to shrinkage and fast colors of cotton fabrics for shirts and dresses. The association constantly advises its members and the public in buying on definite standard specifications and measurements which have been adopted in the industry.

International Association of Ice Cream Manufacturers, Fred Rasmussen, executive secretary, Telegraph Building, Harrisburg, Pa. This association, formerly the National Association of Ice Cream Manufacturers, through its simplified practice committee is actively engaged in standardizing sizes and types of ice-cream cans. In cooperation with similar committees of the Allied States Creameries Association and the International Association of Milk Dealers, it has prepared specifications for a standard interchangeable sanitary fitting which have been accepted and approved by this association A standard cost-accounting system has been developed by the association.

International Association of Industrial Accident Boards and Commissions, Ethelbert Stewart, secretary, Bureau of Labor Statistics, Washington, D. C. Standardization in the safety-code field repre-

sents an important part of the activities of this association. It is joint sponsor for five sectional committees functioning under the American Standards Association, as follows: Safety code for abrasive wheels (with the Grinding Wheel Manufacturers' Association of the United States and Canada); safety code for mechanical power-transmission apparatus (with the American Society for Mechanical Engineers and the National Bureau of Casualty and Surety Underwriters); safety code for rubber machinery (with the National Safety Council); safety code for wood-working plants (with the National Bureau of Casualty and Surety Underwriters); standardization of methods of recording and compiling accident statistics (with the National Council on Compensation Insurance and the National Safety Council). The association inaugurated, and is cosponsor for, the revision of a code for the standardization of industrial-accident statistics.

International Association of Milk Dealers, R. E. Little, executive secretary, 228 North La Salle Street, Chicago, Ill. The association has adopted standards of sanitary thermometer connections for various sizes of pasteurizing vats and tanks. In cooperation with similar committees representing the Allied States Creameries Association and the International Association of Ice Cream Manufacturers, the association's committee on standardization of equipment has prepared specifications for standard interchangeable sanitary pipe and fittings which have been adopted by the association. All sanitary pipe and fittings used in the milk plants are now interchangeable. This committee cooperated with committees of bottle manufacturers and the Department of Commerce in the elimination of various heights of bottles and cap seats and the establishment of standard sizes.

International Society of Master Painters and Decorators (Inc.), E. J. Bush, general secretary, 127 North Jefferson Street, Peoria, Ill. Among the stated objects of this society is to maintain a high standard of quality in materials used in painting and decorating. The legislative committee is actively engaged in securing the passage of a Federal law to compel manufacturers to label properly the paints and other commodities used in the industry. The society has also a committee on color cards working in an attempt to eliminate various colors used under the same names by manufacturers. Its ultimate purpose will be the adoption of an international color card indorsed and adhered to by manufacturers.

Interstate Cotton Seed Crushers' Association (Inc.), George H. Bennett, secretary-treasurer, 915 Santa Fe Building, Dallas, Tex. At the 1928 annual meeting of this association resolutions were adopted relating to the elimination of waste in industry, encouraging sound

and fair trade practices, and the establishment of ethical principles governing competition. Upon approval of the Federal Trade Commission, these resolutions will be put into actual practice. The association has adopted definitions of grade and quality of cottonseed, cottonseed-oil, peanut, soya-bean, and cocoanut products, and issued rules governing the sampling, inspection, weighing, and sale of these commodities. In cooperation with the American Oil Chemists' Society, it has formulated methods of chemical analysis. To render these definitions, rules, and analyses effective, any member of the association found guilty of misbranding or adulteration is dismissed from membership. It cooperates with the United States Department of Agriculture on research in oils and fats and on the grading of cotton linters. It cooperates with the New York Produce Exchange and the American Feed Manufacturers' Association on trading rules. Action is now being taken by the refiners' division of the association looking to a substantial reduction in the number of containers used for vegetable shortening, in cooperation with the division of simplified practice of the United States Department of Commerce. It publishes annually a book of rules governing transactions between its members, methods of chemical analysis, definitions of grades and quality, inspection, sampling, weighing, and arbitration procedure. Lawsuits between members have been practically abolished, so effective have the arbitration rules proved in practice. In the book are given lists of official weighers and inspectors appointed by the association, and of official chemists certified by the American Oil Chemists' Society and appointed by the executive committee.

Laundryowners National Association of the United States and Canada, W. E. Fitch, general manager, drawer 202, La Salle, Ill. The association is cooperating with the Good Housekeeping Institute, the National Better Business Bureau, home economics department of Columbia University, and Women's Wear and Daily News Record in the task of establishing standards of fast color. Through its department of engineering the association is undertaking to standardize plant layouts, ventilation, heating, lighting, and building construction. The association has formulated a standard system of cost accounting for the laundry industry, and it maintains a staff of field accountants to install this system and make cost surveys. In the American Institute of Laundering (Inc.), maintained by the association at Joliet, Ill., practical applications are made of research findings developed by textile experts of the association working at the Mellon Institute for Industrial Research and by the departments of engineering and cost accounting. In its research work the association has received the cooperation of the Converters' Association of New York, the Lowell Textile Institute, the National

Association of Dyers and Cleaners, the National Association of Finishers of Cotton Fabrics, and the National Bureau of Standards. The association is joint sponsor, with the Association of Governmental Labor Officials of the United States and Canada and the National Association of Mutual Casualty Companies, for the sectional committee on safety code for laundry machinery and operations, functioning under American Standards Association procedure.

Leather Belting Exchange. (See American Leather Belting Association.)

Machinery Builders' Society, W. C. Fulmer, secretary, 50 Church Street, New York, N. Y. The several sections of the society are active in standardization work. They have formulated standard rules of obsolescence covering patterns, jigs, and fixtures and standard practice of marking patterns. The hydraulic section developed a testing code for hydraulic turbines which formed the basis for the A. S. M. E. code. The marine section prepared specifications for bronze propellers which have been formally approved by the society.

Malleable Iron Research Institute, Robert E. Belt, secretary, Union Trust Building, Cleveland, Ohio. This institute has taken over the activities of the former American Malleable Castings Association. It has adopted specifications for malleable castings equivalent to those of the American Society for Testing Materials. It assists members, through laboratory and engineering work, in the manufacture of a product which conforms to the requirements of these specifications. Member plants submit to the institute's laboratory test pieces from every heat. Quality certificates are issued to those members whose products meet the specifications. These certificates permit the manufacturers to use the trade-mark of the institute and to advertise their products as having been certified to by it. It publishes regularly the names of members whose products has complied with the specifications.

Manufacturers Standardization Society of the Valve and Fittings Industry, Albert C. Taylor, general secretary, 103 Park Avenue, New York, N. Y. This organization functions as the medium of contact of its members with other bodies involving the development of standards, specifications, and simplification programs affecting the use of the products of the valve and fittings industry. It has working committees on ferrous screw fittings, ferrous flange products, nonferrous screw fittings, nonferrous flange dimensions, safety valves, underwriter valves and hydrants, materials and tests, marking and terminology, screw threads, simplification of product, piping codes, boiler code, steamboat-inspection service rules and regulations, and American marine standards. Official representatives are serving on various A. S. T. M. committees and on American Standards

Association's sectional committees on standardization of pipe flanges and fittings, pipe threads, hose threads, zinc coating, cast-iron pipe, wrought-iron and steel pipe and tubing, drawings and drafting-room practices, and national piping code. The society is one of the sponsors of the sectional committee on pipe flanges and fittings.

Manufacturing Chemists' Association of the United States, John I. Tierney, secretary, 921 Woodward Building, Fifteenth and H Streets NW., Washington, D. C. This association has adopted standard tables for aqua ammonia, hydrochloric acid, nitric acid, sulphuric acid, and zinc chloride. In cooperation with representatives of container manufacturers, the Bureau of Explosives and the Tank Car Committee of the American Railway Association, its standing committees have developed standards for containers which have been incorporated in the official specifications of the Interstate Commerce Commission. Its standing committees have also completed or are now at work on specifications for carboys, steel drums and tank cars, laboratory apparatus, containers for hazardous chemicals and explosives, and packages for the transportation of powdered insecticides and other poisonous articles. In cooperation with the American Chemical Society and the manufacturers of chemical apparatus, a committee of the association prepares specifications for graduates, thermometers, and other laboratory apparatus.

Maple Flooring Manufacturers Association, Edward C. Singler, secretary, 332 South Michigan Avenue, Chicago, Ill. Among the stated purposes of the association are the establishment and enforcement of uniform grades and standards, and the making of the association trade-mark the symbol of excellence in methods and materials. Member firms are permitted to use the association's trade-mark on maple, beech, or birch flooring which is standardized and guaranteed by the association when passed upon by the association's official inspector. Simplified grade names have recently been adopted for the different types of flooring, so that the order of merit of each grade will be apparent to dealer, architect, and builder.

Milling Cutter Society, The, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. The committee on simplification and standardization is actively engaged in eliminating from catalogue lists, sizes and styles of milling cutters which the trade no longer demands, and is establishing proper standard basic mechanical sizes of these tools to be listed in revised catalogues.

Millwork Institute of California, H. T. Didesch, managing director, Box 267, Hollywood Station, Los Angeles, Calif. This institute has adopted a glossary of terms and standard trade practices for sash, doors, blinds, and screens. Work is going forward on the compila-

tion of accredited standards of construction which, when completed, will contain detailed standards for about 12 distinct classifications of work produced by millwork establishments. During 1928 the members of this institute adopted a certification program, under which such member plants as can qualify and subscribe to certain stated requirements, including the set of accredited standards of construction, are to be licensed by the organization. All certified products are to be identified by labels or brands which carry the words "Architectural Woodwork" and "Certified by Millwork Institute of California," together with the central shield of the institute insignia and the license number of the member furnishing the work.

Mine Inspectors Institute of America, C. A. McDowell, secretary, P. O. Box 64, Pittsburgh, Pa. The institute is interested in all phases of standardization relating to the selection, installation, or use of equipment in mines. It is officially represented on the mining standardization correlating committee and is serving as sponsor for a sectional committee on safety code for mine explosives functioning under American Standards Association procedure.

Motor Vehicle Conference Committee, Russell Huffman, secretary, 366 Madison Avenue at Forty-sixth Street, New York, N. Y. This committee, organized in 1919, represents the following national organizations active in the motor vehicle field: American Automobile Association, National Automobile Chamber of Commerce, Motor and Accessory Manufacturers' Association, National Automobile Dealers Association, and Rubber Association of America. Its chief aim is to encourage equitable legislation pertaining to motor vehicle operation and to bring about uniformity of such legislation in all of the States. It has cooperated in the preparation of safety codes for colors for traffic signals and for automobile brakes and brake testing, by representation on sectional committees functioning under American Standards Association procedure.

National-American Wholesale Lumber Association (Inc.), W. W. Schupner, secretary, 41 East Forty-second Street, New York, N. Y. Acting for wholesale lumber dealers, many of whom represent small and unorganized lumber mills, the association is serving to bring together lumber manufacturers and retailers to establish standards and market standardized lumber. It has participated actively in the lumber standardization program under the auspices of the Central Committee on Lumber Standards.

National Association of Building Owners and Managers, Lewis B. Ermeling, executive secretary, 134 South La Salle Street, Chicago, Ill. The association has adopted a standard method of floor measurement for basement space, stores, and office space. During the past year its research committee has made investigations of certain clean-

ing compounds. Its committee on purchasing has made an analysis of the results obtained by the affiliated associations from collective buying of staple commodities.

National Association of Dyers and Cleaners of the United States and Canada, Paul C. Trimble, managing director, 7901 Georgia Avenue, Silver Spring, Md. Standardized practices developed by research under the auspices of the association have been recorded in its monthly journal. Some of these have been placed in the association's textbook on garment cleaning, the second edition of which was published in January, 1928. During 1927 publications relating to the effect of dry cleaning on silks and the removal of stains from cellulose acetate rayon were issued. Recommended practice for the cleaning of furs and leathers and a revised specification for Stoddard solvent were published in 1928. The association is maintaining a research associate at the National Bureau of Standards engaged in developing a method for the removal of tannin stains. Investigations are being made of the fastness of dyes to dry cleaning, the corrosion of dry-cleaning equipment, and new types of spotting agents.

National Association of Farm Equipment Manufacturers, H. J. Sameit, secretary, 608 South Dearborn Street, Chicago, Ill. Nine trade departments of this organization carry on the work of standardization. The plow and tillage implement division has issued a book of standards summarizing the eliminations made by that branch of industry for the past 14 years. The committee on wood materials conservation of the farm-wagon department has published a pamphlet on specifications and grading, and inspection rules for wagon material and wagon stock. These rules have been adopted jointly by this association and the National Hardwood Lumber Association. The association maintains a contact committee with the American Society of Agricultural Engineers. It initiated the movement which resulted in the formulation of the simplified practice recommendation relating to plow bolts. At the present time the association is engaged in the work of formulating specifications for materials used for farm equipment.

National Association of Finishers of Cotton Fabrics, H. E. Danner, secretary, 320 Broadway, New York, N. Y. The membership of this association is composed of job finishers who bleach, dye, or print cotton goods according to instructions from the owners of goods. This association has adopted standard methods for testing cotton fabrics to determine their fastness to light and power-laundry washing. For the purpose of protecting the public against misleading statements, the association has made arrangements with the Pease Laboratories, of New York, N. Y., for the testing of all goods as regards the fastness of colors to both light and washing according to approved standards and requirements. Member finishers whose

goods receive an "A" or "B" rating, both with respect to light and washing tests, are licensed to use the association's label showing that such tests have been made.

National Association of Flat Rolled Steel Manufacturers, Terminal Tower Building, Cleveland, Ohio (secretary, E. T. Sproull). This organization has taken over the activities of the National Association of Sheet and Tin Plate Manufacturers, Hot Rolled Strip Steel Institute, and Cold Rolled Strip Steel Institute. During the past year this association has continued its program of simplification in sizes and gauges of sheet steel and of eliminating the use of light-weight material for roofing purposes. One of the principal projects under way at the present time is the simplification of gauge problems in the flat rolled-steel industry with a view to establishing a uniform gauge practice.

National Association of Glue Manufacturers, H. B. Sweatt, secretary, 1457 Broadway, New York, N. Y. Methods of test and technical problems of interest to the association are investigated by the association's technical division, which has formulated and published standard methods for testing the viscosity and jelly strength of glue. The division directs the activities of a research fellow at the Miner Laboratories, Chicago, Ill.

National Association of Hosiery and Underwear Manufacturers, J. N. McCullaugh, managing director, 334 Fourth Avenue, New York, N. Y. Standardization and research forms the major part of the work of this association. It has adopted the following standards: Method of measuring hosiery, hosiery-box sizes, standard lengths for hosiery, and standard percentage of oil in rayon yarns for knitting. The association maintains a research associate at the National Bureau of Standards. Standardization studies completed by the research associate and submitted to the research committee are standard percentage of moisture and regain for mercerized cotton yarns for hosiery and underwear; standard percentage of moisture and regain for combed and carded cotton yarns for hosiery and underwear; and ⅝ and children's golf hosiery, this latter study having been completed during the past year. At the present time the study of the staining properties of lubricants for all knitting machines is in progress.

National Association of Ice Cream Manufacturers. (See International Association of Ice Cream Manufacturers.)

National Association of Manufacturers of Heating and Cooking Appliances, Allen W. Williams, secretary, Columbus, Ohio. This organization has a committee on simplified practice to deal with all types of stoves and ranges burning coal, wood, or gas as fuel, composed of both members and nonmembers, and serving as a point of

contact between the stove industry and the division of simplified practice. A program of simplification and procedure to secure its adoption has been agreed upon.

National Association of Marble Dealers, Victor Mosel, secretary, Rockefeller Building, Cleveland, Ohio. In 1915 the association formulated principles governing the submission of bids and awarding of contracts for marblework similar to those applying to governmental work. In 1927 the association compiled standard specifications covering the erection of interior marblework.

National Association of Master Plumbers of the United States, George H. Drake, chairman, standardization committee, 218 Lexington Avenue, Buffalo, N. Y. This organization has cooperated in the formulation of simplified practice recommendations relating to vitreous-china plumbing fixtures, range boilers and expansion tanks, wrought-iron and wrought-steel pipes, valves and fittings, hot-water storage tanks, and brass lavatories and sink traps. Symbols for use on plumbing drawings have been adopted by the association. Steps are being taken to have these symbols recognized as American standard by the American Standards Association.

National Association of Musical Instrument and Accessories Manufacturers, H. C. Lomb, president, 45 West Forty-fifth Street, New York, N. Y. This organization, which is affiliated with the Music Industries Chamber of Commerce, is composed of American manufacturers of stringed musical instruments and accessories. It has adopted a uniform nomenclature of parts for the banjo, and also specifications for the standard ukulele, which have been generally approved in industry. Through its standardization committee, it is planning to formulate standard specifications for instruments of the fretted group. A special committee has been organized to promote the use of standards throughout the trade and among the public.

National Association of Mutual Casualty Companies, J. M. Eaton, secretary, 180 North Michigan Avenue, Chicago, Ill. Standardization in the safety-code field forms an important part of the work of this association, which is officially represented on the safety-code correlating committee. It has an active committee on engineering composed of safety engineers connected with member companies. The approval by this committee of American Standards Association safety codes automatically makes them standards for inspection of association members. It is joint sponsor for the sectional committee on safety code for laundry machinery and operations (with the Association of Governmental Labor Officials of the United States and Canada and the Laundryowners National Association of the United States and Canada), functioning under A. S. A. procedure.

National Association of Purchasing Agents (Inc.), G. A. Renard, secretary-treasurer, 11 Park Place, New York, N. Y. Standardization and simplification constitute important activities of this organization. It brought together various bodies interested in standardizing catalogue sizes and developed a standard size. It initiated movements for the adoption of a national standard invoice form which later became the simplified invoice form, and the promulgation of iron and steel scrap specifications which have been widely accepted and made simplified practice recommendations by the division of simplified practice. The association also cooperated in the formulation of simplified practice recommendations for paper sizes, catalogue sizes, and standard warehouse forms, and in the promulgation of standard contracts for pig iron, and coal and other fuels. In cooperation with the American Standards Association, the American Society for Testing Materials, and other national organizations, it is actively engaged in work on pattern equipment standardization, naval stores, gear standardization, and other like movements. The association has eight committees which are endeavoring to conclude simplification projects already under way and have a number of new undertakings that will react beneficially to industry at large. The national committee on Government purchases is endeavoring, among other things, to bring about the same economies in Government purchases as are present in transactions of business houses. The iron and steel committee has cooperated with the American Railway Association in developing the specifications for iron and steel scrap. The national committee on electrical contract forms initiated a cooperative movement between the National Electrical Manufacturers Association, National Electric Light Association, American Electric Railway Association, and its own committee in formulating standard contract forms for the purchase and sale of electrical machinery. The national committee on textiles cooperates with the Department of Commerce and the Cotton-Textile Institute and trade associations in improving conditions in textile fields. The association is enlisting the cooperation of its various national committees in developing that phase of standardization in which their particular committee would be most interested. It is participating in the activities of the planning committee of the division of simplified practice, the national committee on wood utilization, and the consulting committee on lumber standards.

National Association of Railroad Tie Producers, The, Robert E. Lee, president, Springfield, Mo.; Roy M. Edmonds, secretary-treasurer, Syndicate Trust Building, St. Louis, Mo. This association has adopted the revised specifications for crossties and switch ties which were formulated by a sectional committee of official representatives

of this and 12 other organizations and formally approved as American standard by the American Standards Association.

National Association of Sheet Metal Contractors of the United States, W. C. Markle, secretary, 336 Fourth Avenue, Pittsburgh, Pa. A committee of the association has been compiling material for a book relating to the best trade practice, together with specifications for fabricating and erecting sheet-metal work in all branches entering into the construction and equipment of all types of buildings, which will be issued in March, 1929. The association has been active in making effective the simplified practice recommendations relating to the weights and thicknesses of terneplate, and the elimination of lighter than No. 28 gauge sheets for roofing, eaves trough, and conductor.

National Association of Sheet and Tin Plate Manufacturers. (See National Association of Flat Rolled Steel Manufacturers).

National Association of Steel Furniture Manufacturers, J. D. M. Phillips, secretary, Union Trust Building, Cleveland, Ohio. The association has formulated specifications for various kinds of steel furniture, including bookcases, chairs, desks, filing cases, waste baskets, lockers, tables, and wardrobes. It has cooperated in the establishment of the standards for safes complying with the requirements of the Underwriters' Laboratories label service.

National Association of Waste Material Dealers (Inc.), C. M. Haskins, secretary, Times Building, New York, N. Y. This association has established standard classifications for waste materials, including metals, rubber, paper, and cotton and woolen rags. In drawing up standard classifications the association follows its established plan of consulting the associations representing consumers of such material. It has published in its Blue Book, for the information of the trade in general, the following standards or classifications which have been adopted by other organizations affecting materials in which its members are interested: Scrap rubber and packing, iron and steel scrap, bagging, rag stock, and nickel and Monel metal.

National Association of Wood Turners (Inc.), William A. Babbitt, general secretary, Box 517, South Bend, Ind. Turning squares for wood turners have been standardized by the association. Other standardizing activities are carried out by committees appointed by one or more of its affiliated asosciations, namely, the Ash Handle Association, the Hickory Handle Association, the Mid-West Association of Wood Turners, and the New England Association of Wood Turners. Standards for ash and hickory handles have been adopted by the interested associations. The association is now engaged in establishing standards for other turned and shaped wood products.

National Association of Wooden Box Manufacturers, Paul L. Grady, secretary, 2033 Conway Building, 111 West Washington

Street, Chicago, Ill. The association has compiled and issued a book entitled "Wooden Box and Crate Construction," containing a chapter devoted to box and crate specifications. The association is now engaged in the formulation of standards for the packing of canned foods, boots and shoes, furniture, and apples, and is officially represented on the Consulting Committee on Lumber Standards.

National Association of Wool Manufacturers, Walter Humphreys, secretary, 80 Federal Street, Boston, Mass. The activities of this association relating to standardization are carried on at present by two committees—one on research and technical training and another on the standardization of cost accounting. During the past year the latter committee submitted a report which was delivered by the association to the Wool Institute for use by its special committee on accounting. This association is cooperating with the American Association of Textile Chemists and Colorists in research work on chemical processes and application of dyes and chemicals to materials manufactured in the wool industry being conducted at the Massachusetts Institute of Technology.

National Association of Woolen and Worsted Spinners, J. J. Nevins, secretary, 45 East Seventeenth Street, New York, N. Y. The standardization activities of this association are conducted by a joint committee on research and standardization composed of members of this association, the American Association of Woolen and Worsted Manufacturers, and the National Association of Wool Manufacturers.

National Automobile Chamber of Commerce, Alfred Reeves, general manager, 366 Madison Avenue, New York, N. Y. This organization has cooperated with the National Bureau of Standards, Society of Automotive Engineers, and the American Petroleum institute in the development of specifications for motor fuels, brakes, and headlighting. It is now cooperating with committees of the National Conference on Street and Highway Safety, with the committee on model municipal traffic ordinance, and with sectional committees of the American Standards Association on matters relating to the standardization of codes for the operation of automobiles.

National Board of Fire Underwriters, W. E. Mallalieu, general manager, 85 John Street, New York, N. Y. Special consideration has been given recently by the board to specifications for the construction of automobile tank trucks; recommended good practice for marine-oil terminals; safeguards for the use of ethylene in coloring, ripening, and blanching fruits and vegetables; regulations on the construction of incinerators, on acetylene house-lighting systems, public garages, gasoline service stations, and rotary and centrifugal fire pumps. In the standardization of fire-hose couplings the board

has been very active, and to date standard couplings are used in about 2,700 cities and towns. The regulations of the board for the installation of hazardous and protective devices have been issued in 46 pamphlets. Of these, seven have been revised during the past year as follows: Blower and exhaust systems; electric wiring and apparatus; oil-burning equipments; paint spraying and spray booths; pyroxylin plastic—storage and handling (factories); standpipe and hose systems; and sprinkler equipments. The board has issued suggested specifications for gasoline automobile fire apparatus, standard schedule for grading cities and towns of the United States as to their fire defenses and physical conditions, code of suggestions for construction and fire protection of dwelling houses, and a building code. The board is joint sponsor for two sectional committees under the American Standards Association, as follows: Screw threads for fire-hose couplings (with the American Society of Mechanical Engineers and the American Water Works Association) and insulated wires and cables for other than telephone and telegraph use (with nine other organizations). As a member of the fire-protection group the board is joint sponsor for specifications for fire tests of materials and construction (with the American Society for Testing Materials and the National Bureau of Standards) and specifications for rubber-lined fire hose (with the American Society for Testing Materials). (See the Underwriters' Laboratories.)

National Boot and Shoe Manufacturers Association of the United States (Inc.), J. Dudley Smith, secretary, 342 Madison Avenue, New York, N. Y. This association has a conference and style committee, which forecasts styles and, in conjunction with other branches of the industry, selects a limited number of shoe and leather colors for the guidance of retailers, indicating what the merchants should provide for selling during the approaching seasons. In 1914 this association and the National Shoe Retailers Association adopted standard measurements for shoe cartons.

National Building Granite Quarries Association (Inc.), H. H. Sherman, secretary, 31 State Street, Boston, Mass. This association has adopted a uniform proposal blank for use by all members in submitting estimates. This proposal form serves to standardize the terms and conditions embodied in the estimates. It has also adopted uniform contract forms which are recommended for general use on contracts for granite work. These contract forms embody the terms and conditions upon which the proposals are based. The association has formulated complete granite specifications, which include standards of workmanship, requirements, and other essential details.

National Bureau of Casualty and Surety Underwriters, H. P. Stellwagen, secretary, 1 Park Avenue, New York, N. Y. The bureau

is primarily and principally interested in standardization in the field of safety codes. It is sponsor or joint sponsor for seven sectional committees, functioning under the rules of procedure of the American Standards Association, for formulating safety codes for the following subjects: Machine tools (with the National Machine Tool Builders Association), mechanical power-transmission apparatus (with the American Society of Mechanical Engineers and the International Association of Industrial Accident Boards and Commissions), conveyors and conveying machinery (with the American Society of Mechanical Engineers), mechanical power control (with the American Society of Mechanical Engineers), woodworking plants (with the International Association of Industrial Accident Boards and Commissions), tanneries, amusement parks (with the National Association of Amusement Parks).

National Canners' Association, Frank E. Gorrell, secretary, 1739 H Street NW., Washington, D. C. Standardization committees of this association are working, in cooperation with the joint committee on definitions and standards and the Bureau of Agricultural Economics of the United States Department of Agriculture, on definitions and standards for various canned foods. The conference committee with wholesale grocers confers with like committees representing various associations of wholesale grocers on matters of common interest regarding standard forms of contracts. Special attention is being given by the association to proper trade terms in connection with labeling. It cooperates with Federal and State officials in the enforcement of uniform regulations pertaining to proper and intelligent labeling. It maintains a research laboratory for investigating canned food and containers therefor, in cooperation with other organizations. It has committees working on the standardization of tin plate for canners' cans and on the simplification of containers.

National Cinder Concrete Products Association, Harry H. Longenecker, secretary, 1600 Arch Street, Philadelphia, Pa. This association's research committee is developing standards for cinder concrete building units. Work has been completed covering the design of mix and the methods of making, curing, and aging the product. A study is being made of the characteristics of cinders as an aggregate. Experiments are also being conducted to determine the heat transmission through different types of walls as well as the factors governing permanence of cinder concrete.

National Coal Association, Harry L. Gandy, executive secretary, Southern Building, Fifteenth and H Streets NW., Washington, D. C. All standardization work of the association is conducted in cooperation with the Mining Standardization Correlating Commit-

tee functioning under the procedure of the American Standards Association.

National Committee on Wood Utilization, Axel H. Oxholm, director, United States Department of Commerce Building, Washington, D. C. This committee, organized in 1925 at the direction of the President of the United States, is composed of 139 members representing various branches of the wood-products industry. In addition to the associations listed in the 1928 Standards Yearbook, the following organizations are officially represented on the committee: American Society of Mechanical Engineers, Associated Cooperage Industries of America (Inc.), National Association of Farm Equipment Manufacturers, National Council of American Shipbuilders, National Hardwood Lumber Association, National Paint, Oil, and Varnish Association (Inc.), New York Wood Utilization Committee, and the Western Red Cedar Association. The committee has published a report on the use of short-length lumber, less than 8 feet long, and this project is now being extended to further industrial use of short lengths. Another bulletin on the use of end-matched softwood lumber has been widely distributed. Two bulletins on the grade marking of lumber have been widely used. The committee encourages the placing of quality designations on each piece of lumber produced, to insure economical use of proper grades for each purpose. During the past year the committee has completed work on a treatise on wood distillation which embodies recognized practices in the wood chemical industry in the United States and abroad; a report on the use of sawdust and wood flour (ground sawdust); four reports relating to the promotion of proper seasoning, handling, and care of lumber; and a manual on the use of wood in construction, outlining how wood can be used to best advantage. The committee is interested in, and aiding the promotion of, American lumber standards and standardization of plywood for industrial uses. Concrete progress has been made along specific lines, such as the standardization of battery-box specifications. Through various articles the committee has conducted a campaign in promoting the use of secondhand wood containers as a means of decreasing the drain upon the forests. The various committee projects are promoted by recommendations to the trade and consumer and by means of educational exhibits and educational information service. These projects also include studies of the holding power of different types of nails, tests on redesign of wood containers to reduce weight and increase strength, use of acid-penetrating stains for the utilization of stained or knotty stock whose strength is not impaired by such defects, use of chemical preservatives to increase the life of lumber and timbers through increasing resistance to attack of insects and decay, and

development of domestic pulp supplies. In its efforts to put its recommendations into practice the committee cooperates with Government agencies as well as with other consumers and producers. In the development of its projects the committee receives the cooperation of various industries and official and private agencies, notably the National Bureau of Standards of the Department of Commerce and the Forest Products Laboratory of the Department of Agriculture.

National Confectioners' Association of the United States (Inc.), Walter C. Hughes, secretary, Conway Building, 111 West Washington Street, Chicago, Ill. For some time this association has been employing consulting chemists to analyze the products of its members and others for adulteration and to determine whether or not they comply with established standards or in any way conflict with any Federal or State law. A special commitee has been appointed to formulate plans for standardization and research work. Its return-goods committee has adopted standard codes of business ethics for use in the industry and a code system for the marking of candy boxes to show the dates when shipments are received.

National Council of American Cotton Manufacturers, Russell T. Fisher, joint secretary (secretary of the National Association of Cotton Manufacturers, 80 Federal Street, Boston, Mass.); W. M. McLaurine, joint secretary (secretary of the American Cotton Manufacturers Association, Charlotte, N. C.). (See Cotton-Textile Institute.)

National Crushed Stone Association, A. T. Goldbeck, director bureau of engineering, Merchandise Building, Washington, D. C. Standardization activities of the association are conducted in cooperation with the American Society for Testing Materials, the American Concrete Institute, or under the auspices of the American Standards Association and the National Safety Council. It has organized a committee on standards which is composed of three subcommittees on drilling equipment, commercial sizes of crushed stone, and quarry tracks and cars.

National District Heating Association, D. L. Gaskill, executive secretary, 603 South Broadway, Greenville, Ohio. This association has formulated rules for computing the area of radiating surfaces required for heating buildings which have been formally approved by the association. It has also simplified, and made recommendations in relation to, underground installation and the conveying of steam over considerable distances for heating buildings. It has conducted studies relating to the resistance of materials to temperatures.

National Door Manufacturers' Association, H. L. Stillwell, acting secretary, 122 South Michigan Avenue, Chicago, Ill. This associa-

tion is endeavoring to standardize methods of manufacture through the medium of a publication entitled "Standard National Manufacturers' List," and which is now being universally used throughout the United States. It is working in cooperation with West Coast lumber manufacturers on the standardization of thickness and moisture content of shop lumber for use indoors. It is also cooperating with the Central Committee on Lumber Standards, and with the hardwood lumber manufacturers and plywood manufacturers in the development of standards of manufacture. The association is promoting various methods of showing the purchaser the advantages of buying standardized commodities, and it is working with the Millwork Cost Bureau in formulating uniform methods of estimating.

National Education Association, J. W. Crabtree, secretary, 1201 Sixteenth Street NW. Washington, D. C. One of the chief aims of this association is that of raising standards in training and compensation for all members of the teaching profession. Another important activity of the association has been the publication of a book on the planning and construction of schoolhouse buildings. This book, which was prepared by its committee on standardization of schoolhouse planning and construction, in cooperation with the American Society of Heating and Ventilating Engineers, American Specification Institute, National Association of Public School Business Officials, and the National Fire Protection Association, is entitled "School House Planning." In it are set forth the steps necessary to plan and construct a school building.

National Electric Light Association, Paul S. Clapp, managing director, 420 Lexington Avenue, New York, N. Y. Although the association does not formally adopt standard specifications, its committees formulate drafts of specifications which are offered to the membership as recommended practices. Among the committees that have been active in the work are the following technical national committees: Accident prevention, electrical apparatus, hydraulic power, inductive coordination, meters, overhead systems, prime movers, and underground systems. Its committee on codes and standards has formulated certain principles and practices in the field of standardization which have been issued in pamphlet form. The association cooperates in the activities of the division of simplified practice of the Department of Commerce, with the standards committees of various American societies, and with the International Electrotechnical Commission. It is joint sponsor (with four other societies) for studies of boiler feed-water problems. It is joint sponsor for two sectional committees functioning under the rules of procedure of the American Standards Association, as follows: Insulated wires and cables for other than telephone and telegraph use

(with nine other organizations); and rules for electricity meters (Code for Electricity Meters, now in its third edition) (with the Association of Edison Illuminating Companies and the National Bureau of Standards). As a member of the electric light and power group, it is also sponsor for a sectional committee on miscellaneous line materials.

National Electrical Manufacturers' Association, Alfred E. Waller, managing director, 420 Lexington Avenue, New York, N. Y. This association has established conference committees in cooperation with the American Institute of Electrical Engineers, Association of Iron and Steel Electrical Engineers, Association of Railway Electrical Engineers, Compressed Air Society, Institute of Radio Engineers, Hydraulic Society, International Electrotechnical Commission, Mutual Fire Prevention Bureau, National Association of Fan Manufacturers, National Association of Oil Burner Manufacturers, National Electric Light Association, National Fire Prevention Association, National Machine Tool Builders Association, Refrigerating Machinery Association, Society of Automotive Engineers (Inc.), Underwriters' Laboratories, United States Department of Commerce, and the United States War Department. The association is sponsor or joint sponsor for 13 sectional committees functioning under the rules of procedure of the American Standards Association. Of these it is joint sponsor with the American Institute of Electrical Engineers for the following nine projects: Industrial electrical control apparatus; line insulators for voltages not exceeding 750; standards for direct-current rotating machines; standards for alternators, synchronous motors, and synchronous machines in general; standards for induction motors and induction machines in general; standards for direct and alternating-current fractional horse-power motors; power-line insulators for voltages exceeding 750; standards for electric arc welding apparatus; and standards for resistance welding apparatus. It is also sponsor or joint sponsor for terminal markings for electrical apparatus; standards for switch boxes and outlet boxes; frame dimensions of electric motors (with American Society of Mechanical Engineers); and insulated wires and cables other than telephone and telegraph use (with nine other organizations). The association is endeavoring to encourage the use of its standards by promoting voluntary acceptance among its member manufacturers for the class of material in which each manufacturer is interested and to assist in promoting the approval of its standards by the American Standards Association. The association has issued, and keeps under constant revision, the following publications covering standards for the manufacture, performance, and test of electrical apparatus and supplies, as well as instructions for their

proper installations, operation, and care: Handbook of Supply Standards, Handbook of Apparatus Standards, Handbook of Radio Standards (new edition in press), Power Switchboard and Switching Equipment Handbook, Transformer Standards, Transformer Instructions, Motor and Generator Handbook, Motor and Control Instructions, Control Handbook, Building Equipment Control Specifications, Terminal Markings for Electrical Apparatus, and Selection of Direct-Current Motors for Ventilating Fans.

National Federation of Construction Industries, W. S. Hays, secretary, Drexel Buliding, Philadelphia, Pa. Organized to promote closer cooperative relations between producers, manufacturers, distributors, contractors, architects, engineers, realtors, financiers, and other construction interests, the federation fosters the development and adoption of standards by its member establishments and associations in the construction industry.

National Fence Manufacturers Institute, C. M. Best, secretary, 229 Henry W. Oliver Building, Pittsburgh, Pa. The institute has organized a standards committee to make recommendations concerning standardization activities of interest to the institute membership. It inaugurated the movement which resulted in the formulation of the simplified practice recommendation relating to woven wire fencing which has been adopted by the industry.

National Fertilizer Association, The, Charles J. Brand, executive secretary, 616 Investment Building, Washington, D. C. In carrying on standardization and simplification work in the fertilizer industry, this association cooperates with the United States Department of Agriculture, United States Department of Commerce, and with many State organizations, agricultural colleges, experiment stations, and extension services. At its 1928 annual convention important action was taken to formulate and adopt standard terms in order to lessen confusion in the minds of farmers. A special committee of the fertilizer industry, working in cooperation with the United States Department of Justice, has drafted a code of trade practices relating to the elimination of wasteful selling methods, unfair trade practices, and the reduction in the number of grades of fertilizer. In order to diminish the number of grades, a large portion of the fertilizer-using territory, working under the leadership of this association, has adopted the triangle method of locating fertilizer ratios, which contemplates that all grades or analyses shall ultimately comply with the ratios determined by the triangle. Conferences have been held from time to time in the waste-elimination program with respect to excess analyses, and it is the aim of this association to conduct further conferences along similar lines.

National Fire Protection Association, Franklin H. Wentworth, managing director, 60 Batterymarch Street, Boston, Mass. Among

the subjects upon which the 32 technical committees of the association are now at work are automatic sprinklers, blower systems, building construction, electric power houses, electric railway car houses and cars, farm fire protection, field practice, fire pumps, fire records, flammable liquids, garages, gases, hazardous chemicals and explosives, laws and ordinances, manufacturing hazards, marine hazards, wharves, private fire supplies, protection of records, pyrotechnics, salvaging operations, signaling systems, storage of combustible fibers, and zoning. The standards of the association are officially adopted by the National Board of Fire Underwriters and the organizations interested in fire protection or prevention. The association is represented on the joint fire-protection committee (with the American Water Works Association and the International Association of Fire Chiefs). It is sponsor or joint sponsor for five projects functioning under the American Standards Association, as follows: Safety code for building exits, regulations for electric wiring and apparatus in relation to fire hazard (National Electrical Code, edition of 1928), insulated wires and cables for other than telephone and telegraph use (with nine other associations), fire-fighting equipment in metal mines (with the American Mining Congress), safety codes for the prevention of dust explosions (with the United States Department of Agriculture). As a member of the fire-protection group, it is also joint sponsor for specifications for fire tests of materials of construction and specifications for rubber-lined fire hose.

National Founders Association, J. M. Taylor, secretary, 29 South La Salle Street, Chicago, Ill. Standardization, as such, is outside the scope of the activities of the association. However, it is joint sponsor, with the American Foundrymen's Association, for a safety code for the protection of industrial workers in foundries, formulated by a sectional committee under the rules of procedure of the American Standards Association.

National Hardware Association of the United States, George A. Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa. This association cooperated in the initiation and formulation of simplified-practice recommendations relating to builders' hardware; sheet steel; eaves troughs, conductor pipe, conductor elbows, and fittings; terneplate; loaded paper shot shells; shovels; flash lights; hack-saw blades; and package sizes for insecticides and fungicides.

National Hardwood Lumber Association, The, Frank F. Fish, secretary, 2008 Straus Building, Chicago, Ill. This association has formulated rules for the measurement and inspection of hardwood lumber, cypress, plywood, and veneer, which are the universal standards of the trade in the United States and many foreign countries. The association maintains one or more licensed and bonded inspectors

in each of the principal hardwood markets and producing centers of the United States and Canada.

National Hay Association (Inc.), The, Fred K. Sale, secretary-treasurer, South Main Street, Winchester, Ind. The association has adopted grade rules for hay and straw which form the basis for the specifications for these commodities promulgated by the Federal Specifications Board. It has also adopted trade rules and inspection and weighing rules. When requested to do so it investigates the qualifications of inspectors and permits approved inspectors to make record of the association's approval on their official certificates of inspection.

National Lime Association, W. V. Brumbaugh, acting manager, 927 Fifteenth Street NW., Washington, D. C. This association has promulgated specifications for lime plaster, lime stucco, lime mortar, and lime in concrete, as well as for lime in asphalt, concrete, and earth roads. Standard specifications are available on paper, strawboard, glass, leather, insecticides, fungicides and disinfectant, beet sugar, cane sugar and sorghum sirup, bleaching powder, bleaching liquor, soda, sand-lime brick, silica brick, pigments, cold-water paints, dye stuff and intermediates, calcium carbide and cyanamide, rubber, lubricating greases, animal glue and gelatin, varnish, and textiles. The association cooperated with the American Society for Testing Materials in the preparation of specifications for quicklime and hydrated lime for various purposes, and with the Building Officials Conference in the formulation of the building-code requirements for lime. It also cooperated in the initiation of the work of the Building Code Committee of the Department of Commerce.

National Lumber Manufacturers Association, Wilson Compton, secretary-manager, Transportation Building, Washington, D. C. This organization comprises 13 regional associations of lumber manufacturers and timber owners. Standardization of grades, sizes, and nomenclature of lumber (one of its important activities) is carried on by its manufacturers' standardization committee made up of one representative from each regional or subscribing association. The association also has representation on the Hardwood Consulting Committee which has cooperated with the Central Committee on Lumber Standards in formulating American standard basic provisions for hardwood lumber, subject to revision annually thereafter. The association cooperated in the initiation of the work of the Building Code Committee of the Department of Commerce and the work of the National Committee on Wood Utilization. It has taken a leading part in the organization and activities of the Central Committee on Lumber Standards and the Consulting Committee on Lumber Standards. It is also cooperating with the

American Railway Engineering Association and the American Society of Agricultural Engineers by representation on their committees, and with the American Standards Association, on seven of whose sectional committees it is officially represented. In cooperation with other branches of the lumber industry, this association adheres as far as possible to American lumber standards, and A. S. A. standards for railway cross and switch ties. The association has been instrumental in formulating specifications for maximum spans for joists and rafters, building-code limitations on floor areas in buildings, details of heavy timber mill construction, fire safe industrial buildings, frame construction details, and recommended requirements for building codes. The association's work for the past year included the unification of patterns for worked lumber, progressive studies of a suitable basis for the measurement of the dimensions and of definitions of dryness of American standard lumber, and revisions of structual grading provisions. Its plans for the coming year include further work on a basis for measurement, on lumber dryness definitions, and on bringing up to date the American standards for structural material, continued emphasis on the "7,000 series of moldings," and active cooperation with committees and organizations preparing building laws and codes for adoption by cities or States.

National Macaroni Manufacturers Association, M. J. Donna, secretary-treasurer, Braidwood, Ill. All standardization work of this organization is carried on by a committee of manufacturers working under the direction of this association and in cooperation with the United States Department of Agriculture, Federal Trade Commission, and State food-regulatory officials. The association has adopted standards for alimentary pastes, and definitions of purified middlings, semolina, and farina. It has prepared specifications for raw materials. The method used by this organization to encourage compliance with standards and to facilitate the use of specifications is through publicity in the association's journal and through tests obtained in its laboratory on the composition of the raw material used and of the finished products offered for sale. All products manufactured by its members are subjected to chemical tests and analyses at the association's laboratory to determine whether or not they comply with the standards and specifications.

National Machine Tool Builders Association, Ernest F. DuBrul, general manager, 630 Vine Street, Cincinnati, Ohio. The association has 10 committees at work on various types of machine tools and machine-tool elements, including tapers, tool posts, tool holders, milling cutters, machine-tool speeds, and mounting dimensions of electric motors. It has adopted the following standards: T slots, their

bolts, nuts, and cutters; driving speeds for machine-tool drives; standard speeds for constant-speed motors for machine-tool drives; diameters for machine pulleys; shaft diameters in machine-tool construction; milling machine spindle noses and arbors; safety code for grinding machines; and steel wheel guards for grinding machines. The association is joint sponsor for two sectional committees functioning under the rules of procedure of the American Standards Association, as follows: Small tools and machine-tool elements (with the American Society of Mechanical Engineers and the Society of Automotive Engineers) and safety code for machine tools (with the National Bureau of Casualty and Surety Underwriters).

National Paint, Oil, and Varnish Association (Inc.), George V. Horgan, general manager, 18 East Forty-first Street, New York, N. Y. The standardization activities of this association are carried on by a joint committee on simplification which represents the National Paint, Oil, and Varnish Association (Inc.) and the American Paint and Varnish Manufacturers Association (Inc.), the last named being a consolidation of the former National Varnish Manufacturers Association and the Paint Manufacturers Association of the United States. This committee has been instrumental in eliminating superfluous sizes of containers and color varieties in paints, varnishes, etc.

National Paper Box Manufacturers Association, Frank S. Records, executive secretary, Liberty Trust Building, Philadelphia, Pa. This association has issued a dictionary of terminology for the set-up paper-box industry relating to box construction, materials, machine processes, and measurements and types of boxes. It cooperated with the division of simplified practice in the establishment of standard minimum thickness of box board contained in simplified practice recommendation for this commodity.

National Paper Trade Association, The, Frank E. Floyd, executive secretary, 420 Lexington Avenue, New York, N. Y. This association has cooperated with the National Association of Purchasing Agents and the division of simplified practice of the Department of Commerce in developing standard sizes for catalogues and paper in sheets. It has adopted the standard sizes for tissue paper and has cooperated in the initiation and formulation of standard sizes on ply goods and hard-fiber twines as recommended by the division of simplified practice. The association's recommended weights for writing paper have been adopted by the Writing Paper Manufacturers Association.

National Paving Brick Manufacturers Association, G. F. Schlesinger, managing director and chief engineer, National Press Building, Washington, D. C. The leading part in the movement which

has resulted in the standardization of the sizes and varieties of paving brick under the auspices of the division of simplified practice has been taken by this association. It has acted as the authorized agent for the Department of Commerce in furnishing tabulations and analyses of shipments of vitrified paving brick, upon which have been based successive steps in the process of eliminating excessive sizes and varieties.

National Petroleum Association, Fayette B. Dow, general counsel, Munsey Building, Washington, D. C. The association has organized a department of standards and tests, with groups in all of the petroleum refining centers in which members of the association are located, which has been active in the preparation of specifications in cooperation with the American Petroleum Institute, the American Society for Testing Materials, the Society of Automotive Engineers, and the Federal Specifications Board. Chemists of member companies of this association are cooperating with the National Bureau of Standards in effecting more uniform testing methods of petroleum and its products for use in member company laboratories.

National Pickle Packers Association, C. J. Sutphen, secretary, 140 North Dearborn Street, Chicago, Ill. This association has adopted standard specifications for cooperage used in packing pickles. It has adopted pickle standards and a uniform guarantee, which it publishes in connection with its code of ethics. It also publishes an official chart showing various sizes of pickles. The association is now engaged in developing a standard seed which will produce shapely fruit desirable for pickling purposes. Work is also going forward in the standardization of glass containers for pickles.

National Research Council, Vernon Kellogg, permanent secretary, Twenty-first and B Streets NW., Washington, D. C. The National Research Council, which was established in 1916 by the National Academy of Sciences, is a cooperative organization of the scientific men of America. It is composed of 11 major divisions. Its division of chemistry and chemical technology acts as the American section of the International Union of Pure and Applied Chemistry and appoints the American representatives on the committees of the union, among which are committees for reformation of the nomenclature in organic and in biological chemistry, the committee for the establishment of physical chemical standards, the committee on tables of constants, the committee on pure chemical products for analytical research, the committee on thermochemistry, the committee on combustible solids and liquids, the committee on ceramic products. and the committee on industrial hygiene. Under the auspices of the International Research Council and the National Academy of Sciences, the National Research Council has prepared the Interna-

tional Critical Tables of Numerical Data, Physics, Chemistry, and Technology, which is being issued in seven volumes, of which five have been published. Cooperating with the division of engineering and industrial research are 12 organizations vitally interested in standardization. Its work is carried on through several committees and advisory boards. Among these boards are those for civil engineering, mining and metallurgy, mechanical engineering, electrical engineering, highway research, and the American Bureau of Welding, all of which, especially the American Bureau of Welding, deal with problems involving standardization. Among committees of the division concerned with methods of standardization are the committee on electrical insulation, the committee on industrial lighting, and the committee on heat transmission.

In the division of anthropology and psychology a committee on the psychology of the highway is concerned with standardization in the adoption of highway signs and of tests for drivers. The functions of this committee are to study the devising of highway signs and signals which will be in accordance with the correct principles of vision and mental reaction and to study the possible adaptation of systems of mental and physiological tests to the examination of drivers of automobiles, public and private. This committee cooperates closely with the committee of the national conference on street and highway safety on the study of causes of accidents, and with a committee on causes and prevention of highway accidents of the highway research board. The activities of the committee on highway signs and signals have consisted in a study of signal colors with special reference to the dominant wave lengths of the red and green standards in their relation to color-blind drivers. Work on the safe limits of defective vision for drivers has been commenced this year.

National Retail Dry Goods Association, C. E. Sweitzer, managing director, 225 West Thirty-fourth Street, New York, N. Y. This association has cooperated actively with other organizations in the standardization of bed blankets, radio apparatus, and the size of the United States flag. It has also engaged in the formulation of standards for accounting systems for retail stores, retail-trade terminology, standards of practice for retail advertising, standards of practice for operation of certain nonselling departments in retail stores, and retail-store organization. The association at the present time is engaged in the formulation of standards for packing boxes and containers and, in cooperation with the division of simplified practice, is putting forward the simplified invoice form. It is also working under the auspices of the American Standards Association on standardization of specifications for refrigerators and grade specifications of sheeting for consumer use.

National Retail Hardware Association, H. P. Sheets, managing director, Meyer-Kiser Bank Building, Indianapolis, Ind. This association has been active in the initiation and formulation of simplified practice recommendations relating to builders' hardware, loaded paper shot shells, cut tacks and small cut nails, woven-wire fence, garden hose, paint and varnish, paint and varnish brushes, shovels, forged tools, files and rasps, and many other lines.

National Retail Lumber Dealers Association, Adolph Pfund, secretary-manager, 326 West Madison Street, Chicago, Ill. This association, representing the retail lumber industry, took an active part in the lumber standardization movement sponsored by the United States Department of Commerce which resulted in the formulation of the simplified practice recommendation relating to American lumber standards. Much of the work of this association was carried on through its retail lumber dealers' standardization committee, and later through the consulting committee of lumber retailers, whose recommendations were submitted to the Central Committee on Lumber Standards for approval as American lumber standards. The association has representation on both the Central Committee on Lumber Standards and the Consulting Committee on Lumber Standards and is now cooperating with these committees as well as with manufacturers, fabricators, wholesalers, architects, engineers, and builders in the establishment of moisture contents as bases for the measurement of American standard lumber sizes and for definitions of lumber dryness. The members of this organization are actively encouraging the use of standard lumber and are extending by educational means to their customers an appreciation of the advantages to be derived from standardization. This association has undertaken a nation-wide advertising campaign advocating the use of lumber complying with nationally recognized standards, and permitting its member companies to issue to purchasers certificates underwritten by the association, guaranteeing that the material delivered conforms in grading with nationally adopted manufacturers' standards, and in quantity exactly with the invoice rendered.

National Safety Council, W. H. Cameron, managing director, 108 East Ohio Street, Chicago, Ill. The council has issued a total of 96 safe-practices pamphlets, the last 6 during the year, as follows: Engineering—a factor in accident prevention; safety rules—their formulation and enforcement; warning signs—their use and maintenance; caring for injured workers; training for first aid; the safety man in industry. The council is sponsor or joint sponsor for 12 sectional committees functioning under the American Standards Association, as follows: Safety code for conveyors (with the American Society of Mechanical Engineers); safety code for floor and wall

openings; safety code for forging and hot-metal stamping (with the American Drop Forging Institute); code on identification of gas-mask canisters; identification of piping system (with the American Society of Mechanical Engineers); industrial-accident statistics code (with the National Council on Compensation Insurance and the International Association of Industrial Accident Boards and Commissions); safety code for paper and pulp mills; safety code for power presses and foot and hand presses; safety code for rubber mills and calenders (with the International Association of Industrial Accident Boards and Commissions); safety code for textiles; color for luminous traffic signals (with the American Association of State Highway Officials and the National Bureau of Standards); safety code of window washing. The American Society of Safety Engineers, which functions as a division of the National Safety Council, is sponsor or joint sponsor for three additional sectional committees, as follows: Safety code for ladders; safety code for walkway surfaces (with the American Institute of Architects); safety code for compressed-air machinery (with the American Society of Mechanical Engineers).

National Sand and Gravel Association, Stanton Walker, director, engineering and research division, Munsey Building, Washington, D. C. The association's committee on washed-gravel ballast has recommended specifications for grading of washed-gravel ballast, prepared in cooperation with the American Railway Engineering Association, which have been adopted as tentative by both associations. Its standard specifications committee has recommended certain commercial sizes of sand and gravel and the form of specifications for gravel. At the suggestion of the Bureau of Internal Revenue, a committee is engaged in the development of information concerning standard depreciation practices and scale of rates for operation in the sand and gravel industry. A committee is engaged in preparing suitable recommendations for uniform National and State legislation covering workmen's compensation insurance in marine and gravel operations. A committee is engaged in the development of standard practices with respect to equipment assigned railroads for hauling sand and gravel. The association's committee on engineering problems exercises general supervision over the activities of the association's research laboratory. The association has been active in the preparation of publications dealing with the uses of sand and gravel. Besides the monthly National Sand and Gravel Bulletin, it issues bulletins and circulars, among them being Representative Specifications for Different Uses of Sand and Gravel, Summary of Specifications for Sand for Concrete-Pavement Construction, and Summary of Specifications for Gravel for Concrete-Pavement Construction.

National School Supply Association, T. W. Vinson, executive secretary, 53 West Jackson Boulevard, Chicago, Ill. Through its trade relations committee, this association has cooperated with the division of simplified practice of the United States Department of Commerce in eliminating superfluous sizes of composition blackboard. It also cooperated in the preparation for a conference on wood portable and folding chairs.

National Slag Association, H. J. Love, secretary, 937 Leader Building, Cleveland, Ohio. This association's engineering and problems committee has made a comparative analysis of all available existing data pertaining to the characteristics and uses of blast-furnace slag as a material for railway ballast, as aggregate in all classes of structural concrete and concrete products, concrete and bituminous types of highway construction (base and wearing courses), highway maintenance, and as a filtering material for water and sewage. The association is cooperating not only with technical societies, but also with Government bureaus, universities, colleges, State departments, firms, and individuals possessing laboratories in which construction materials are tested. One division of an investigation on durability of blast-furnace slag has been completed by a research associate at the National Bureau of Standards.

National Slate Association, W. S. Hays, secretary, Drexel Building, Philadelphia, Pa. The association has issued recommended specifications for slate roofs, floors, walks, and blackboards; and slate for electrical, plumbing, and sanitary purposes. It has cooperated with the division of simplified practice in the simplified practice recommendations relating to structural slate, roofing slate, and blackboard slate. It has published standard specifications for slate for floors, terraces, and walks, and for slate for flat and sloping roofs. There are under preparation standard specifications for structural uses and other possibilities in the use of slate.

National Supply and Machinery Distributors Association, George A. Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa. Although this association has no committee on standardization, it has organized a committee on simplification, which cooperates with the division of simplified practice of the Department of Commerce.

National Syrup and Molasses Association, Daniel R. Forbes, executive secretary, 1422 F Street NW., Washington, D. C. This association has initiated standardization by appointing a committee to make a survey of the industry preparatory to recommending proper standards for sirups and molasses.

National Terra Cotta Society, J. J. Carney, acting secretary, 19 West Forty-fourth Street, New York, N. Y. This association has formulated standard specifications for the manufacture, furnishing,

and setting of terra cotta. It has also prepared a short form of specification for incorporation in the architect's specifications to be used in connection with standard specifications and the standard general conditions of the American Institute of Architects. It maintains three research associates at the National Bureau of Standards investigating architectural terra cotta.

National Tuberculosis Association, Linsly R. Williams, managing director, 370 Seventh Avenue, New York, N. Y. The association has formulated standards for the diagnosis, classification, and disposition of pulmonary and glandular tuberculosis. It is intrusted with the responsibility of rating and classifying by grades the tuberculosis sanatoriums and hospitals of the United States, under the standards adopted by the American Sanatorium Association.

National Wholesale Grocers' Association of the United States, M. L. Toulme, secretary, 6 Harrison Street, New York, N. Y. In cooperation with the Rice Millers' Association this association has adopted a standard form of contract for the sale of rice based on the grades and specifications of the United States Department of Agriculture. It has approved the standard form of contract for canned foods adopted in cooperation with the National Canners' Association, the Canners' League of California, Western Canners' Association, and many other organizations representing producers of food products.

New England Water Works Association, F. J. Gifford, secretary, Tremont Temple, Boston, Mass. This association is cooperating with the American Gas Association, American Society for Testing Materials, and the American Water Works Association in serving as joint sponsors for the sectional committee on specifications for cast-iron pipe and special castings under A. S. A. procedure.

North Carolina Pine Association, The, G. L. Hume, secretary, National Bank of Commerce Building, Norfolk, Va. All matters pertaining to the inspection, manufacture, and grading of lumber are handled by the inspection committee of this association, with authority to investigate and make recommendations which are acted on at meetings of the association. At the present time the association is engaged in the work of making its classification, inspection, grades, and sizes of lumber conform to those of the American lumber standards.

Northern Hemlock and Hardwood Manunfacturers Association, O. T. Swan, secretary-manager, Oshkosh, Wis. This association has published a book of standards on hemlock and tamarack grading rules conforming to American lumber standards. Its hardwood rules are those adopted by the National Hardwood Lumber Association. The standardization work of this association is conducted through

membership on the Central Committee on Lumber Standards as well as through the activity of its own bureau of grading and inspection. In order to make its standards effective, the association has adopted a system of branding and grade marking whereby a member firm is assigned a number and is licensed to use the association brand as long as its grading is in accordance with the American lumber standards. An inspector visits the plants of member mills monthly to ascertain whether or not the requirements are being complied with. The association maintains two field men to encourage architects, contractors, and retail lumber dealers in the use of its standards.

Northern Pine Manufacturers' Association, The, W. A. Ellinger, secretary, 1103 Lumber Exchange, Minneapolis, Minn. This association has adopted standard grading rules to conform with those of the American lumber standards. In order to encourage and facilitate the use of the standards adopted it maintains an inspection bureau for the purpose of supervising the grades of lumber at the sawmills and furnishing reinspection service to buyers.

Northern White Cedar Association, Norman E. Boucher, secretary, 702 Lumber Exchange, Minneapolis, Minn. This association has published standard specifications governing the manufacture and grading of northern white cedar poles, posts, ties, shingles, and other products. It has been active in encouraging officials in several of the central and midwestern States in the use of its specifications relating to posts for guard rails. For carrying on its work having a bearing on standardization, the association has organized committees on the following subjects: Posts, poles, ties, and pulpwood.

Oak Flooring Manufacturers' Association, W. L. Claffey, secretary, 228 North La Salle Street, Chicago, Ill. The association publishes oak-flooring grading rules, rules governing reinspections, standard thicknesses and widths, standard measurements, and standard counts of oak flooring. Its standard grades of oak flooring became effective January 1, 1928.

Paperboard Industries Association, G. R. Browder, general manager, 608 South Dearborn Street, Chicago, Ill. This association is composed of manufacturers of paper board, corrugated and solid-fiber containers, and folding boxes. It maintains a research laboratory for designing and testing shipping containers and interior packing, in order to develop the best container and packing for the shipment of certain articles. The association has issued a booklet of standards containing standard gauge lists effective in the paper board, container, and folding-box industries; standard mill specifications covering the purchase of board to be used in shipping containers and folding boxes, as well as standard trade customs. It has also

published an illustrated handbook of useful information, including the carrier's specifications and regulations with respect to fiber boxes used for freight and express shipments. Members of the association are privileged to use its insignia in connection with the certificates used by manufacturers, showing that boxes bearing these certificates conform to all construction requirements of the Consolidated Freight Classification or the Official Express Classification.

Pine Institute of America (Inc.), C. F. Speh, secretary-manager, Barnett National Bank Building, Jacksonville, Fla. This institute has taken over the activities of the Turpentine and Rosin Producers' Association, which sponsored the movement resulting in the passage of the Harrison Act, establishing Federal standards for color for rosin and providing for the establishment of standards for turpentine. The use of these standards for the sale of any of these commodities in interstate commerce is compulsory. In cooperation with the American Society for Testing Materials, the organization has assisted in standardizing methods for determining foreign matter in rosin. Work is now being done in a similar manner on the establishment of the melting point of rosin.

Pipe Nipple Standards Corporation, Julian Armstrong, executive vice president, 400 North Michigan Avenue, Chicago, Ill. This organization, the members of which are representatives of manufacturers of pipe nipples, functions as the medium for cooperation in the promotion and maintenance of standards of quality in the pipe-nipple industry. In cooperation with the National Bureau of Standards it has initiated and formulated two proposed commercial standards relating to steel and wrought-iron pipe nipples. Its future program includes the establishing of standards for other qualities of pipe nipples. The standards of this organization are identified to the trade and protected by a registered trade-mark stamped on the product or package, the use of which is licensed under a signed agreement between each manufacturer and the organization. The agreement also calls for periodic inspection of the manufacturing plants to check each licensee's adherence to the standards.

Plate Glass Manufacturers of America, P. A. Hughes, secretary, First National Bank Building, Pittsburgh, Pa. This association has cooperated in the preparation of specifications for plate glass for glazing purposes, which are included in the United States Government master specifications for flat glass for glazing purposes.

Plumbago Crucible Association, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. As the result of investigation extending over several years, the association inaugurated the standardization of crucible sizes on a scientific basis. It served as joint sponsor with the American Foundrymen's Association for a sectional

committee which formulated size numbers and outside dimensions of plumbago crucibles for nontilting furnaces in nonferrous foundry practice, which have been approved as "tentative American stand ard" under American Standards Association procedure.

Plywood Manufacturers Association, M. Wulpi, commissioner, 178 West Adams Street, Chicago, Ill. This association has taken an active part in the preparation of grading rules for figured woods and plain woods now forming a portion of the rules issued by the National Hardwood Lumber Association for the measurement and inspection of veneers, thin lumber, and plywood. The association has published a book entitled "Veneers and Plywood," to be used as a reference or text book.

Portland Cement Association, W. M. Kinney, general manager, 33 West Grand Avenue, Chicago, Ill. The membership of this association, organized in 1902, includes over 80 per cent of all Portland cement manufacturers in the United States, as well as manufacturers in Canada, Cuba, Mexico, and South America. It maintains 32 district offices in the principal construction centers and a general headquarters and research laboratory on concrete in Chicago. In the research laboratory more than 50,000 individual experiments and tests are made annually, for the purpose of developing standard specifications. It was in this laboratory that the water-cement ratio method of specifying and proportioning concrete was developed. The association has cooperated with the American Society for Testing Materials and other organizations in formulating specifications and tests for Portland cement, concrete aggregates, and related subjects. All members of the association manufacture in accordance with these specifications. The association is officially represented on 8 A. S. T. M. committees, on 16 committees of the American Concrete Institute, and on committees of a number of other organizations. It is represented, with four other organizations, on the joint committee on standard specifications for concrete and reinforced concrete, and with six other organizations, on the joint concrete culvert pipe committee. It cooperated in the initiation of the work of the Building Code Committee of the Department of Commerce. The association is a member of the American Standards Association. The association maintains six research associates at the National Bureau of Standards investigating the properties of cement.

Radio Manufacturers Association, H. B. Richmond, director, engineering division, 30 State Street, Cambridge (39), Mass. Work of this association is conducted through committees on standardization of the engineering division. In its work these committees have had the active cooperation of the Institute of Radio Engineers, the National Bureau of Standards, and other organizations. In 1927

arrangements were made for clearing all radio standards through the American Standards Association. In order not to limit developments in the radio industry, the standards formulated are first issued as "recommendations." The following important subjects have been covered by recommended standards: Wiring devices, including a standard color code for battery cables, etc., rheostats, panels, condensers, dials, vacuum tubes, antenna systems, loud speakers, panels, plugs, jacks and switches, power equipment, power transformers, receiving sets, and resistance units. These recommendations, which have been put in pamphlet form and distributed to the membership of the association, are being generally complied with.

Refrigerating Machinery Association, The, Fred Nolde, secretary, 23 South Fifty-second Street, Philadelphia, Pa. A committee of the association is drafting specifications for refrigerating equipment. The association is officially represented on the sectional committee functioning under the American Standards Association in the preparation of standards for pipe flanges and fittings. It is represented on a joint research committee on welded pressure vessels, which carries on research and experimentation through the National Bureau of Standards on the welding of unfired pressure vessels. It is also represented on a joint refrigerator and machine committee consisting of representatives of refrigerator manufacturers and machine companies organized for the purpose of standardizing design and trade practices. It is officially represented on several other joint or sectional committees, as follows: Research on the corrosion of materials used in refrigerating and ice-making equipment, national code for pressure piping, research on heat transmission, standardization of electric-motor frame dimensions, speeds of driven machines, safety code for mechanical refrigeration, and standardization of ice cans.

Rice Millers' Association, F. B. Wise, secretary, P. O. Box 1289, New Orleans, La. In addition to establishing standard contract forms and rules for sale which are adhered to by practically all rice shippers, the association issues inspection certificates based on the grades and specifications for milled rice recommended by the United States Department of Agriculture. It maintains a corps of samplers in the field and a laboratory equipped to test rice for quality, grade, and condition.

Rubber Association of America (Inc.), The, A. L. Viles, general manager and secretary, 250 West Fifty-seventh Street, New York, N. Y. This association is composed of groups, known as divisions, of manufacturers of different classes of rubber goods, and also of general committees giving attention to accounting, crude rubber, foreign trade, tax, and traffic matters. Among the more important

standardization activities are those relating to packages for tire accessories and repair materials, inspection rules on automobile fabrics, gauges for rain clothing, specifications covering installation of rubber flooring, dimensions for hard-rubber battery containers, garden-hose sizes, purchasers' specifications for hose and belting, Federal specifications for hospital rubber supplies, Federal specifications for rubber and canvas footwear, delivery and inspection rules on proofed fabrics, tire sizes and types, scrap-rubber specifications and packing, and also the elimination of unnecessary variety in drug sundries, the adoption of official crude-rubber type samples and packing specifications as basis for transactions in crude rubber, and the establishment of uniform cost accounting for rubber manufacturers. The association does not issue construction or chemical specifications covering any rubber products, its work on specifications being confined to the standardization and simplification of purchasers' existing specifications.

Rubber Heel Club of America, The, George A. Stetson, secretary, 370 Atlantic Avenue, Boston (9), Mass. In cooperation with the National Boot and Shoe Manufacturers Association, this organization inaugurated the movement which resulted in the elimination of various sizes of rubber heels. This work is now being carried on by the rubber heel and sole department of the Rubber Association of America.

Sand-Lime Brick Association, Ellen Knight, secretary, Saginaw, Mich. This association cooperated actively in the compilation of data used as a basis for a recommended standard size of, and quality specification for, sand-lime brick, contained in a simplified practice recommendation for this commodity. It has a standing committee which keeps the association informed as to the adherence to the recommendations.

Scientific Apparatus Makers of America, J. M. Roberts, secretary-treasurer, 460 East Ohio Street, Chicago, Ill. In cooperation with the American Chemical Society, this organization has been active in the elimination of useless sizes, shapes, and designs of apparatus. A list of the sizes and shapes retained was published in 1927.

Sheet Metal Ware Association, Warren S. Smith, secretary, 342 Madison Avenue, New York, N. Y. In 1924 this organization initiated the movement which resulted in the elimination of excess sizes and varieties of sheet-metal ware and the promulgation of the current simplified practice recommendation relating to tinware, galvanized, and japanned ware.

Sheet Steel Trade Extension Committee, Terminal Tower Building, Cleveland, Ohio (chairman, G. H. Charls). This committee, which functions under the National Association of Flat Rolled Steel

Manufacturers, conducts research, including investigations of coatings to resist corrosions, paint blistering on galvanized sheets under various conditions, paints for sheet steel, and resistance of sheet steel to fire and lightning in farm and industrial buildings, garages, and other structures. It has cooperated with the United States Department of Commerce in establishing standards and in the elimination of excess sizes and practices, and engages in standardization work relative to gauges and other dimensions.

Silk Association of America (Inc.), The, Ramsay Peugnet, secretary, 468 Fourth Avenue, New York, N. Y. Revision of finished goods rules, of thrown silk rules, and of woven label rules, compilation of raw goods rules, preparation of uniform contract forms to be used in the purchase and sale of finished goods and of raw goods, publications of the cost-accounting manual for commission throwsters, preparation of a cost manual for broad silk manufacturers, and the adoption of a cost sheet for ribbon manufacturers are among the standardization activities undertaken by this association during the past year. Committees are now working on standard terms for the broad silk industry, a minimum standard for piece goods, twists for throwsters, and put-ups and color lines of pound goods for sewing silk manufacturers. To further the adoption of an international raw silk classification the American Technical Committee recently conferred with the Raw Silk Association of Japan at conferences held at Yokohama, and the raw-silk classification committee has started on the third period of its work. The association is also cooperating with the Federal Government in the matter of specifications for silk used in the Army and Navy and in the development of a standard parachute silk.

Simplex Concrete Pile Association (Inc.), 2 Rector Street, New York, N. Y.; W. M. B. Freeman, 38 Chauncey Street, Boston, Mass. An important step in the standardization work of this organization has been the formulation and adoption of specifications for standard simplex concrete piles.

Society of American Foresters, The, Ward Shepard, secretary, 517 Lenox Building, 1523 L Street NW., Washington, D. C. This association has taken an active interest in the work going forward under the auspices of the American Standards Association, and is officially represented on the sectional committees on safety code for logging and sawmill machinery; methods of testing wood; and specifications for railroad ties, wood and steel poles.

Society of Automotive Engineers (Inc.), C. F. Clarkson, secretary and general manager, 29 West Thirty-ninth Street, New York, N. Y. Approved standards are published as the society's specifications in the society's handbook, which is revised and published in March

each year. In the present edition of the handbook are more than 600 specifications. In 1928, 63 standards were adopted, including the following: Motor-coach storage batteries, fan belts and pulley assemblies, revised laboratory tests for automobile headlighting, Woodruff keys, steering-gear connecting rods and duplex carburetor and air cleaner mountings. In the small-tool field, in which standardization is beginning to make headway, specifications have been adopted for the tolerances in spark-plug holes and the dimensions of taps for them, taps for straight pipe threads up to and including 1 inch diameter, and standard blanks for cylinder and thread plug gauges and ring thread gauges. One of the most important projects completed during the year was a revised standard list of low-pressure, or balloon tire sizes which has been agreed to by the tire and car manufacturers. Possibly the greatest accomplishment in standardization for the year was in the aeronautical field, for which standards were adopted for tail-skid shoe mountings; aircraft storage batteries; a variety of aeronautic bolts and nuts and small aircraft fittings, such as eyebolts, nonmetallic pulleys, rigid terminals, shackles and turnbuckles, generator engine starter and fuel-pump mountings. The most important of the new aeronautic standards are for the propeller hub shaft ends. Of more than 100 current standardization projects, many include structural parts for wheels and wheel hubs, and airplane tires and rims. International agreement is being approached on the standardization of annular ball bearings. In the electrical field research is in progress on developing improved specifications for insulated and high tension ignition cable. New or revised specifications are being formulated for body sheet steel, steel heat treatment, notes and physical property charts, various types of automobile lamps and their mountings, propeller shafts and fittings for motor boats, motor-coach and motor-truck bumpers, various nonferrous metals, felt, black baking enamels, and other materials. In the field of production engineering, work is being conducted on classification and grading of grinding wheels, abrasive papers and cloths, and standardization of various types of small tools. Important work is in progress on the extension of and addition to the present standards for spline fittings.

Advertising in the society's handbook is limited to automobile parts or materials made in accordance with the society's specifications, certificates being signed by proper officials of the manufacturing firms to the effect that the products advertised comply with the designated specifications. Systematic surveys of the extent to which the society's standards and specifications are used are made regularly in order that they may be kept up to date. The principal means of furnishing information regarding the specifications

and their promulgation are the handbook and the S. A. E. journal (monthly), and direct circularizing, correspondence, and use of the trade press. The society is joint sponsor for nine sectional committees functioning under the rules of procedure of the American Standards Association. Of these it is joint sponsor with the American Society of Mechanical Engineers for the following five projects: Standardization and unification of screw threads; ball bearings; bolt, nut, and rivet proportions; pins and washers; and wire and sheet-metal gauges. It is also joint sponsor for transmission chains and sprockets (with the American Society of Mechanical Engineers and the American Gear Manufacturers Association); safety code for aeronautics (with the National Bureau of Standards); automobile headlighting specifications—laboratory tests for approval of electric headlighting devices for motor vehicles (with the Illuminating Engineering Society); and small tools and machine-tool elements (with the American Society of Mechanical Engineers and the National Machine Tool Builders Association). During 1928 the society was represented on about 30 committees or boards of other national organizations or governmental bureaus and departments. The American Petroleum Institute and the National Automobile Chamber of Commerce maintain four research associates at the National Bureau of Standards investigating fuels, the Society of Automotive Engineers being responsible for the administrative details of their maintenance at the bureau. The society directly maintains two research associates at the bureau investigating automobile headlighting. In addition, it is sponsoring a research program at the bureau on vapor-lock in airplane-fuel systems. The society also maintains a production committee and a motor-vehicle fleet operation and maintenance committee for the advancement of the branches of the society's activities in these fields.

Society for Electrical Development (Inc.), Kenneth A. McIntyre, managing director, 420 Lexington Avenue, New York, N. Y. This society comprises in its membership all branches of the electrical industry and is devoted to cooperative educational work. It has inaugurated a so-called "red seal plan" for identifying a house that is properly and adequately wired. The plan involves wiring specifications, an inspection, and an award. Inspection is provided locally by a representative of a duly authorized operating organization, who checks the specifications against the job. If the wiring installation conforms to the specifications an award is made consisting of a miniature red seal, permanently affixed to some part of the main service panel, and a certificate signed by officers of the operating organization is issued to the house. This society has also

promulgated a model uniform electrical ordinance for the purpose of providing a guide that may be followed in the drawing of municipal regulations for installation of electrical-wiring equipment. In this connection a field and headquarters service is rendered to communities interested in improving or enacting electrical ordinances.

Society of Industrial Engineers, The, George C. Dent, executive secretary, 205 West Wacker Drive, Chicago, Ill. Among the society's committees are several dealing with standardization and similar topics, including management terminology, elimination of waste in management and manufacture, production standards, and plant-maintenance standards.

Society of Naval Architects and Marine Engineers, Daniel H. Cox, secretary, 29 West Thirty-ninth Street, New York, N. Y. This society is a member of the American Marine Standards Committee and is serving as joint sponsor with the American Society of Civil Engineers and the Association of Amercan Steel manufacturers for the sectional committee on structural-steel shapes functioning under the American Standards Association.

Society for the Promotion of Engineering Education, F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa. The standardization activities of this society are limited to work having a direct bearing upon the teaching of engineering subjects. It is serving as joint sponsor for two sectional committees functioning under the American Standards Association, as follows: Scientific and engineering symbols and abbreviations (with four other organizations) and standards for drawings and drafting room practice (with the American Society of Mechanical Engineers).

Society of Terminal Engineers, Charles H. Newman, secretary, 30 Broad Street, New York, N. Y. The society serves as a medium for collecting and interchanging information on all phases of terminals, for organizing and carrying on research in the various branches of terminal activities, and for the advancement of ethical and professional standards in terminal engineering, construction, and operation. While the society itself carries on no standardization activities, it has a research committee whose work during the past year has been to investigate the condition of records employed by terminal engineers and to analyze problems that come up in the field of port or terminal development.

Southern Cypress Manufacturers' Association, J. R. Black, secretary-manager, Barnett Bank Building, Jacksonville, Fla. Through the committee on grades and specifications, all of the association's rules have been brought into conformity with American lumber standards.

Southern Hardware Jobbers Association, John Donnan, secretary-treasurer, 281 American National Bank Building, Richmond, Va.

This organization cooperated with the National Hardware Association of the United States and the National Retail Hardware Association in the movement which resulted in the formulation of the simplified practice recommendation relating to sizes and varieties of loaded paper shot shells.

Southern Pine Association, H. C. Berckes, secretary, New Orleans, La. One of the functions of the association is the maintenance of standard grades for Southern pine lumber and the supervision of the mills to assure uniformity in their manufactured products. Its staff of inspectors visit the plants of the member firms monthly to check up the work of the mill graders. Firms receiving this service place the mark of the expert grader on all of the lumber they make. Through the Central Committee on Lumber Standards and the National Committee on Wood Utilization it has cooperated with the Department of Commerce in the national wood standardization program. It has issued specifications for grades of rough and dressed Southern pine lumber, for rough and dressed timber, and for car material.

Southern Sash, Door, and Millwork Manufacturers' Association, C. B. Harman, secretary, Forsythe Building, Atlanta, Ga. The association has set up standards for sizes, grades, and designs for sashes, doors, and millwork. It has established standard methods for millwork cost accounting and standard specifications of manufacture.

Southern Supply and Machinery Dealers Association, Alvin M. Smith, secretary, care of Smith-Courtney Co., Richmond, Va. In 1927 this association took part in the standardization of wrought-iron and wrought-steel pipe, valves and fittings, and the packing of carriage, machine, and lag bolts. In 1928 it cooperated with the division of simplified practice in the formulation of simplified practice recommendation relating to hack-saw blades.

Steel Barrel Manufacturers Institute, D. S. Hunter, secretary, Bulkley Building, Cleveland, Ohio. The institute has adopted minimum weights for barrels of various types and sizes, standard threads and measurements for bung openings, and standard distances between rolling hoops. It initiated the movement which resulted in the simplified practice recommendation relating to the sizes of steel barrels and drums. All members of the institute have pledged themselves to adhere to the standards developed by the institute or established by the Interstate Commerce Commission.

Steel Founders' Society of America, William J. Corbett, secretary-manager, Magee Building, Pittsburgh, Pa. The society cooperates with the American Society for Testing Materials in formulating specifications for steel castings and is represented on the joint committees on pattern equipment standardization, on foundry

refractories, and on the investigation of the effect of sulphur and phosphorus in steel.

Structural Service Bureau, H. J. Baringer, technical secretary, 112 South Sixteenth Street, Philadephia, Pa. This bureau has cooperated actively in the preparation of standards, codes, and specifications which have been promulgated by National, State, and municipal authorities, the National Board of Fire Underwriters, American Society of Heating and Ventilating Engineers, and other organizations. It has also cooperated in the compilation and issuance of specifications which have been adopted by the following organizations: The Associated Tile Manufacturers, Common Brick Manufacturers Association, National Slate Association, National Lime Association, Eastern Clay Products Association, and a number of individual firms.

Tap and Die Institute, The, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. The committe on simplification and standardization is actively engaged in the task of eliminating from catalogue lists sizes and styles of taps and dies which the trade no longer demands and is establishing proper standard basic mechanical sizes of these tools to be listed in revised catalogues.

Technical Association of the Pulp and Paper Industry, R. G. Macdonald, secretary, 18 East Forty-first Street, New York, N. Y. This association has adopted officially and published 28 methods of testing paper, formulated in cooperation with the National Bureau of Standards. Additional methods are being worked upon at the present time. Work is also going forward on proposed standard test conditions for determining the initial strength of pulp. Through its committe on heat, light, and power, this association is cooperating with the American Society of Mechanical Engineers in the development of a scheme for the identification of piping systems. It is cooperating also with the American Society for Testing Materials through its paper-testing, materials-testing, and roofing-felt committee.

Telephone Group. In its standardization activities conducted under the auspices of the American Standards Association, the telephone industry operates as a group, consisting of the Bell Telephone System and the United States Independent Telephone Association. The A. S. A. executive committee representative of the group is F. L. Rhodes, of the Bell Telephone System, 195 Broadway, New York, N. Y. C. C. Deering, 19 South La Salle Street, Chicago, Ill., is secretary of the United States Independent Telephone Association. The work of standardization of materials and methods for the Bell System is performed by groups of experts, who have formulated a sufficiently wide range of standards to meet ordinary needs.

The United States Independent Telephone Association has organized a plant division chiefly for the purpose of acting as a clearing house to gather and promulgate facts of value to the member companies and act for the association in its cooperative work with outside interests, such as the American Standards Association, the National Electric Light Association, and the National Bureau of Standards. It has been active in the organization and work of the American committee on inductive coordination, which includes representatives of not only the telephone and electric-light groups but also the electric-railway group and the steam and the electrified railroad group. The telephone group is sponsor or joint sponsor for two sectional committees functioning under the A. S. A., as follows: Manhole frames and covers (with the American Society of Civil Engineers) and specifications for wood poles.

Textile Color Card Association of the United States (Inc.), The, Margaret Hayden Rorke, managing director, 200 Madison Avenue at Thirty-sixth Street, New York, N. Y. This association has developed a standard color card used in the textile and allied industries of America to identify the colors by the name or number assigned to them. The association also issues the standard hosiery color card used by the hosiery industry of America.

Tire and Rim Association of America (Inc.), The, C. E. Bonnett, general manager, Guarantee Title Building, Cleveland, Ohio. This association, composed of manufacturers of vehicle tires, rims, wheels, bases, or their related parts, was organized for the purpose of conducting standardization and inspection work. It has adopted rim standards for passenger cars, trucks and busses, airplanes, and motorcycles. It carries on the work of inspection to see that rims conform to the standards set by it.

Tissue Paper Manufacturers Association, E. H. Naylor, secretary, 44 Vernon Street, Springfield, Mass. In cooperation with the National Paper Trade Association the association has adopted and promulgated standard sizes for tissue paper in accordance with simplified practice recommendations of the United States Department of Commerce. Members of the association are authorized to use the official label and the seal of the association in guaranteeing the packages to be in accordance with simplified practice recommendation as to size and count.

Turpentine and Rosin Producers Association. (See Pine Institute of America.)

Underwriters' Laboratories, Dana Pierce, president, 207 East Ohio Street, Chicago, Ill. For 27 years the laboratories have been maintained by the National Board of Fire Underwriters for examining and testing appliances and devices on contracts entered into with

the owners and manufacturers of such appliances and devices respecting the recommendation thereof to insurance companies. Definite specifications relating to design details and performance characteristics have been formulated by the laboratories with special reference to life and fire hazards and accident and theft prevention, many of these being for electrical materials and devices. Arrangements are made with manufacturers for the inspection of devices and materials at the factories by laboratories inspectors, and standard goods are identified by stamps, transfers, labels, or other markings whereby they may be recognized wherever found. As a member of the fire-protection group of the American Standards Association, the organization is joint sponsor for specifications for rubber-lined fire hose (with the American Society for Testing Materials) and specifications for the fire tests of materials and construction (with the American Society for Testing Materials and the National Bureau of Standards). The organization is sponsor for specifications and standards for electrical devices and materials with relation to fire and casualty hazards.

United States Pharmacopœial Convention, Lyman F. Kebler, M. D., secretary, 1322 Park Road NW., Washington, D. C. One of the prime objects of this body is to establish uniform quality standards for the use of those engaged in the practice of medicine and pharmacy in the United States. Through its committee on revision, the convention revises the United States Pharmacopœia at intervals of 10 years. The Pharmacopœia describes and gives standards for such drugs as are recognized therein. The tenth decennial revision became effective January 1, 1926. The companion book, the National Formulary, the fifth edition of which became official July 1, 1926, is revised by the American Pharmaceutical Association and published and controlled by that association. The United States Pharmacopœia and National Formulary, official at the time of investigation, are recognized as authorities by the national food and drugs act of June 30, 1906, and similar laws of many States in the Union.

United States Potters Association, Charles F. Goodwin, secretary-treasurer, East Liverpool, Ohio. Through its committees, this association is endeavoring to establish uniform shop conditions and practices throughout the industry. The committee on machinery makes an annual survey of new installations and improvements in mechanical equipment; the committee on kilns and firing reports new developments and has undertaken the study of conditions which actually prevail in the most modern types of kilns. The research committee studies the fundamental processes involved in the manufacture of pottery products, for the purpose of standardizing the

methods of testing the raw materials and the finished product. In its research and standardization work the association cooperates actively with the National Bureau of Standards.

United Typothetæ of America, Edward T. Miller, secretary, 173 West Madison Street, Chicago, Ill. This organization has published a dictionary of printing terms, including standard definitions of the various operations in printing and binding, a standard form for estimating printing, and standard cost finding and accounting systems for printers. Its research department has made a special study of printing processes and methods. The organization has taken an active part in promoting the standardization of paper sizes, in cooperation with the National Paper Trade Association, the Writing Paper Manufacturers Association, and the division of simplified practice.

Wallpaper Manufacturers' Association of the United States, Henry Burn, president, 461 Eight Avenue, New York, N. Y. This association has published trade regulations which include specifications relating to the width and length of wall paper. These regulations, which affect nearly 75 per cent of the wall paper used, have passed the test of the Federal Trade Commission. They furnish protection to the purchasers of wall paper by requiring the word "ungrounded" to be printed on the side of the pattern of wall paper which has not been covered with color prior to printing.

West Coast Lumbermen's Association, W. B. Greeley, secretary-manager, White-Henry-Stuart Building, Seattle, Wash. This association, which was organized in 1901, as the Pacific Coast Lumber Manufacturers Association, is actively engaged in the promotion of Douglas fir, west coast hemlock, Sitka spruce, and western red cedar. Its activities pertain mainly to the logging, manufacture, and merchandising of the above-mentioned forest species. It has adopted grades and sizes as provided in the American lumber standard basic grade provisions and has corrected its official grading rules from time to time to cover changes made in these standards. It had issued several publications furnishing technical detailed information on working stresses for American lumber standard grades. The promotion of American lumber standards is accomplished through meetings, publications, and personal contact by the association officials and its grading and inspection personnel. The grading standards actually in use are checked monthly at each member's plant.

Western Pine Manufacturers Association, A. W. Cooper, secretary-manager, 510–517 Yeon Building, Portland, Oreg. This association has taken an active part in the American lumber standards movement and has put into practice, with very minor exceptions,

the standard sizes of manufacture adopted cooperatively by the manufacturers, distributors, and consumers of lumber, and is adopting the American standard patterns for worked lumber.

Western Red Cedar Association, W. H. Jones, secretary, Peyton Building, Spokane, Wash. The association has issued specifications for western red cedar poles and for butt treating of cedar poles in open tanks. It has cooperated with the American Wood-Preservers' Association and the National Electric Light Association in connection with specifications for butt treating in open tanks.

Wirebound Box Manufacturers Association, R. M. McClure, secretary-treasurer, 111 West Washington Street, Chicago, Ill. This association has organized a standardization and specifications committee to pass upon all specifications for new wire-bound containers, when requested, and to consider all proposed changes or amendments offered in existing specifications authorized by the Interstate Commerce Commission or other regulatory agencies; and by the Army, Navy, or other branches of the Federal Government. The committee supervises, conducts, or cooperates in the actual testing of wire-bound boxes in the different box and crating laboratories, and in the design of new packages, these results being drawn upon in the actual writing of the specifications. The principal accomplishment in 1928 was an extended series of tests on the strength of the thinner thicknesses of veneer used, or possible of greater use, in wire-bound boxes; also another study to determine the effects of positioning staples and placement of binding wires with reference to those portions of the box subject to greatest strain and stress in transit.

Wool Institute (Inc.), The, A. D. Whiteside, president; L. A. Hird, secretary, 2 Park Avenue, New York, N. Y. This institute, which was organized in the past year, has prepared a program for the establishment of standards relating to fabrics and other materials manufactured in the wool industry. No definite standards or specifications have as yet been formulated.

Writing Paper Manufacturers Association, E. H. Naylor, secretary, 44 Vernon Street, Springfield, Mass. Organized in 1861, this is the oldest trade association in the United States. It has adopted and promulgated certain trade customs relating to writing paper, including standard sizes and weights. The weights listed are approved by the National Paper Trade Association. It has approved a classification of cotton rags promulgated by the National Association of Waste Material Dealers.

X. BIBLIOGRAPHY ON STANDARDIZATION (1928)

Supplementary to the list printed in the Standards Yearbook for 1928, pages 353–372

[Compiled by Anne L. Baden, division of bibliography, Library of Congress, under the direction of William Adams Slade, chief bibliographer. The call numbers accompanying the entries are those of the Library of Congress]

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