DEPARTMENT OF COMMERCE

HERBERT HOOVER, Secretary

STANDARDS YEARBOOK

1928

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, January 4, 1928.

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

In the first issue 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 1927 and their programs for future work. Moreover, a special feature is made of the accomplishments and current activities of the various foreign national and the several international standardizing agencies. Included also is a bibliography contributed by courtesy of William Adams Slade, chief, division of bibliography, Library of Congress.

The Standards Yearbook has proved its value in the daily work of officers and agencies concerned with standardization, especially in its official or governmental aspect. It furnishes the answers to a great volume of urgent inquiries received by the Bureau of Standards from manufacturers, industrial experts, engineers, and purchasing agencies, both governmental and general.

Respectfully,

GEORGE K. BURGESS,
Director, Bureau of Standards.

Hon. HERBERT HOOVER,
Secretary of Commerce.

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STANDARDS YEARBOOK, 1928

I. SCOPE OF STANDARDIZATION

This century has seen few things as significant as the rise of standardization as a method of human progress. It has, to a scarcely realized extent, taken hold of the details of our industrial régime. Its immediate aims are so well known as to suggest a brief review of its wider aspects.

Modern knowledge is classified by standard systems in which minute subdivisions are given code numbers. This makes possible modern bibliographies, libraries, and card indexes into which flow vast volumes of data oriented by code number. This standardization harvests discovery, classifying and making it available, speeding up its utilization.

Our epoch is a "machine age." A book embodies knowledge, a machine embodies skill—standardized, energized to do a service in a standard way. In "mass production" standardization is the basis, framework, and method of the machine process, for all machine dimensions and process characteristics are measured for service.

Human activities are based on time schedules, with times allotted for food, work, rest, and play. Trains on schedule time carry people to meet countless appointments and duties. The flow of raw materials and power is scheduled to produce for industry the staples in the quantities and at the times and places to meet the measured demands. Business engages to supply at each set time and place the things called for, to fit the measured supply to the measured need.

Time measurements to-day are taking account of the latest findings of astronometry, which is so precise that a change of 40 seconds in 80 years has been measured. For small time intervals, the oscillation of a quartz crystal at constant temperature is used to standardize radio-frequency (waves per second) and inversely to measure time, giving a time scale subdivisible into hundred-millionths of a second or less. Any radiation frequency emitted by an atom is the ticking of an atomic clock, the oscillation mechanism of which causes hundreds of trillions of waves per second. The accurate standardization of these frequencies—some of which, like those of the iron atom, have thousands of distinctive rates—is the basis of spectroscopy, which has created a new astronomy, a new chemistry, and a new physics.

Standardization is the modern way of making permanent each advance. It assures that never again shall there be a "lost art," for

arts and crafts are run by measured records or standards. We begin to normalize even the skill of the craftsmen in motion studies. Marey and Gilbreth, studying motions, have given us an art for portraying skilled fingers in vital operations of industry. Time and trajectory of such motions are embodied in time-scaled wire models for study. The photocyclochronograph and high-speed cameras record the ensemble permitting the analysis of each detail.

Man's mental response is gauged. We know how fast a person should respond to stimuli through eye, ear, tongue, nose, or touch. The strength of each muscle is measurable by dynamometers. Each detail of physical life is subjected to analysis, measurement, record. Normal magnitudes of physical and mental behavior are deduced from thousands of individual measurements, and these standard norms become bases of reference for diagnosis, prognosis, and prescriptive régime.

Standards of measurement multiply. They give the network of measures to which all standardization is referred. Standards, exact and constant, are being supplied to all nations. The requisite science for precise measurement is being steadily developed. Units are devised to standardize the measured data of matter and energy.

Position on the earth is being standardized by using a single zero for longitude, one for latitude, and one for altitude—mean sea level. These three bases, however, formerly gave variable results. After decades of measurements by a chain of observers around the world, we now standardize the variation-of-latitude measurement by numerical data, graphs, and formulas. Knowing how the pole of the earth's rotation wanders around its pole of figure, we stabilize our coordinates of position, while the variation of mean sea level is still a problem of precise geodesy.

Standard values of physical aspects of matter and energy are called "constants." They are basic for processes in industry and experiment in science. They comprise melting points, heats of combustion; mechanical equivalents of heat, light, and electric energy; hardness of metals; densities of materials, their strength, yield point, and elastic limits; the characteristics of radiation, the quantum, the velocity of light, and countless other magnitudes which are wrought into controls to guide experiment and production. The ice and steam points fix and bound the fundamental interval of temperature from which the temperature scale extends downward to absolute zero, upward to the temperatures of the stars. These extensions are fixed by reference points, freezing points, boiling points, or the ionizing temperatures of elements. They gauge and make usable those aspects and potencies which inhere in the nature of things. In their totality physical constants are the precise quantitative description of nature and its phenomena. Vast num-

bers of such data are printed in engineering handbooks and enter into the design of structures everywhere.

The need for uniform usage leads to accepting the best known value as standard for computation, experiment, design, or secondary standardization. Atomic weights experimentally determined are reviewed by an international commission on atomic constants and its decisions fix the standard atomic weights for chemistry.

Such quantitative data or constants are often in the form of an equation, a nomogram, or a graphic curve which sums up whole series of quantitative data, and replace tables. The standard or characteristic curve, such as the hysteresis loop or the stress strain diagram, is significant and affords a standard means of studying cycles of variation. Examples are the steam engine indicator diagram and time-pressure curves for the high-powered gun or the human heart. Such curves are studied in the diagnosis of defective operation. They are standards related to physical constants.

Initially man devised new utilities to meet his needs. An arrow head was made. Its design and the method of making it were preserved, reused, bequeathed as priceless craftsmanship—standardized for a standard need. Man first took nature, doubtless, as given selecting what he found at hand to serve his need. Even to-day survives a feeling that the user must take industrial products as given, selecting what he finds to fill his needs. A new note is a persistent insistence that the use must fix the standard. This is an engineering ideal, for it meets a need by specific design, creating a product suited to the need.

Standardization begins to pervade all human activity. The beaten path is the standardized path, beaten smooth by footsteps which stabilize their own standards as the river cuts the channel which guides its flow. Human action, too, beats its trail into habits—standard reactance with its economy of time and energy and its skill stored in neural arcs and automatic responses. Language is a standard vehicle for the commerce of ideas for which the alphabet gives standard symbols. Words are standard symbols of standard concepts.

Symbols are basic tools of thought and communication. They must be reasonably standard and of single-valued meaning. They are used in formulas, graphs, and equations as shorthand for important basic quantities. The use of graphic symbols for functioning parts of a radio set-up is an example of an ideographic language. Graphic symbols in a radio hook-up diagram are self-explanatory almost without any text. Altogether symbols now multiplying in great numbers and being standardized for countless uses, constitute the universal graphic vocabulary of a fast developing ideographic language, of which the standard symbols of music and mathematics already in world-wide use are brilliant examples.

The scope of standardization comprises (1) standardization of basic tools of thought and expression—words or terms, abbreviations,

symbols, definitions, and the interpretations and conditions governing their use; (2) standardization of dimension, size, form, and the magnitudes of pertinent characteristics and properties of matter and energy; (3) standardization of correlated dimensional interrelations, such as preferred numbers, staple series of size or grades, allowances and tolerances, or other seriation of serviceability factors which constitute standard practice or process. The coordination of the machine process calls for staples of standard size, design, and material, and set time, place, and quantities to be delivered. These insure the smooth functioning and economy of production and transportation. An equally standard system of devices for utilizing such staples must be provided. However, rigid standardization does not hold back innovations, so strong is the feeling that standardization should imply, if not the ideal, at least the best feasible.

Modern standardization provides that a standard shall be reviewed and revised to keep pace with progress both in science and industry and in the user's ideals of satisfying service. This minimizes the lag in using new discovery—a real problem of human progress.

With the tendency for standardization to expand its scope to comprise every controllable thing comes the parallel movement to measure each need so that a standard can be gauged to satisfy accurately such need, as we measure the foot to supply the well-fitting shoe. This tendency, despite the simplification of varieties for the same need, may increase the total by providing more specialized satisfactions of more unit needs. The use of diverse surgical instruments specialized for a vast variety of operations is an example.

The factor analysis essential to standardization of process stimulates the development of measured controls. These may be so accurate that high quality becomes automatic, uniform, never failing. Such analysis is a first step in turning over handicraft to the automatic machine. As the essential motions are derived from the analysis and the measured controls devised, skill becomes incorporable in mechanism, from which stage the automatic machine is but a step.

The number of items to be standardized is so vast that no wholly centralized standardization service is practicable. Everywhere "all interests concerned" with each item are busily experimenting in the laboratory; observing service, its flaws and successes; measuring needs to be met, or creating new standards. Doubtless every user, by approval, criticism, report, or suggestion, aids in standardizing the products he uses.

The scope of standardization is clearly enlarging and its key position in industrial and scientific progress entitles it to the fullest possible cooperation of all concerned. Standardization is more than the act of bringing the user and the maker together in a clear understanding on the quality of service. Its aim is also to satisfy the user's needs with increasing efficiency and economy. It conserves all gains achieved while serving as the vehicle for further advance.

II. INTERNATIONAL STANDARDIZING AGENCIES

INTERNATIONAL CONFERENCE ON WEIGHTS AND MEASURES (SEVENTH) AT PARIS, SEPTEMBER, 1927

[Thirty-one national governments officially represented under the terms of the treaty of May 20, 1875]

Notable advances toward complete international agreement on fundamental questions of measurement were made at the Seventh International Conference on Weights and Measures. The American delegates were Dr. George K. Burgess, Director of the Bureau of Standards, and Dr. Samuel W. Stratton, president of the Massachusetts Institute of Technology. The present year (1927) is the fiftieth anniversary of the establishment of the International Bureau of Weights and Measures, and in commemoration of the event a special meeting was held under the auspices of the French Academy of Sciences in connection with the conference. A history of the International Bureau by its director, Dr. Ch.-Éd. Guillaume, has been published [1] and gives an interesting review of past achievements.

It was peculiarly fitting that this, the seventh international conference, should be the most important in point of results secured since the first conference in 1875. The actions of the 1927 conference affect fundamentally many kinds of measurements and standards, and were based on the results of painstaking scientific research covering many years. The new decisions involve the international temperature scale, the fundamental standard of length (of the meter) and the basis of the world's electrical units.

Under the treaty of May 20, 1875, there was established the International Committee on Weights and Measures, the International Bureau of Weights and Measures, and the International Conferences on Weights and Measures. The treaty, to which 31 of the leading governments are now parties, gives the conference jurisdiction over the fundamental problems affecting the international metric standards and precise metrology.

The international conference meets once in six years, and is made up of delegates from the 31 national governments. Adoption of any proposition by the conference can be secured only by the unanimous vote of all nations represented, each nation having one vote. The recommendations of the conference are, in effect and when ratified, binding on the signatory powers, and because of this fact and because unanimous agreement is required for adoption, the process of effecting important changes is usually slow.

[1] La creation du Bureau international des Poids et Mesures, et son oeuvre, Paris, Gauthier-Villars et Cie.

SUMMARY OF ACTIONS

1. Official adoption of an equivalent for the meter in terms of the wave length of the red radiation from cadmium.

The president of the committee referred to the subject of the requested definition of the meter. The following definition proposed by the delegation from the Austrian Republic was unanimously adopted:

The unit of length is the meter, defined by the distance at the temperature of melting ice between the centers of two lines traced on the platinum-iridium bar deposited at the International Bureau of Weights and Measures, and declared prototype of the meter by the first general conference on weights and measures, this bar being subjected to normal atmospheric pressure and supported by two rollers, at least 1 centimeter diameter, situated symmetrically in the same horizontal plane and at a distance of 572 millimeters from each other.

The conclusions reached by the International Bureau of Weights and Measures have aroused great scientific interest, but still require certain supplementary studies, which, for lack of time, it was impossible to complete before the conference. In consequence, the conference instructed the international committee to pursue the required studies during the next two years, and gave to the international committee full power to make, at its 1929 session, a decision with regard to all necessary corrections to be made to the old certificates in the light of the results obtained in these experiments.

The president then called upon Dr. Burgess to explain the request of the Bureau of Standards of the United States concerning the definition of the fundamental standard of wave length for light waves. After this explanation the president read the text adopted by the committee concerning this definition:

In the present state of our knowledge it is recommended that the conference adopt as the fundamental standard for the length of light waves the wave length of the red radiation emitted by cadmium vapor, as determined by the experiments of Messrs. Benoit, Fabry, and Perot.

According to these experiments, the wave length of this radiation is 643.84696×10^{-9} meter when the light is propagated in dry air at 15° (hydrogen scale) under a pressure of 760 millimeters of mercury, with $g = 980.665$ cm/sec.^{2}, standard value of gravity. The light shall be produced by a high-voltage current, direct or alternating, of industrial frequency (excluding high frequency) in a vacuum tube having internal electrodes. The lamp shall have a volume not less than 25 cm^3 and a capillary tube, the diameter of which shall not be less than 2 millimeters; it shall be maintained at a temperature about 320°, and the value of the current which traverses it shall not exceed 0.02 amperes. At room temperature the tube shall not be luminous when the high-tension circuit is established in it. The provisional value of the meter in wave lengths of the red ray of cadmium under the conditions specified above, is then equal to 1,553,164.13, with a precision indicated by the last figure.

At the request of M. Tanakadate and M. Kösters two additional recommendations were included, and the three propositions were unanimously adopted. The Japanese recommendation is as follows:

The Japanese delegation fully approves this proposition, upon which subject it expressed similar views at the last conference. However, as far as relates to the prescription of the cadmium lamp, it reserves the right to suggest a possible modification in the near future. We may yet offer a lamp of special construction invented by Professor Nagaoka. In his laboratory it has been established that this lamp functions at ordinary temperatures and produces radiation both intense and of very great purity, but its life is relatively short. These facts are under investigation at Tokio; the researches are being followed up, and we hope to be able to perfect this apparatus before the next conference.

The proposition of M. Kösters reads as follows:

It is recommended that the greenish yellow ray of krypton, 560 mμ, finer than the red ray of cadmium, ought to be studied in special laboratories equipped for this purpose, in order to prepare for its possible eventual substitution for the red ray of cadmium. The ray of krypton gives, when the tube is maintained at room temperature, interferences visible up to 250 millimeters; and, if the tube is subjected to extremes of temperature obtainable in the laboratory, the interferences are observable for a difference of path of about 500 millimeters. The contraction of the line occurs symmetrically, and as far as can be determined it is free from satellites.

The definition and the two recommendations were adopted unanimously. The effect is to give an actual metric value which may be modified after experiment.

2. Agreement upon the adoption of an international temperature scale and authorization for the researches, agenda, and other incidentals thereto.

M. Volterra, president of the committee, spoke of the importance of the question which has long been studied by the committee and the experts. The Bureau of Standards had prepared a memoir for presentation to the conference. This memoir had since been submitted to the representatives of the National Physical Laboratory and the Physikalisch-Technische Reichsanstalt. The representatives of these three institutions presented a new memoir, taking into account the remarks of M. Keesom, Director of the Cryogenic Laboratory of Leiden. The committee, after having taken the memoir and its propositions into consideration, presented to the conference the following recommendation:

The committee, recognizing the practical importance of the representation of an international thermometric scale, recommends to the conference the tentative acceptance of the reference points, the interpolation formulas, and the methods of measurement proposed unanimously by the three national laboratories of Germany, the United States of America, and Great Britain.

The committee recommends also that the annexed text be held for study on the program of the special conferences on thermometry, which are to be held under its auspices.

Dr. Burgess pointed out that in 1911 the three larger national laboratories had realized the necessity of a single practical scale. Recently at London, the representatives of these laboratories, after receiving the recommendations of the Leiden laboratory with respect

to low temperatures, agreed upon a common basis resulting from a compromise; that is to say, a mean of the values which appeared to be the most exact. This single tentative scale will not replace the thermodynamic scale, but its adoption makes it possible to wait until future experiments shall have succeeded in fixing more accurately the thermodynamic scale. The adoption of this scale will greatly facilitate the labors of the thermometric conference during the coming year. It seems, from a scientific and practical point of view, that this constitutes real progress toward an eventual single scale. The recommendations of the committee were unanimously adopted.

3. Standard temperature for comparing industrial end standards. It was agreed to appoint a committee of five, to study the question and to present a report by March 1, 1929, on a standard temperature for comparing industrial end standards, and it was further agreed that this temperature should be approximately the room temperature.

4. Official designation of an international advisory commission of 10 members on the standardization of the electrical units, including representatives appointed by the several national laboratories, with request for report by March, 1929.

The next order of business was the discussion of the functions of the international bureau with respect to the study of electrical standards. The president of the committee spoke of the studies and discussion to which this question had given rise. He recalled that a report of the British delegation recommended that a committee of experts study the question of electrical units and standards. The Advisory Committee on Electricity had its rise in this recommendation.

The international committee, after a preliminary study of the memorandum of the British delegation and of the recommendations submitted in the name of the Bureau of Standards of the United States of America, transmitted them for detailed examination to a scientific conference composed of Messrs. Kösters, Stratton, and Tanakadate, of the international committee, and Messrs. Burgess, Director of the Bureau of Standards; Paul Janet, Director of the Laboratoire Central d'Électricité at Paris; Sears, jr., Custodian of Weights and Measures at London; and Guillaume, Director of the International Bureau. At an official meeting held in Paris, September 27, 1927, the following project was developed, presented to the committee by M. Janet on September 29, 1927, and unanimously adopted:

The International Committee of Weights and Measures approves the organization of a consultative committee on electricity, having for its object to advise the International Committee of Weights and Measures on questions relative to systems of electrical measurement and electrical standards. This committee shall be limited to 10 members, and be composed of (1) a representative of each of the national laboratories designated by the international committee and (2) specialists designated by the international committee.

The president of the consultative committee on electricity shall be taken from among the members of the international committee, and shall be designated by it.

The memoirs presented by the British delegation and by the delegation of the United States are transmitted for examination to the scientific committee on electricity. A report on this subject should be presented not later than March 1, 1929.

The seventh conference decided to give full powers to the International Committee of Weights and Measures after taking cognizance of the report of the consultative committee, to pass into execution the stipulations of article 7 of the treaty of 1921.

In the Standards Yearbook for 1927 (p. 185) mention was made of negotiations looking toward the adoption of an international temperature scale, and it was stated that international standardization of the temperature scale would probably be a reality in the near future. International agreement was, in fact, reached during the past year. The Seventh General Conference of Weights and Measures, meeting at Paris in September, 1927, formally adopted a standard temperature scale proposed by the Bureau of Standards, the National Physical Laboratory of Great Britain, and the Physikalisch-Technische Reichsanstalt, with the cooperation of the Cryogenic Laboratory of the University of Leiden. The definition of the international temperature scale, as adopted, is given below:

1. The thermodynamic centigrade scale, on which the temperature of melting ice and the temperature of condensing water vapor, both under the pressure of one standard atmosphere, are numbered 0° and 100°, respectively, is recognized as the fundamental scale to which all temperature measurements should ultimately be referable.

2. The experimental difficulties incident to the practical realization of the thermodynamic scale have made it expedient to adopt for international use a practical scale designated as the international temperature scale. This scale conforms with the thermodynamic scale as closely as is possible with present knowledge, and is designed to be definite, conveniently and accurately reproducible, and to provide means for uniquely determining any temperature within the range of the scale, thus promoting uniformity in numerical statements of temperature.

3. Temperatures on the international scale will ordinarily be designated as "°C," but may be designated as "°C. (Int.)" if it is desired to emphasize the fact that this scale is being used.

4. The international temperature scale is based upon a number of fixed and reproducible equilibrium temperatures to which numerical values are assigned and upon the indications of interpolation instruments, calibrated according to a specified procedure at the fixed temperatures.

5. The basic fixed points and the numerical values assigned to them for the pressure of one standard atmosphere are given in the following table, together with formulas which represent the temperature (t_p) as a function of vapor pressure (p) over the range 680 to 780 mm of mercury.

6. Basic fixed points of the international temperature scale:

	°C
(*a*) Temperature of equilibrium between liquid and gaseous oxygen at the pressure of one standard atmosphere (oxygen point)	−182.97

$$t_p = t_{760} + 0.0126\ (p-760) - 0.0000065\ (p-760)^2$$

	°C
(*b*) Temperature of equilibrium between ice and air-saturated water at normal atmospheric pressure (ice point)	0. 000
(*c*) Temperature of equilibrium between liquid water and its vapor at the pressure of one standard atmosphere (steam point)	100. 000

$$t_p = t_{760} + 0.0367\ (p-760) - 0.000023\ (p-760)^2$$

(*d*) Temperature of equilibrium between liquid sulphur and its vapor at the pressure of one standard atmosphere (sulphur point)	444. 60

$$t_p = t_{760} + 0.0909\ (p-760) - 0.000048\ (p-760)^2$$

(*e*) Temperature of equilibrium between solid silver and liquid silver at normal atmospheric pressure (silver point)	960. 5
(*f*) Temperature of equilibrium between solid gold and liquid gold at normal atmospheric pressure (gold point)	1, 063

Standard atmospheric pressure is defined as the pressure due to a column of mercury 760 mm high, having a mass of 13.5951 g/cm³, subject to a gravitational acceleration of 980.665 cm/sec.² and is equal to 1,013,250 dynes/cm².

It is an essential feature of a practical scale of temperature that definite numerical values shall be assigned to such fixed points as are chosen. It should be noted, however, that the last decimal place given for each of the values in the table is significant only as regards the degree of reproducibility of that fixed point on the international temperature scale. It is not to be understood that the values are necessarily known on the thermodynamic centigrade scale to the corresponding degree of accuracy.

7. The means available for interpolation lead to a division of the scale into four parts.

8. *From the ice point to 660° C.* the temperature t is deduced from the resistance R_t of a standard platinum resistance thermometer by means of the formula

$$R_t = R_o(1 + At + Bt^2)$$

The constants R_o, A, and B of this formula are to be determined by calibration at the ice, steam, and sulphur points, respectively.

The purity and physical condition of the platinum of which the thermometer is made should be such that the ratio R_t/R_o shall not be less than 1.390 for $t = 100°$ and 2.645 for $t = 444.6°$.

9. *From −190° to the ice point,* the temperature t is deduced from the resistance R_t of a standard platinum resistance thermometer by means of the formula

$$R_t = R_o\ 1 + At + Bt^2 + C(t-100)t^3$$

The constants R_o, A, and B are to be determined as specified above, and the additional constant C is determined by calibration at the oxygen point.

The standard thermometer for use below 0° C. must, in addition, have a ratio R_t/R_o less than 0.250 for $t = -182.97°$.

10. *From 660° C. to the gold point,* the temperature t is deduced from the electromotive force e of a standard platinum *v.* platinum-rhodium thermocouple, one junction of which is kept at a constant temperature of 0° C., while the other is at the temperature t defined by the formula

$$e = a + bt + ct^2$$

The constants a, b, and c are to be determined by calibration at the freezing point of antimony, and at the silver and gold points.

11. *Above the gold point* the temperature t is determined by means of the ratio of the intensity J_2 of monochromatic visible radiation of wave length λ cm, emitted by a black body at the temperature t_2, to the intensity J_1 of radiation of the same wave length emitted by a black body at the gold point, by means of the formula

$$\log_e \frac{J_2}{J_1} = \frac{c_2}{\lambda}\left(\frac{1}{1336} - \frac{1}{(t+273)}\right)$$

The constant c_2 is taken as 1.432 cm degrees. The equation is valid if $\lambda\ (t+273)$ is less than 0.3 cm degrees.

The adoption of this scale involves no significant change in the temperature scales of the various national laboratories, but serves as a means of unifying and stabilizing the practice of these laboratories and of providing a uniform scale of temperature which will doubtless be almost universally adopted. This accomplishment constitutes one of the most important standardization projects of the year.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

(Eighth International Conference of Chemistry, Warsaw, Poland, September 4 to 14, 1927)

The conference met under the presidency of Ernst Cohen, of the University of Utrecht.

The work of the union at its annual conference is carried out by a number of committees, the final recommendations of which, after approval by the union as a whole, are submitted to the member countries for letter ballot before official adoption. While the union has not taken final action on pending questions during the year, the list of the present committees of the union, together with the subjects engaging their attention follows:

1. The Committee on Standardization of Inorganic Nomenclature made several recommendations.

2. The Committee on Standardization of Organic Nomenclature reviewed the published reports of the committee and brought in certain amendments.

3. The Committee on Standardization of the Nomenclature of Biological Chemistry unanimously recommended certain decisions respecting the glucides, lipides, protides, and soluble ferments.

4. **The Committee of the Bureau of Physical-Chemical Standards.**—This bureau has been established at the University of Brussels and is under the direction of Prof. Jean Timmermans. The function of the bureau is to prepare a series of chemical substances in the highest degree of purity, to determine accurately their principal physical properties, and to supply samples of these extremely pure materials at a moderate price to the laboratories of the world. A depot of samples of these materials has been established at the National Bureau of Standards, Washington, D. C., for the convenience of American chemists.

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5. The Committee on Pure Products for Research has completed the codification of an approved set of tests for purity of a list of chemical reagents and this will be published in 1928. The committee recommended that its title be changed to "Committee on Analytical Chemistry" and that it be divided into three subcommittees as follows: (*a*) Committee on pure reagents for analysis; (*b*) committee on comparative study of analytical methods applied to industrial materials; (*c*) committee on definitions of industrial materials.

6. The committee on thermochemical data deals with the problems of standard methods in combustion calorimetry and standard substances for the calibration of combustion calorimeters. The committee considered that the progress of work accomplished concerning the correction of thermochemical data suggests the need for a uniform manner of publishing tables containing values corrected and referred to the standard. The commission expressed its thanks to the editor of the International Critical Tables for publishing thermochemical data in calories as well as in kilojoules.

7. **The Committee on Tables of Constants.**—This committee urged the importance of the resumption of annual publication of the "Annual Tables of Constants and Numerical Data" as soon as possible. Steps were also taken in the direction of a closer degree of cooperation amongst the countries and scientific organizations of the world in the work of the international commission in charge of annual tables.

8. **The Committee on Solid Fuels.**—This committee deals with standardization of nomenclature and of methods of analysis in this field. Two type specimens of coal will be prepared for the committee and distributed to its members to serve as reference controls in the comparison of analytical methods. The committee, after having received a communication from its president relative to the results obtained to date on the analysis of coals, and more specially on their moisture content, decides that the existing data do not permit adopting a definite method for this determination. The creation of a general committee in the United States composed of men of science and industrial and business men to classify commercial solid fuels was announced.

9. **The Committee on Liquid Fuels.**—This committee deals with the standardization of nomenclature and methods of test employed in the examination of liquid fuels and petroleum products in general. During 1928 the work will be concentrated upon studies of methods of examination of (*a*) light motor fuels; (*b*) heavy motor fuels, such as Diesel engine oils; and (*c*) lubricating oils.

10. **The Committee on Ceramic Products.**—This committee deals with the standardization of nomenclature and methods of testing ceramic materials. Standard samples of refractory clay and washed

kaolin have been prepared for distribution to the various countries of the world and will be used to establish a comparison of present national testing methods.

11. **The Committee on Bromatology.**—The committee submitted for final vote of the countries adhering to the union a list of recommendations and established the following agenda for study during 1928: (*a*) Standardization of methods of determining iodine number, (*b*) standardization of methods of determining moisture, (*c*) standardization of methods of determining cellulose.

12. **The Committee on Scientific and Industrial Property Rights.**—This committee deals with the problems involved in legal protection by means of copyright and patent laws.

13. **The Committee on Industrial Hygiene.**—This committee deals with industrial hazards of a chemical nature, and will consider at its next meeting methods of protection against gases, vapors, and injurious fumes in factories engaged in the manufacture of dye intermediates, dyes, pigments, etc.

The conclusions presented by the committee were adopted unanimously by the councils of the union. Nineteen nations were represented: Argentina, Australia, Belgium, Canada, Czechoslovakia, Denmark, Estonia, France, Great Britain, Italy, Japan, Latvia, Holland, Poland, Rumania, Spain, Switzerland, United States of America, and Uruguay. The full reports of the conference can be obtained from the Secretary of the Union, 49 Rue des Mathurines, Paris, at 10 fr. per copy.

The ninth conference will be held in Holland in July, 1928.

INTERNATIONAL COMMISSION ON ILLUMINATION

(National Physical Laboratory, Teddington, England)

The international commission was formed in 1913 by reorganization of the former International Photometric Commission to provide a coordinating agency through which knowledge of the lighting art might be promoted in all countries within the sphere of its influence. While primarily an agency for international standardization, it concerns itself with practical problems of improved lighting conditions through its several national committees. The statutes of the commission define its scope as follows: "The study of all matters bearing on illumination and its cognate sciences, and the establishment of appropriate means of international agreements on illumination matters."

The commission is organized in a manner somewhat similar to the International Electrotechnical Commission. It conducts its work through committees, of which there are at present 15, on the following subjects: (1) Vocabulary, (2) definitions and symbols, (3) factory and school lighting, (4) automobile headlights, (5) heterochromatic pho-

tometry, (6) street lighting, (7) signal glasses, (8) diffusing materials, (9) photometric test plates, (10) accuracy of photometry, (11) light flux distribution, (12) daylight illumination, (13) cinema lighting, (14) fundamental research on glare, and (15) colorimetry.

The International Commission on Illumination met at Bellagio, Italy, August 31, to September 4, 1927. Previous meetings were held in Berlin in 1913, Paris in 1921, and Geneva in 1924. J. W. T. Walsh is the secretary, National Physical Laboratory, Teddington, England. At the Bellagio meeting Dr. E. P. Hyde, president, resigned, and C. C. Paterson, of Great Britain, was elected as his successor.

Forty-six papers and reports were presented at the Bellagio meeting, but there was no plenary session and no official commission actions. The papers presented at the meeting included reports on photometry, automobile headlighting, school and industrial lighting, nomenclature, glare measurements, research, and street lighting.

INTERNATIONAL CONGRESS FOR TESTING MATERIALS

The first International Congress for Testing Materials since the World War was held in Amsterdam, September 12 to 17, 1927. This congress was arranged by an organization committee of Swiss and Dutch engineers and manufacturers who felt that the work of the old International Association for Testing Materials, whose activities were discontinued as a result of the war, should again be taken up. As a consequence, delegates had been called for from all the countries formerly active in testing work. The congress proved to be a success with over 450 in attendance, a cordial spirit prevading all of the discussions. The United States took an active part; the A. S. T. M. was officially represented by past president W. H. Fulweiler and vice president T. D. Lynch; and, in all, there were 11 from the United States who attended. Eighteen of the eighty-five papers presented were by American authors.

Of primary interest, of course, were the discussions on the possibility of reviving the Old International Association for Testing Materials. A meeting of the delegates was held in advance of the congress at which the views of the representatives of the various countries were expressed. This meeting was attended by 32 delegates representing 17 nations as follows: Germany, United States, England, Austria, Denmark, France, Holland, Hungary, Sweden, Switzerland, Czechoslovakia, Spain, Italy, Norway, Rumania, Russia, and Belgium. There were differences of opinion, some feeling that the old international society should be reorganized in its old form, others believing that no attempt should be made to organize a formal society, but that international congresses held periodically would suffice. Similarly, there was some difference of

opinion as to whether standardization work should be attempted. It was decided that an international society be organized in some form and a special committee of seven members was appointed which reported at the plenary session held toward the close of the congress at which time a suggested constitution was submitted.

The expressed objects are to secure international cooperation, exchange of views, experience, and knowledge in regard to all matters connected with the testing of materials. Questions of standardization of materials are to be regarded as being outside the scope of the organization.

Since the congress, formal invitation has been received from the secretary of the new international association requesting American adherence to the new movement and inviting members of the A. S. T. M. to join the new association. These, together with the constitution itself, are under consideration by the executive committee of the A. S. T. M.

The various papers presented at the International Congress for Testing Materials will be issued in book form.

INTERNATIONAL CRITICAL TABLES

(Washington, D. C.)

At the organization meeting of the International Union of Pure and Applied Chemistry, held in London in June, 1919, the union approved as one of its projects the compilation of International Critical Tables of Numerical Data of Physics, Chemistry, and Technology, and assigned to the United States of America the financial and editorial responsibility for the undertaking. The project was later given the patronage of the International Research Council at its Brussels meeting in 1923.

On behalf of the National Academy of Sciences, the National Research Council of the United States accepted the executive, editorial, and financial responsibilities of the project, and with the cooperation of the American Chemical Society and the American Physical Society created a board of trustees to take charge of the financial and business administration, and a board of editors to supervise and carry out the preparation of the text. Dr. Edward W. Washburn was made editor in chief.

The board of editors organized the work early in 1922 with the aid of 10 corresponding editors in various parts of the world, and enlisted the aid of approximately 300 cooperating experts having a special knowledge of some portion of the subject matter.

Volume 1 (415 plus xx pp.) was published in 1926. It covered such topics as systems of weights and measures, general constants of nature, properties of chemical elements, laboratory technic, ready reference tables on the physical properties of chemical substances, radioactivity, astronomical, and geodetic data and aerodynamics.

Volume 2 (616 plus xv pp.) appeared in 1927 and covered the characteristic properties of a great variety of natural and industrial materials and products, together with certain additional miscellaneous information of technological interest. It also contained a very complete section devoted to the properties of metals and alloys.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

(28 Victoria Street, Westminster, London, England)

The International Electrotechnical Commission was organized in 1906, an outgrowth of a resolution adopted by the International Electrical Congress of St. Louis, in 1904, to the effect that steps should be taken to secure the cooperation of the technical societies of the world by the appointment of a representative commission to consider the question of standardization of nomenclature and rating of electrical apparatus and machinery.

A plenary meeting of the International Electrotechnical Commission was held in Rome on September 22, 1927. At this meeting the commission gave formal approval to the standardization proposals of its technical advisory committees, which had been in session September 4 to 12, at Bellagio, Italy. The work of the commission is carried on by advisory committees on the following subjects: Nomenclature, rating of electrical machinery, symbols, prime movers, steam turbines, lamp caps and sockets, voltages, traction motors, insulating oils, regulations for overhead lines, radio valves, measuring instruments, rating of rivers, and terminal markings. Only a brief digest of the committee action approved by the plenary session of the commission can be given.

Nomenclature.—"The value to the electrical industry throughout the world of a unified technical language is not easily measured, and the production by the International Electrotechnical Commission of an electrical vocabulary would provide that unity and stability to the language of the engineer which is so essential to a clear understanding of the written word among all the nations of the earth." The advisory committee has agreed upon a definite system of classification for the vocabulary, has selected the main groups under which the terms to be defined will be listed, and has made a beginning in the preparation of definitions of individual terms. A classification number will be given to each term in electrotechnical terminology. This number will be fixed by the international committee, and each term will have an official definition in English and French. In establishing national vocabularies in other languages national committees are, of course, free to introduce terms additional to those adopted, numbered, and defined internationally.

Rating of Electrical Machinery.—Great progress was made by the advisory committee in revising International Electrotechnical

Commission publication No. 34 on rules for electrical machinery. The Bellagio meeting is a milestone in the work of this committee, for the decisions reached resulted in the production of a new and enlarged document, arranged in separate parts, dealing, respectively, with general considerations, transformers, rotating machines, and traction motors. This arrangement in separate parts permits adding further independent parts as may become necessary.

Each part carries all important requirements for defining the International Electrotechnical Commission rating, thus providing international commerce with a standard of quality necessary for the equitable comparison of tenders (bids and proposals) for electrical machines received from different countries, thus limiting competition to considerations of price and delivery times.

Symbols.—This committee is responsible for International Electrotechnical Commission publications 27 and 35, which give letter symbols for fundamental units and electrical quantities, certain mathematical symbols and rules for abbreviations of metric weights and measures, and graphic symbols for diagrams and electric curcuit plans. The revision of publication 35, particularly with respect to symbols for electric traction, was begun and a comparison of the symbols for telegraph and telephone is authorized, the national committee being invited to submit proposals and present practice. It was decided to prepare symbols for heat and thermodynamics.

Prime Movers.—The work of this advisory committee is organized into two subcommittees, on (1) hydraulic turbines, and (2) steam turbines. A series of definitions for hydraulic turbines was issued in 1913 as International Electrotechnical Commission publication No. 39. At the Bellagio meeting this document was completely revised and the section of hydraulic turbines completed. It is proposed for issue as International Rules for Hydraulic Turbines, January 31, 1928. The subcommittee on steam turbines took no definite action and made no recommendations for plenary approval. Much progress was, however, made in reaching tentative agreements and in bringing together the views of the delegates on different points. A meeting is suggested within a year for the careful and detailed study by the subcommittee of the British and United States codes for the testing of steam turbines.

Lamp Sockets and Caps (Bases).—All users of electric light will appreciate the value and importance of world-wide agreement on the dimensions necessary to secure interchangeability of lamp sockets and caps (bases) which are in universal use. The advisory committee has the cooperation of a committee of lamp manufacturers and received a report from this committee to the effect that for outside diameter of the ordinary size Edison screw cap agreement had been reached between the American and European manufacturers in regard

to the dimensions and tolerances. The lamp manufacturers committee will continue its efforts to secure agreement in regard to depths of thread and base length and other dimensions involved in securing interchangeability. The bayonet type of base and socket was standardized at the New York meeting in 1926. Small bayonet bases and sockets are under discussion.

Voltages.—A list of voltages, which can be used by all countries when the subject of voltage to be adopted is in question, has been proposed by the committee on voltages. This committee is preparing a list of standard voltages for testing insulators for transmission lines, so that manufacturers can prepare a series of standard designs to reduce costs and insure quicker delivery.

Traction Motors.—The advisory committee on traction motors considered proposals on (*a*) dielectric tests, (*b*) methods of temperature measurements, and (*c*) commutation tests. A proposed formula for use in making dielectric tests is to be submitted to all national committees for discussion and criticism. The variation-of-resistance method for temperature measurements is retained except where it is unduly difficult of application. Special commutation tests were agreed upon, and proposals for the study of overload tests at reduced excitation and overspeed tests are made.

Insulating Oils.—The committee has taken steps to unify tests for insulating oils and is endeavoring to decide upon the tests necessary to indicate the suitability of an oil for insulation purposes. Much experimental work has been done in several countries to provide data. In addition to laboratory tests, tests in miniature transformers of typical and uniform design will be made. Agreement on specifications for sampling was effected and these will be submitted to the various national committees under the regular six months' rule of the commission. The importance of issuing reliable tables for converting viscosity measurements into absolute units was pointed out.

Regulations for Overhead Lines.—Long distance high-voltage transmission of electrical energy has raised the problem of protecting the public against injury and public services against interference, as well as the reduction of risk of failure of the supply. The divergence in the rules and regulations established by the authorities of different countries has been studied, and the committee is establishing a model form for the study of the problems involved in overhead line construction, for making available for general use everywhere the standard materials for line construction, and to facilitate the preparation of plans and estimates for transmission systems.

Radio Communication.—Two types of receiving-valve caps (radio tube bases) were standardized—a European type, which is a compro-

mise between existing British and continental standards, and an American type.

Measuring Instruments.—The advisory committee on measuring instruments was established at the New York (1926) meeting of the commission. Watt-hour meters only are being considered at present. The answers to a questionnaire that had been circulated to all national committees were considered by the advisory committee, and steps taken to expand the questionnaire and again circulate it to all national committees.

Rating of Rivers.—This advisory committee was appointed in September, 1926. No final decisions were arrived at by the committee, but after very full discussion, the various suggestions as to head to be employed, efficiency, and flow were referred back to the national committees for further consideration.

Terminal Markings.—No standardization of terminal markings was attained, but a basis for further study was agreed to, and tentative proposals for a large number of items will be circulated to each national committee.

Retiring president Signor Guido Semenza, of Italy, pointed out that since 1923 the national committees have increased from 21 to 26, the advisory committees from 10 to 15, and the income from 1,800 to 2,400 pounds sterling. Prof. C. Feldmann, of Holland, was elected president. The next meeting of the commission will be held in 1930 in Scandinavia.

INTERNATIONAL FIXED CALENDAR LEAGUE

Calendar Revision.—During the past year much publicity has been given to a proposed new calendar advocated by the International Fixed Calendar League and presented before the League of Nations.

The principal feature of the proposed calendar is that the year is divided into 13 equal months of 4 weeks, or 28 days each, the new month, to be known as Sol, being inserted between June and July.

The proposed use of thirteen 28-day months would leave one extra day to be accounted for on ordinary years and two extra days on leap years. It is proposed to insert these between December and January, and between June and Sol, respectively. These extra days would be without week-day names.

Some of the advantages claimed for the proposed calendar are that for business and statistical purposes corresponding time intervals would be directly comparable; each month would always contain a whole number of weeks; the end of each month would coincide with the end of the week; each day of the month would always fall on the same day of the week; any given week day in any given month would always fall on the same day of the month; movable holidays would become fixed; the calendar would become perpetual—that is, all years would be alike.

The proposed 13-month calendar appears to be gaining strong support from business organizations because of its applicability to cost accounting, business statistics, etc.

Many business organizations are already operating on the basis of four-week intervals, without regard to calendar months. The proposed 13-month year would have certain obvious advantages over any possible use of a four-week period under our present calendar.

INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION

The following actions [2] pertaining to standards, standard instruments, and nomenclature were taken by the International Geodetic and Geophysical Union at its third general assembly held at Prague, September, 1927.

The International Geodetic and Geophysical Union is a branch of the International Research Council established under the auspices of the council during the meetings at Brussels, July, 1919. Its objects are: (1) To promote the study of problems concerned with the figure and physics of the earth, (2) to initiate and coordinate researches which depend upon international cooperation and to provide for their scientific discussion and publication, and (3) to facilitate special researches, such as the comparisons of instruments used in different countries. The activities of the union are carried on through sections, namely, geodesy, seismology, meteorology, terrestrial magnetism and electricity, oceanography, volcanology, and scientific hydrology. Each of the adhering countries is represented in the International Geodetic and Geophysical Union by a National Committee on Geodesy and Geophysics; the American Geophysical Union constitutes this committee in the United States for the National Research Council. (There is in the American Geophysical Union no section of scientific hydrology.)

The International Research Council was created with a view to reorganizing international scientific associations, and from a small beginning, with only a few of the allied countries supporting it, there are now about 35 countries adhering to the International Research Council and to one or more of its unions. Since the meeting at Brussels in July, 1919, there have been three assemblies of the International Geodetic and Geophysical Union, namely, at Rome in May, 1922; at Madrid in October, 1924; and at Prague in September, 1927. The transactions of the International Geodetic and Geophysical Union and of its sections are published following each general assembly; bulletins covering the scientific activities of the sections are also published, some at regular intervals and some irregularly between the assemblies. Each section has standing committees and reporters who

[2] Preliminary note furnished by the general secretary of the American Geophysical Union.

consider various matters submitted to them between the general assemblies and make reports at those assemblies.

Only those matters are considered at these general conferences where international cooperation or advice is needed and in suggesting specifications or standards for the various classes of work involved. Matters relating to standards, standards instruments, and nomenclature upon which actions were taken at the Prague assembly are indicated below.

Geodesy.—In the section of geodesy the reports and resolutions at the Prague assembly had to do with standardization of various classes of geodetic work and the obtaining of uniform practices by the geodetic organizations of the different countries adhering to the section.

Seismology.—While the science of seismology is not yet far enough advanced to adopt standard instruments or to standardize procedures, committees were appointed by the section of seismology to suggest a standard method of designating the different phases of the seismogram and to determine which of these phases should be listed in the reports of earthquakes.

Another committee was appointed to consider the telegraphic code to be used in sending prompt notices.

The project for a new list of seismological stations was strongly urged, but, since the American Geophysical Union under the general supervision of H. O. Wood is revising his earlier list for publication by the National Research Council, no action was taken.

Another committee was appointed to consider the various tables giving the times of arrival of the phases of an earthquake at distant stations.

Meteorology.—In the section of meteorology, 22 resolutions were adopted, and among these there were the following relating to standards:

One resolution invited the attention of geophysicists to the advantages of using, where practicable, geodynamic height in calculations and tables.

The section authorized its commission for solar radiation (*a*) to encourage by all possible means the maintenance of an international network of pyrheliometric stations for measuring the intensity of solar energy, (*b*) to include in this network as many high-level stations as possible, and (*c*) to make provision that at the high-level stations especially careful attention be given to the measurement of ultra-violet radiation and the ozone content of the atmosphere.

The commission for solar radiation was authorized to cooperate with the commission for solar radiation of the International Meteorological Committee in arranging for the intercomparison of substandard pyrheliometers in use in the different countries, in preparing

a program and practical instructions to be recommended for the daily observations, and in securing the prompt publication of monthly summaries of results.

The bureau of the section was authorized and requested to draw up a report of the various practices of the different sciences comprised within the International Geodetic and Geophysical Union with regard to units of measurements and to invite the cooperation of the bureaus of the other sections of the union, with the ultimate object of a common unitary system for all the sciences comprised within the union.

The section approved the appointment of a commission to consider the question of the use of geopotential in the geophysical sciences as the vertical coordinate in the representation of the position of a point with reference to the earth for the purposes of geodynamic problems.

In view of the increased importance of the application of meteorological statistics of the weather to the problems of agriculture, public health, and other aspects of public economics the bureau of the section was authorized to ask the International Conference of Directors of Meteorological Rèseaux to receive a deputation of the section at a meeting of the directors in 1929 (which may be regarded as a jubilee celebration of the International Meteorological Congress at Rome) in order to urge the consideration of a more scientific grouping of meteorological statistics than the customary one by calendar months of arbitrary and unequal length. The intent of this resolution was to advocate the use of the week in place of the month as a unit of time in meteorology, although week was not mentioned in the resolution.

Terrestrial Magnetism and Electricity.—In the section of terrestrial magnetism and electricity, 29 resolutions were adopted, and among these there were the following concerned with standards, standard instruments, and nomenclature:

A subcommittee was appointed to propose definite choice of the criteria suggested for magnetic characterization of days.

A committee was appointed to act with a committee of the Magnetic Commission of the International Meteorological Committee to consider the future relationship of the two bodies.

It was recommended that Greenwich time be adopted in observatory publications, but no date for such adoption was fixed.

It was decided that data for the application of noncyclic changes in the calculation of diurnal inequalities should be given in observatory publications, whether such changes were applied or not.

Methods for computing values of a magnetic element for a given date and of the annual secular variation of a magnetic element during a given year were defined, and special attention was invited to the

advantages of referring magnetic surveys of different countries to common epochs.

The desirability of intercomparison of coil magnetometers of different countries was emphasized.

It was recommended that adequate provision be made to permit obtaining complete magnetograph records on highly disturbed days.

An international committee was appointed to advance auroral studies.

A committee was appointed to consider the best means of promoting research and instruction in the methods of applying the principles of geophysics to investigations of the earth's crust.

Recommendations were made in five resolutions regarding atmospheric electricity that data be compiled for Greenwich or zonal time, that results from all as well as quiet days be included in potential-gradient compilations, that there be a thorough investigation made of different forms of ion counters, and that knowledge of the optical phenomena of lightning be extended.

A committee was appointed to consider reports on and the improvement in uniformity of terminology.

The opinion was expressed that the study of correlations between radio reception and magnetic, atmospheric-electric, and auroral activities and solar activity should be encouraged in every possible manner, although it did not appear that the time had arrived at which any international program could be usefully framed.

Oceanography.—In the section of oceanography the work was chiefly concerned with steps taken in the attempt to coordinate the activities of the section with those of other organizations. A recent accomplishment of the section reported was the preparation of lists of oceanographers and oceanographic institutions throughout the world, these publications being of great value to those engaged in oceanographic work. A committee was formed to consider standardization or oceanographic instruments.

Volcanology and Scientific Hydrology.—No formal reports have as yet been received from either of these sections indicating any actions that might concern standards, standard instruments, and terminology.

Group Sections.—In a group-section meeting, including the sections of geodesy, seismology, and oceanography, a resolution was adopted regarding ocean depths, which in effect recommended the investigation of these critical areas by the methods of acoustic sounding, gravity observations above them, and seismologic observations on the adjacent shores.

The above synopsis is a preliminary one, furnished by John A. Fleming, general secretary of the American Geophysical Union. The transactions of the general assembly of the union and of its sections

at Prague are being prepared for publication by the secretary genera of the union and by the respective secretaries of the various sections.

INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION, SECTION OF GEODESY

Geodesy is a branch of science which needs, for the solution of its problems, the collection of data in widely separated parts of the earth's surface. International cooperation in geodesy was first secured by the creation of the Geodetic Association of the German States. The scope of this body was enlarged in the middle eighties when it became truly international in character by the inclusion of other nations. At the meeting of the International Geodetic Association in 1889 the United States was represented, for the first time, by a member of the United States Coast and Geodetic Survey.

The International Geodetic Association has held triennial meetings which delegates from something over 20 countries attended. The last meeting of that association was held in 1912 in Hamburg, Germany. When the war broke out the countries engaged in the conflict withdrew support from the association, and before the end of the war only six of the smaller neutral countries (Holland, Denmark, Sweden, Norway, Switzerland, and Spain) still adhered to the association, the name of which has been changed to The Geodetic Association Reduced to Neutral Countries (Association Géodésique Reduite entre Etats Neutres). After the war, the International Research Council was created at Brussels in 1919 with a view to reorganizing international scientific associations. From a small beginning, with only a few of the allied countries supporting it, there are now about 35 countries adhering to the International Research Council and to one or more of its unions.

The present officials of the section of geodesy are: President, Dr. William Bowie, chief of the division of geodesy of the United States Coast and Geodetic Survey, Washington, D. C.; secretary, Gen. G. Perrier, of the French Army, Paris, France. These officials, together with five elected members, constitute the executive committee which administers the affairs of the section of geodesy between conferences. The section of geodesy has, as its principal functions the triennial meetings at which reports are made by the delegates from the adhering countries on the work done since the previous conference. These reports set forth the amount of work of various kinds accomplished as well as give a statement as to work in progress and, where possible, describe plans for the future. Important features of such reports are descriptions of new instruments and methods used in the geodetic work. The section has standing committees and reporters whose duty it is to consider the various matters submitted to them between general conferences and to make reports on them at such meetings.

In general, these reports have to do with standardization of the various classes of geodetic work and the obtaining of uniform practices by the geodetic organizations of the different countries adhering to the section. In general, the several classes of geodetic work are called first, second, and third order, the first being the highest. The section of geodesy has no authority to direct or order any country to do its work in accordance with the specifications adopted at a conference, but very few countries would be willing to do their work in a manner less accurate than that stipulated as a desirable standard.

At the general conferences only those matters are considered on which international cooperation or advice is needed or the setting forth of specifications or standards of the various classes of geodetic work.

The results of the activities of the old International Geodetic Association and of the present section of geodesy have been of great value in the geodetic field and the activities of both organizations have greatly advanced geodetic science. The geodetic publications resulting from the organization of the section of geodesy are:

1. The triennial reports on geodetic work accomplished by each of the countries sending delegates to the conferences
2. The Comptes Rendus or detailed report of the deliberations during the conferences.
3. The Bulletin Géodésique which is published quarterly under the direction of the secretary of the section of geodesy.
4. Special reports and tables prepared by the secretary of the section of geodesy in accordance with recommendations made by the conferences.

INTERNATIONAL RADIOTELEGRAPH CONFERENCE AT WASHINGTON

Upon the invitation of the State Department of the United States, representatives of 79 governments met at Washington October 4, 1927, to revise the 1912 International Radiotelegraph Conference at London. Hon. Herbert Hoover was chairman of the conference. The final session was held November 25, at which time the delegations of all the governments represented signed the convention and general regulations without reservations. The treaty was submitted by the President on December 12 for ratification by the Senate.

This convention and general regulations will go into effect January 1, 1929. The treaty will standardize the use of radio throughout the world. The radio-frequency spectrum from 10 to 60,000 kilocycles per second was allocated to the following services: Mobile, fixed, broadcasting, special (including radiobeacons, radio compass, and amateurs). All nations will use the same bands of frequencies for corresponding services, eliminating thereby interference between

different services. The standard of frequency agreed to is the standard of time, the mean solar second.

The establishment of a list of three-letter signals and abbreviations makes possible the carrying on of essential communications between any two stations without respect to the language used by the operators.

Radio is the only means of communication for mobile stations, and the procedure for operation of such stations is so standardized that it will be possible to carry on such communication effectively. The use of radio for distress purposes was recognized as of foremost importance and the distress frequency (500 kilocycles) is given adequate protection. A standard method for the operation of automatic alarm signals was adopted. This insures that in the development of such devices they will all be made to respond to the same signal.

An International Technical Consulting Committee was set up, which will study technical questions submitted to it. The reports of such a committee will serve to keep all nations informed as to standards of procedure, technical developments, etc., in the radio art.

INTERNATIONAL STANDARDS ASSOCIATION

A meeting of the committee of seven, which was appointed at the New York conference of 1926, was held in London, November 14 and 15, 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 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.

MAISON DE LA CHIMIE

(Paris)

The Maison de la Chimie has been organized in Paris as an international headquarters for chemistry. It has been suggested that it would be a suitable location for the central office of the International Union of Pure and Applied Chemistry.

PHOEBUS LABORATORY

(Geneva, Switzerland)

The Phoebus Laboratory at Geneva, Switzerland, was organized by the lamp manufacturers of Europe for the testing of electrical incandescent lamps (essentially as does the Electrical Testing Laboratories of New York). The testing capacity is about 200 kilovolts, the supporting funds being chiefly derived from lamp testing. The laboratory furnishes much information required by special committees engaged in specific standardization enterprises. A great revival of scientific interest in lamps and lighting is noted as a result of the work done at the Phoebus Laboratory and as a result various manufacturers have been stimulated to organize similar laboratories of their own.

THE SECOND PAN AMERICAN STANDARDIZATION CONFERENCE

PROGRESS IN STANDARDIZATION

The Second Pan American Standardization Conference, called by the Inter-American High Commission in accordance with the resolution adopted at the first conference at Lima in 1924, met at the Pan American Union Building in Washington from May 9 to 11, inclusive, 1927.

The following resolutions were adopted by the conference:

1. To recommend to the various governments the advantages resulting in approval in the shortest time possible of the project of convention formulated

by the Inter-American High Commission in compliance with the request which it received from the first conference celebrated at Lima, which project has already been submitted to the various governments.

2. That in order to facilitate the accomplishment of the agreement contained in section A of resolution 1, of the conference of Lima * * *

(*a*) It is recommended that the Inter-American High Commission get in touch as quickly as possible with the organizations of importers and large consumers in the United States who import Latin American products and who would be most helpful for the project for the purpose of obtaining all kinds of practical data concerning the condition in which exported Latin American products are most acceptable, including full details concerning classification, variety, packing, etc., and wherever possible representative samples, submitting all these details to the respective Latin American countries.

(*b*) There is recommended to the governments of the various Latin American Republics the great advantage resulting from the fullest collaboration of other Federal departments with the Inter-American High Commission and its national sections in an educational campaign among all producers and exporters interested in inter-American commerce with the purpose of their adopting in exporting the manner of classification and packing indicated in order to obtain in the principal buying country the best conditions.

(*c*) There is recommended likewise to the respective governments the great advantage of organizing as quickly as possible in each country associations of producers and exporters who may be requested to collaborate with North American organizations in the work indicated, continuing and expanding the preliminary work of propaganda initiated by the governments and the sections of the Inter-American High Commission, taking into consideration that adoption of the best methods will be more feasible if producers and exporters receive from the respective associations of which they may be members the data, counsels, and explanations which each case may require, it being understood that each government and the Inter-American High Commission shall continue, availing themselves afterwards of the facilities of the associations created, to disseminate all kinds of information of practical utility for these producers and exporters.

(*d*) That there be recommended to the governments of the various Latin American countries through the central executive council of the Inter-American High Commission the great advantages resulting from the services of experts in cultivation and distribution of their various exportable products with the purpose of obtaining with the greatest rapidity and facility a production corresponding to the types and forms most acceptable in the consuming markets.

3. That with the purpose of beginning immediately and obtaining more quickly some practical results there be initiated the adoption of uniform specifications of products which are now being exported in greater quantities from each country to the United States.

4. That taking into consideration that almost all the Latin American countries speak the same language, there may be adopted in general the same names for specifications of identical products, so that in the future one product or its different classes will not be designated by different names. This at present causes great confusion and constitutes a drawback in inter-American trade. Therefore, the exchange of nomenclatures and samples among the Latin American countries must be encouraged, as well as the organization of commissions needed in this work composed of representatives of the countries interested.

5. That it recommend to the governments of the American countries that it would be advantageous for them to obtain, by means which in practice may result most adequately, every kind of report concerning systems which should be followed for the prevention, control, and combating of plagues and diseases which affect

animals and animal products as well as fruits, vegetables, and vegetable products which are in demand in the buying countries of America, with the object of promoting the commerce of these articles and eliminating the obstacles which may arise from these causes.

It is recommended likewise to the governments interested the advantages of establishing among themselves an exchange of information concerning methods adopted and results obtained in prevention, control, and combat of the above-mentioned plagues, and that likewise there be carried on in each country an intensive educational work among producers and exporters so that the systems which may be found most efficacious may be put into practice.

That there be organized a permanent committee composed of representatives residing in Washington of the various countries interested for the study of ways and means of organizing an inspection service for animal and vegetable products which may guarantee and facilitate commerce in that class of products, and that this committee make a report accompanied by concrete conclusions to the Third Pan American Standardization Conference.

6. To recommend to the governments, chambers of commerce, and interested Latin American associations that they procure as early as possible the introduction and consideration in their respective countries of the system of classifying wool which is based on the diameter of fiber and which is now in use in the United States and England. Requests may be made to the Department of Agriculture in Washington for samples and data necessary to this work. This department is urged to collaborate in every way possible in carrying out the work.

Likewise, to recommend that in the preparation of bundles of fleeces sisal twine shall not be used nor twine of vegetable fibers, badly wound, which become mixed with the wool, decreasing its quality and making difficult its manufacture.

7. It is recommended to the American countries that there be created a bulletin for commercial, industrial, and agricultural propaganda which shall be devoted to the study of these matters, preferably from the point of view of simplification and standardization.

That this bulletin be published by the Central Executive Council of the Inter-American High Commission in Spanish, English, Portuguese, and French, and its cost be borne by the various countries in proportion to the number of copies for which each government may subscribe, the bulletin to be distributed widely and freely in each country.

The national sections of the Inter-American High Commission should send to the central executive council for publication in this bulletin any document produced in their countries relative to specifications and any information which they may consider of common interest.

This committee will be formed by the agricultural or commercial attachés of the embassies or legations of the Latin American countries, and in the absence of these by the respective heads of the missions or the persons whom the heads of the missions may designate.

8. That there be recommended to the principal associations of manufacturers and exporters in the United States the great advantages which would result from their agreement in the shortest time possible to adopt gradually the decimal metric system in their exporting to Latin America, beginning by indicating the equivalent metric decimal in their bills of lading and shipping documents together with the corresponding American system, and gradually adopting containers and units agreeing absolutely with the metric system in their exportations to the above-mentioned countries, in all cases in which this may be possible, and also agreeing that the exporters in Latin America indicate their shipments in units which may be in accord with the metric decimal system. And that they approach as much as possible the systems now used, but avoiding in all cases fractions.

9. That there be presented to the consideration of the respective governments the desirability of celebrating within a maximum of three years the Third Pan American Standardization Conference in Cuba in the city and on the date which its government may indicate, in which conference representatives of the Federal departments which are carrying on in each country educational work suggested should participate, as well as representatives of associations which may be founded for the same purpose, those who may be collaborating in this movement in the United States, and the offices of the Inter-American High Commission in Washington, as well as its sections in each country, each one of these organizations submitting reports on the progress which may have been achieved.

The agreements which are made in this conference and subsequent ones concerning uniformity of specifications should bear respective numbers and should be designated by the name of the city in which the conference may have been convoked.

10. It is agreed that the central executive council of the Inter-American High Commission communicate these resolutions to all the governments of America, recommending that they give their approval and aid, and that they be communicated likewise to the national sections of the High Commission and to the Pan American Union that they may conform with the purpose.

It is recommended also that the High Commission in publishing the minutes and documents of this second conference make use of the metric and the American systems of weights and measures, the second system preceding the first in the English text and the first system preceding the second in those which may be published in other languages.

III. NATIONAL STANDARDIZING AGENCIES

NATIONAL BUREAU OF STANDARDS

(United States of America)

(See Section V)

This laboratory was established in 1901, has 11 specialized divisions, and a staff of 850, of which 554 are scientific and technical. There are 17 buildings, a library of 30,818 volumes, and 146,582 tests were completed during the past fiscal year. The director is G. K. Burgess.

NATIONAL PHYSICAL LABORATORY

(Teddington, England)

This laboratory (established in 1900) has 8 divisions, a staff of 570, of which 251 are scientific and technical. There are 20 buildings and a library of 9,000 volumes. During the past fiscal year 609,323 tests were completed. The director is J. E. Petavel.

Standards.—The National Physical Laboratory is giving unremitting attention to the maintenance of standards. Work has been active on the international temperature scale, which will represent as closely as possible the thermodynamic centigrade scale. It will be practically determined between −195 and 660° C. by the platinum resistance thermometer; between 600 and 1,100° C. by the platinum, platinum-rhodium thermocouple using a 10 per cent rhodium alloy; above 1,100° C. it will be based on Wien's law, with the freezing points of gold (1,063° C.) and of palladium (1,550° C.) as fixed points.

Comparisons of the British, French, German, and American electrical standards are in progress and those completed show satisfactory agreement. Apparatus is now designed for high-voltage measurements. Resistances may be measured up to a million megohms in the testing of insulating materials. Inter-comparisons of the candlepower standards with the Physikalisch-Technische Reichsanstalt show good agreement at an efficiency of 4 w. p. c., but show discrepancies at 1.5 w. p. c. The results are now published.

Interference methods in which the wave length of light is the standard of length have been successfully used in comparing end gauges, with a precision equal to the mechanical methods formerly used.

Physics.—An interesting development is the formation during the year of a committee on the application of X-ray methods to industrial problems. An instrument for measuring the percentage of

carbon dioxide in an inclosure has been worked out, based upon the measurement of the velocity of sound in the gases with the aid of a quartz crystal kept in oscillation. The heat evolved by the respiration of fruit is now measured by a new differential calorimeter. An auxiliary research has been published giving results of humidity measurements based on the change of refractive index of a glycerine film in equilibrium with atmospheres of varying humidity. A paper just published gives the loss of heat from uncovered steam pipes.

An X-ray tube with detachable electrodes has been designed and studies made of the optical axes of single crystals. An instrument for measuring the radiation pressure of sound waves is about completed. The ripple-tank method of determining the acoustic properties of buildings before construction by model sections has been improved during the year. The image is now thrown upon a screen and photographed by a motion-picture camera. The relation between such ripples and acoustic wave phenomena has been investigated. The methods have been applied to the proposed Melbourne town hall. The laboratory is now able to measure the sound absorption of materials and to study the acoustics of proposed buildings.

Progress has been made in the photoelectric method of spectrophotometry, and the difficulties encountered have been overcome for wave lengths down to 0.3 microns. Six papers were issued on the theory of lenses, and three papers on the methods of color specification, which will have important uses in the dye industry.

Electricity.—A new method of producing low and telephonic frequencies is based on the direct harmonic production of the frequencies from the seconds given by well-regulated clocks. A spectrum of whole number frequencies over most of the audible range is thus possible, which may be extended into the radio-frequency region by the multivibrator principle. International comparisons have been made of radio-frequency quartz oscillators.

High permeability nickel-iron alloys with a low hysteresis loss at low flux densities are being investigated as core materials for instrument current transformers. By the use of this material it is hoped to conduct measurements of current up to 10,000 amperes.

The effect of glare on the ability of the eye to perceive differences of brightness is being investigated. Methods based upon small-scale models are being developed to study the daylight factor of rooms, and the measurement of skylight illumination has been continued with improved apparatus.

Metrology.—Studies of screw thread tolerances and of extremes of temperature on aircraft watches are completed. A study of the deformation of pivots under static load is in progress as well as a study of the effect of the direction in which jewels are cut with respect to the optical axis. A 4-meter comparator has been built

and placed over the 50-meter bench, and this, with other improvements, will make possible the more rapid standardization of surveying tapes. A notable feature of the testing work has been the increase in volumetric glassware submitted for test.

Engineering.—The investigation of elasticity and fatigue has developed into an examination of the fundamental phenomena involved in the failure of single metal crystals and of metallic aggregates. It is likely to lead to results of far-reaching importance, and has already furnished information of much value in the study of the strength of materials. Endurance and fatigue tests have been made on various materials to determine their suitability for vehicle springs. The lubrication research has included determinations of the change in attitude and eccentricity of a cylindrical bearing with change of load and a study of the variation of the static friction of lubricated surfaces with temperature. Tests have been made to determine the value of various types of road surfacing in minimizing skidding and the effect of wheel dimensions on the wear of roads is also being studied.

Metallurgy.—A paper describing the production of beryllium metal has been published and efforts are being made toward the production of beryllium of high purity with a view to increasing its ductility. A preliminary survey of the constitution of beryllium-aluminium alloys has been made and a study of the properties of the zinc-cadmium alloys has been completed. The brittleness of wrought-iron chains has been shown to be due to the formation of cracks in the surface layer caused by a surface hardening from numerous small impacts. The presence of small quantities of nitrogen has been found to affect materially the structure and constitution of the iron-chromium alloys.

Aerodynamics.—The comparison of the observed flow around airfoils with theory has been continued and differences found in the region of the nose have been closely examined. Pressure measurements have been made over an airfoil set at a large angle of incidence. The equipment for comparative experiments in air and water has been completed. The standard Pitot tube has been recalibrated on the new whirling arm, giving a result in complete agreement with that found in 1914. Much attention has been given to the best means of overcoming wing flutter which occurs on high-speed airplanes. This problem has been attacked both analytically and experimentally. Work on air propellers has included an investigation by means of photography of the flow around a model screw working in water.

William Froude Tank.—The investigation of the effect of waves on the resistance, propulsion, and pitching of ships has been continued. Full-scale observations during exceptionally rough weather have been supplemented by tests in the tank. A paper has been published on

the scale effect of rudder forces and the maneuvering value of unbalanced rudders of different shapes behind single and twin screw ships of the same fullness. The calculation of the wave resistance of three-dimensional symmetrical forms has been compared with the results of experiments on models. The number of ship models tested during the year was 63, compared with 36 for the preceding year.

PHYSIKALISCH-TECHNISCHE REICHSANSTALT

(Charlottenburg, Germany)

The Physikalisch-Technische Reichsanstalt in Charlottenburg was established in 1887 as a national research and testing institution. Its first president was Herman von Helmholtz; the present direction is in the hands of Prof. Friedrich Paschen. The budget of the Reichsanstalt amounted to 1,500,000 marks for the year 1927. There is a staff of 262, of which 83 are scientific and technical. There are 9 buildings, a library of 20,000 volumes, and 611,000 tests were completed during the past fiscal year.

The organization includes four divisions—(1) weights and measures, (2) electricity and magnetism, (3) heat and pressure, and (4) optics. In addition, there are a number of smaller laboratories under the direct supervision of the president—(*a*) research laboratory of the president, (*b*) laboratory for radioactivity, (*c*) chemical laboratory, (*d*) laboratory for precision instruments and sound, (*e*) low temperature laboratory, and (*f*) photochemical laboratory. The following covers the work of the Reichsanstalt from July 1, 1926, to November, 1927:

1. Laboratory of the President.—The neon lines were investigated by means of the Perot-Fabry interferometer standards. They have a companion. Lines of spectral type *s–p* have a satellite toward the shorter waves, which has about one-ninth the intensity of the principal component and in relation to the Zeeman effect with the principal line shows no Paschen-Back effect. The companion corresponds probably to the isotope. The ortho-helium lines were obtained as triplets with separation relations in accord with the new theory of Heisenberg. The spectrum Pb II of lead was analyzed further with respect to series theory. The spectrum Al II of aluminum was completed by analysis of the singlet system. The ionization potential of Al plus is 18.74 volts.

2. Laboratory for Radioactivity.—A new objective method was worked out for atom disintegration based upon the application of the Geiger point counter, from which notable progress in this field is expected. It has already been established by this method that the alpha rays of polonium can disintegrate the four elements—boron, nitrogen, magnesium, and aluminum. Further investigations concerning the Compton effect with X and gamma rays gave interesting

conclusions concerning the nature of these rays. In the laboratory 281 tests of strong and weak radioactive substances were completed. The standard radium solutions, which serve for the standardization of emanation-measuring instruments, were put through a systematic control experiment by which the constancy of these solutions over a time interval of at least six years was demonstrated. For the measurement of the stronger alpha ray preparations a convenient instrument was built.

3. Chemical Laboratory.—The investigations of the elements masurium and rhenium, discovered in 1925, were advanced. Especially was their geochemical relation studied. A few milligrams of pure rhenium were successfully prepared, and the analytical characteristics of this element were determined. Sixty kinds of glass for the glass-container industry were tested for alkali solubility in water at 80 to 100° C., and 26 kinds of glass for optical purposes were tested for weathering. Numerous analytical chemical investigations were made. The electrical charge of colloidal particles of several slightly soluble silver salts was determined.

4. Laboratory for Precision Gauges and Sound.—This laboratory was fully occupied with testing for scientific and technical purposes. The precision instrument activities dealt primarily with settling disputes in the field of standardization; secondarily with current tests of standard screws, gauges of various kinds, master rings, taper gauges, lead screws, etc. In the field of acoustics, frequency determinations have assumed growing importance. The number of frequency tests of tuning forks in connection with technical and musical purposes was considerable. The already internationally regulated question of concert pitch is, on account of lack of uniformity, again being studied. This necessitates the investigation of the dependence of the tone of the more important musical instruments upon temperature.

5. Cryogenic Laboratory.—A new low temperature laboratory has been equipped, in which 20 liters of liquid nitrogen and 10 liters of liquid hydrogen may be produced hourly.

6. Photochemical Laboratory.—A quantitative determination was made of the bromine liberated in the photochemical dissociation of silver bromide (*a*) when the silver bromide was held in a gelatine emulsion, and (*b*) when no emulsion was used. Further, the Herschel effect and other bleaching-out effects in photographic plates were investigated, and the influence of X rays upon silver bromide in relation to the quantum equivalent law was studied. A special photochemical laboratory was arranged for in May, 1927, in order to take up photochemical work more effectively.

7. Division of Weights and Measures.—This division was principally engaged in revising and completing the testing regulations. A number of new scale constructions were submitted, as well as new measuring apparatus for mineral oils.

A procedure was developed by which end gauges could be tested with the highest accuracy by interferometry. A large number of end gauges of the first quality (including four ranging in length from 200 to 500 mm) were tested.

The determination of the ratio between the meter and the wave length of the yellow green krypton line has been carried to a point such that it can be shortly concluded.

8. Division of Electricity and Magnetism.—(*a*) ELECTRICITY.—Recent comparisons of the English and German resistance unit show that the newly determined value of the ohm of the Reichsanstalt agrees with the British values for 1912 and 1925 within 1×10^{-5}.

Work carried out in cooperation with the Reichsanstalt shows that German industry now is in a position to produce aluminum of electrical conductivity equal to that obtained in other countries.

The electrical resistance and the heat conductivity were investigated for a series of metals using single and multiple crystals at low temperatures, in part to 1.3° absolute. Further, the thermoelectric forces of alloys and superconducting metals were measured between 4.2 and 1.3° absolute.

Work on the new determination of the velocity of light has advanced. The required guard ring condenser for this has been constructed.

For testing purposes, a bridge for dielectric loss measurements at 800 cycles per second and a new bridge for measuring Pupin spools have been designed.

For the analysis of weak currents (microphone currents) a Braun oscillograph was constructed. With the aid of this apparatus investigations were carried out on vowel sounds, which makes a test of different theories possible. Investigations on the piezo-electric excitation of elastic vibrations showed that with suitable arrangements not only longitudinal, but also transverse and torsional vibrations may be produced. With this it was possible to construct luminous piezo-electric resonators as frequency standards, including standards for very low frequencies (for example, 1,500 cycles). The international frequency measurements for the purpose of comparison of the standard frequencies of the different countries were again undertaken with the aid of two of the Bureau of Standards quartz oscillators.

In the field of high voltage and insulator investigation there was developed a new loss-free compressed gas condenser for voltages of about 300 kilovolts.

The investigations begun earlier on the discharge in gases have been continued, in which the energy distribution between the cathode and the effect of added mercury on the normal cathode fall were studied. In a special investigation the percentage content of atomic hydrogen at glow discharge in hydrogen was determined.

(*b*) MAGNETISM.—New methods were worked out for determining the permeability and hysteresis at high frequency. The question of the validity of Poynting's law for materials possessing hysteresis was investigated. A method was devised for measuring the initial permeability of wires. A process was also developed for melting small quantities of metals in a high-frequency field.

The magnetostriction of ferromagnetic material was measured by a method of superposing two high-frequency circuits, in which the change in length of the bar under investigation produces a change in capacity. Alloys of iron and nickel, nickel and cobalt, and cobalt and iron, and several other alloys were thus measured.

(*c*) MISCELLANEOUS.—The effort to attain an international unification of X-ray dossage made an investigation of the various methods of absolute dosage measurement necessary, which showed an agreement of 1 or 2 per cent. X-ray spectrometric work was undertaken to clarify the influence of chemical combination on X-ray spectra, and to decide the question whether the lines $K\beta'$ and $Ka_{3\,4}$ are X-ray spark lines. The X-ray absorption spectra of tungsten has been investigated.

The heat capacity of a Berthelot combustion calorimeter was measured anew electrically and the heat of combustion of benzoic acid was measured. The data obtained differ only slightly from those of Fischer and Wrede, and are in good agreement with the result obtained by Dickinson.

9. Division of Heat and Pressure.—The foundations of the practical temperature scale for very low and very high temperatures have been extended. By means of the gas thermometer the boiling points of nitrogen and hydrogen have been measured down to the triple point. The transmission of absorptive screens for pyrometric purposes has been measured for use in determining the temperature of radiating bodies at any wave length. An apparatus has also been constructed to measure color temperature.

An investigation of the thermal expansion of thermometer glasses up to the softening point provides a new point of view regarding the aging of glasses. The compressibility of helium, hydrogen, and neon were measured at temperatures between -200 and $-258°$ up to 100 atmospheres, and for nitrogen and neon between 0 and 100° up to 200 atmospheres. A research apparatus for obtaining the heat of vaporization of water at high pressures could consequently be tested at 180 and 210°. The measurements of heat transfer of saturated and superheated steam to tubes are being continued with improved apparatus. Investigations on atmospheric humidity showed that the aspiration psychrometer used in connection with Sprung's formula gives acceptable values up to 90° C. Several viscometers were standardized by comparison with an apparatus for the absolute

determination of viscosity, and a series of four mineral oils was investigated which now serve as standard liquids for the testing of viscometers. For measuring large volumes of gas a standard nozzle for a pipe 100 cm in diameter was compared with the largest standard nozzle heretofore studied and then with the aid of these standard nozzles the discharge coefficient of a number of orifice meters was investigated. During 1926 there were tested 576,488 clinical thermometers, 5,442 expansion thermometers, 216 pieces of apparatus for electrical and optical temperature measurement, 458 pressure measuring instruments, 438 pieces of apparatus for investigating petroleum oils, and 141 instruments and objects of various sorts.

10. Division of Optics.—The spectroscopic work has dealt chiefly with the interference method for the analysis of the finest spectral lines and the reflection at silvered glass and quartz surfaces. A great improvement of the resolution methods, of visibility and brightness of the interference fringes was worked out and a new type of spectroscope—the multiplex interference spectroscope—was developed. Comparative investigations on different precision polarization apparatus were made, a test method for steel balls was developed, and the suitability of the cadmium vapor arc lamp with the addition of gallium for reproducing wave-length standards was investigated.

The measurement of the constants of the Stefan-Boltzmann law with a new receiver in an absorption-free atmosphere was continued. Spectral measuring apparatus for dyestuffs and Warburg's light unit were constructed and the question of different international light units was thoroughly worked out.

The procedure for making large areas of the thinnest metal foil was further improved, and the magneto-optical properties of ferromagnetic materials was investigated. An especially sensitive vacuum thermoelement was made of foil. The registration of spectrograms with a new register photometer by Zeiss was arranged for testing purposes. A new registering process was worked out for taking opacity curves. Cows' and calves' eyes were investigated quantitatively for the spectral transmission of their constituent parts.

Among articles tested for the optical industry may be mentioned standard lamps, mirrors, filters, telescopes, objectives, polarization apparatus, prisms, quartz plates, and various kinds of glass, including determinations of transparency in the infra-red and ultra-violet and the index of refraction for different wave lengths.

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

(Paris)

The Laboratoire d'Essais is under the Conservatoire National des Arts et Métiers and functions under the Ministry of Public Instruction and Fine Arts, Undersecretary of State for Technical Education.

A technical commission of 23 members supervises the work and the director is M. F. Cellerier. This is the national testing laboratory of France. Its staff comprises 180 members, nearly three times the pre-war status.

The work is divided into five divisions—Physics and measurements, metals, materials, machines, and chemistry. From January to October, 1927, 2,972 tests were completed, divided as follows: 402 in physics and measurements, 865 in metals, 597 in materials, 208 in machines, and 900 in chemistry.

Physical Tests.—Sources for producing ultra-violet rays and radiological equipment were installed for the scientific examination of oil paintings. Apparatus was installed for determining the coefficient of thermal conductivity of materials at high temperatures up to 1,300° C. A pin machine was provided for measuring the surfaces, notably, of skins and leathers. A special apparatus was installed intended for the study of sounds.

The division for physical testing has made special studies (1) of the sound produced by acoustical warning devices to ascertain the physical characteristics of complex sounds or noises produced, (2) the scientific examination of oil paintings, (3) study of a method of testing materials at moderate temperatures (100 to 600° C.) and at high temperatures (above 600° C.)

In the first research on the sound produced by acoustical warning devices, the method consists essentially in sending simultaneously into a photorecording Blondel oscillograph (*a*) a sine wave current produced by a three-electrode vacuum tube oscillator emitter at a known musical frequency, (*b*) a sort of telephonic current produced by a sensitive electromagnetic microphone, before which functions normally the warning device after amplification in a resistance apparatus with three-electrode vacuum tube. One thus obtains for a given current "a" comparative curves of the different warning devices.

The second research on oil paintings consisted in recording photographically the effects of fluorescence from ultra-violet rays and the opacity to X rays.

In the third research the material was used in the form of a slab, of which one face resting on a thick metal plate is raised to a constant, high temperature. On the other face rests a calorimeter provided with a thermal guard ring. The quantity of heat which traverses the panel is determined from the heating of the water in the calorimeter or from the quantity of water vaporized, depending on the temperature.

Verification of Measuring Instruments.—Equipment for verifying measuring instruments has been increased by the addition of certain sets of alcolometers, densimeters, and standard thermometers of

various ranges. Since January, 1927, the Laboratory d'Essais has verified the Luchaire instruments for determining the flash point of liquids and inflammable varnishes, in conformity with instructions from the Minister of Commerce and Industry, February 19, 1927, for the legal verification of Luchaire apparatus and accompanying thermometers. For some years the question has been raised of having test methods sufficiently qualified to permit defining with some precision on the one hand, motor gasoline and, on the other hand, heavy combustible mineral oils resulting from the distillation of petroleum. Following studies directed especially by the National Office of Liquid Fuels for the Minister of Commerce and Industry, various ministerial instructions have been prepared upon the subject, notably (1) instructions for the legal verification of Luynes-Bordas apparatus (model of 1925) and the accompanying thermometer, and (2) instructions concerning methods of analysis of heavy combustible mineral oils resulting from the distillation of petroleum. Following these various ministerial instructions the verification of Luynes-Bordas distillation apparatus was made also at the Laboratory d'Essais during the current year.

Tests of Metals.—In perfecting the equipment for tests of metals a new Chevfy dynamometer intended for tests of rubber and cord wire, and a Chauvin au Arnoux micrometer were acquired.

The special tests and technical researches included, the study of casehardening with cyanide of potassium; microscopic study of many samples of tungsten obtained by fusion in the electric arc; measurement of the variations and hardness-to-scratch of metal coatings and artificial emeralds; tensile tests of cable clamps, equipped with wedges, and anchoring clamps for cable intended for the electrification of railroad lines; tension tests of steel tubes equipped with mandreled flanges; compression tests of duralumin tubes; torsion tests of universal joints and elastic joints composed of steel wire joining two plates; tension and hardness tests at high and low temperatures of special brasses and of ferrous metals.

Tests of Structural Materials.—In perfecting the equipment there have been added a Monnin pendulum hammer for testing woods; also a jaw crusher. Among special tests and technical researches are the following: Various magnesium alloys; various special insulating products; special wood for shuttles (tests of resistance to shock); a special coating for covering cement reservoirs intended to hold mineral oils or their derivatives; test of permeability to gasoline, to petroleum, to oil, gas, and benzol under pressure.

Tests of Machines.—The equipment for this work has been augmented by an installation for the test of heating radiators, conformably to the prescriptions of the last congress for heating by hot water and steam. Special tests and technical researches in this field

comprised studies and technical researches on methods of tests of radiators and boilers for heating, determination of the coefficient of friction of ordinary and ball bearings, special cast bearings which give, while running, coefficients of friction of the same order of magnitude as ball bearings; the coefficient of starting friction is, however, greater for the cast bearings. Tests of different arrangements for economizing gasoline in automobiles, the admission of fresh air to the motor on down grades or while idling (in traffic delays, etc., motor continuing to run), and tests on the road. Test of an automobile transmission permitting a continuous change of speed; numerous measurements of the output of air or other fluids through filtering surfaces for automobile carbureters and other usages.

Chemical Tests.—The laboratory has been equipped with a Courtonne furnace for incineration or analysis of coals, a MacNaught apparatus for measuring the lubricating power of oils, and a Milliard-Dantzer photocolorimeter for the study of the constitution of colors. Among the special tests and technical researches was a study of the aging of wood by measuring the hydrogen ion (pH) concentration of a decoction. This work was presented by M. F. Cellerier, Director of the Laboratory, to the Congress for Testing Methods at Amsterdam.

LABORATOIRE CENTRALE ELECTRICITÉ

(Paris, France)

This laboratory was established in 1888, has 4 specialized divisions, and a staff of 21, of which 14 are scientific and technical. There are 4 buildings, with a library of 14,000 volumes. M. Paul Janet is the director of the laboratory.

New accessions during the year included a converter group (an alternating-current motor generating a continuous current) designed for charging storage batteries. The new apparatus is destined for use in the newly organized high-tension laboratory. For this purpose also a high-tension transformer in oil, with a maximum potential of 300,000 volts, has been acquired. This was constructed so that it may be coupled with a similar apparatus to obtain a voltage of 600,000. A system of transformers and autotransformers permits feeding the high-tension transformer by means of electric energy furnished by the Compagnie Parisienne de Distribution d'Electricité and to vary the voltage progressively.

Between July 1, 1926, and November 1, 1927, 1,798 tests were made. Among these may be mentioned tests of storage batteries for submarines for the Navy. These tests call for a special support, to permit subjecting the cells during the charge to movements similar to those to which they will experience in practice under the influence of rolling and shock caused by the Diesel motors.

Tests of storage batteries for traction purposes were made under conditions simulating those encountered in service; that is, vibration during discharge.

Tests of circuit-breakers in oil were requested by the union of electrical syndicates. These tests were conducted as follows: The circuit-breaker to be tested and the control circuit-breaker were placed directly across the terminals of two diphase alternators which were connected in parallel. The power of each alternator was 10,000 kilovolt amperes and the voltage 12,000 volts. The closing of the control circuit-breaker produced a short circuit, the opening of which was brought about by the breaker under test, at a time after closing which could be adjusted. Oscillographic records of voltage and of current were obtained during the period of interruption, as well as measurements of the velocity of the moving parts and of the oil pressure. Twenty-six sets of apparatus have thus been tested. These tests have been marked by numerous incidents which, thanks to the safety measures taken, have given rise to no accident. Tests of lightning arresters have been made, using batteries of condensers previously employed in the Eiffel Tower wireless station. The Delon apparatus has given fine service in this kind of testing.

Numerous photometric tests, especially determinations of luminous distribution curves, have been made. This is one consequence of the campaign in France, in progress now for several years, for the better utilization of light sources.

Researches on Electrical Units.—Studies relating to electrical units have been actively pushed. This service is in course of reorganization, a special laboratory being under construction near Paris, in a district where the disturbing influence of stray currents from metropolitan railroads will not interfere with laboratory measurements.

A comparison of the standards of this laboratory for electrical resistance was made with those of the National Physical Laboratory, employing two 1-ohm coils. The results obtained were as follows:

Coil No.	NPL	LCE
	20° C.	*20° C.*
4.202	1.00008 4	1.00005 8
4.204	1.00003 7	1.000010

The results are expressed in terms of the ohm at Washington. The differences, as may be seen, are twenty-eight millionths, while before the war, in identical comparison, errors did not exceed a few millionths. It is hoped to take up, early in 1928, the study of our standards of resistance and determine the cause of the slight difference. A new series of standard cells is under construction.

New standards of inductance are also under development, those constructed several years ago not being satisfactory. The measurement of a capacity in terms of these inductances gave results differing by 2 parts in 1,000 from absolute measurements made on the same capacity by Bedau at the Sorbonne.

Heating of Conduits.—At the request of the Union des Syndicats de l'Electricité and the city of Paris, a study has been undertaken at the laboratory on the current density admissible in separate conduits under different conditions of use (in tubes or in wooden moldings). This study was completed in 1927.

Photometry.—The laboratory collaborated in a study for the Laboratory for Researches, the Compagnie du Gaz of Paris, to establish a standard of white light based upon the properties of a black body. This work is far from completion.

Another study is being pursued on the relation between the brilliance of the black body and its temperature. For this research we utilized a disappearing filament pyrometer constructed according to our specifications and on which the standardization has been completed in collaboration with M. Ribaud, of Strasburg.

Researches are in progress on the determination of the reflecting power of diffusing substances. A special apparatus is under construction. A provisional instrument was made and with it a determination was made of the reflecting power of various wall papers. The results are now published.

NATIONAL STANDARDIZING BODIES

National standards committees or associations are now functioning in 20 countries. 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; Russia, 1923; Denmark, 1924; Poland, 1924; and Finland, 1924.

The method of cooperation developed by the British is followed, with more or less modification, by all of the national bodies. Technical decisions involved in the formulation of standards are rendered by so-called "sectional committees" made up primarily of accredited representatives of the various groups interested therein.

Three conferences of the secretaries of the national standardizing bodies have been held, the first in London in April, 1921; the second in Zurich in July, 1923; and the third in New York in April, 1926. As a result of these conferences, 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.

At the New York conference of the national standardizing bodies attempts were made to lay the basis for a general international organization for cooperation in industrial and engineering standardization matters, a so-called "International Standards Association." 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. Information concerning the recommendations of the committee of seven is given in Chapter II.

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 Engineering Standards Committee, which are presented in Chapter VIII.

Australia.—Australian Commonwealth Engineering Standards, Association, E. S. Maclean, secretary, Macleay House, 16 College Street, Sydney, New South Wales.

This association was founded in 1922 by the Commonwealth Institute of Science and Industry, the Institution of Engineers (Australia), Australasian Institute of Mining and Metallurgy (Inc.), and the Australian Chemical Institute under the auspices of the Commonwealth Government. It has an administrative organization comprising a main committee and a number of standing committees, with headquarters in Sydney and five branch offices in other centers. Sectional committees, with the attendant subcommittees and panels, have been formed to deal with the actual preparation of standard specifications. These committees number in all over 200, and include a personnel of approximately 1,000 members.

In March, 1925, the association published its first specifications. Up to July, 1927, the association had published a total of 67 specifications, and had 132 additional specifications under preparation. A summary of the specification-making activities is given in the accompanying table.

Industrial groups	Published	Approved for issue	In hand	Total
Civil engineering	1		28	29
Mechanical engineering		1	10	11
Electrical engineering	26	17	40	83
Transportation	13	3	7	23
Chemical industry	27		8	35
Mining			18	18
Total	67	21	111	199

The association does not initiate standardization proposals, but receives recommendations from those who experience a need for specific standards or whose observations and experience would seem to indicate that the principles of standardization might, with benefit, be applied to some particular industry. If investigations justify action the main committee establishes a sectional committee to prepare the proposed standard specification.

A sectional committee is constituted of nominees of all bodies directly interested in the subject under consideration, and every effort is made to secure adequate representation of such interests. The A. C. E. S. A. makes no appointments to a sectional committee other than that of the chairman. It provides the necessary organization for the establishment and control of committees and for the promulgation of the approved standards.

An Australian standard specification is published for use as such during a "tentative" period of 12 months. Recommendations received as the result of its use during this period are considered and, subject to such amendments as may be deemed advisable, the specification is then confirmed as an Australian standard.

After confirmation as an Australian standard the specification is subject to periodical review, in order that it may be kept abreast of progress in the industries concerned.

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

The Austrian standards committee was organized in 1920 by the national industrial commercial associations as the central agency for standardization in Austria.

Any proposed work of standardization is submitted by the central committee to a new subject committee organized for the purpose or to an existing subject committee if qualified to handle the work. Each subject committee is composed of representatives of producers, consumers, distributors, and technical experts. Before being adopted as standard the findings of the subject committee are given publicity in the periodical Sparwirtschaft to invite criticisms. Standards are given designating letters and numerals which indicate the groups and subgroups in which they have been placed, the groups being arranged decimally.

Standardization activities are classed in six major groups. An indication of the status of the activities in these groups in 1927 is given below.

	Completed	Printed for criticism	Under way	Total
General standardization	4		1	5
Building trades	25	39	16	80
Chemical industry		8	22	30
Electrical industry	42	4	38	84
Mechanical industry	81	84	39	204
Transportation	7	3	14	24
Total	159	138	130	427

Belgium.—Association Belge de Standardisation, Gustave L. Gerard, secretary, 33 Ru Ducale, Brussels, Belgium.

The Belgian standards association, which was organized in 1919, is composed of official representatives of certain Belgian associations and industrial groups, the number of representatives varying with the interest of the associations or groups in standardization activities. The largest representation (five members) is held by the Belgian Association of Constructors. The Central Industrial Committee of Belgium and the Belgian iron and steel industry have three representatives each. The groups of graduates from the engineering schools at Brussels, Ghent, Liege, Louvain, and Mons have two representatives each, as does also the solid fuel industry. The chemical industry has one representative, and one representative is assigned to each of several other industries, such as the mining, lime and cement, glass blowing, ceramics, wool textiles, cotton, flax and jute textiles, hides and leather, foods, pulp and paper, public works, public utilities, wood and furniture, and printing. Representation is also held by certain individuals listed as "associate members."

The above-mentioned representatives collectively form the main committee of the association which has charge of the standardization programs. It examines and passes upon proposals for standardization made to it by a technical society, a trade association, or any interested industry. When decision is made to undertake the proposed standardization, the main committee organizes a technical committee made up of persons especially qualified to carry on the work, selected by the main committee from its own members or members of technical societies or trade associations interested in the proposed standardization, and also of certain officials delegated by the Government departments. The technical committees elect their own officers and organize subcommittees of competent persons for handling the different parts of the standardization problem. The findings of the technical committees are submitted for approval by the main committee which takes into consideration not only the scope of the standardization work but also the adequacy of representation of the interested organizations. Approved reports and specifications are published and placed on sale. Special efforts are made to induce the representatives to bring the publications to the attention of their associations and to encourage the adoption of the standards by the Government departments and public utilities.

The expenses of the association, including those for publication and the maintenance of the general office staff of the secretary, are covered by contributions from the associations represented on the main committee and from associate members at rates of assessment established at each annual meeting in March. Funds are also obtained from the Government departments to defray part of the

costs of the standardization work in which they are particularly interested.

In addition to 11 publications dealing with general standardization topics, the association has published 30 documents covering standards and specifications in the civil, electrical, mechanical, and mining engineering fields. Work is now going forward not only in these fields but also in the chemical industry, and much attention is being paid to the standardization of the sizes of papers and technical drawings and documents.

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

This association was organized during the latter part of the World War, at the suggestion of the British Board of Trade and the British Engineering Standards Association. The organization committee was formed in 1917 and immediately took up work on certain materials required for war purposes, and on January 21, 1919, letters patent were issued by the secretary of state, authorizing the formation of the Canadian Engineering Standards Association. The main committee of the association acts as the advisory committee for Canada of the British Engineering Standards Association.

The association operated until 1925 with funds provided by grants from the department of trade and commerce of the Dominion Government and by subscriptions received from various industrial firms and technical organizations. In 1925, however, on account of the imperative necessity for economy, the grant from the department of trade and commerce was withdrawn, but the National Research Council of Canada, realizing the importance of the work being carried on by the association, made arrangements to guarantee the budget, with the understanding that special efforts be made to obtain financial support from Canadian industry. The main committee of the association has, therefore, for financial purposes, been constituted an associate committee on engineering standards of the research council. The association, however, continues to carry on its operations independently on the lines followed since incorporation. An annual report is made to the research council.

The association is organized on lines similar to those adopted by the British Engineering Standards Association. The members of the association serve on its various committees gratuitously, giving it the benefit of their technical or business experience in the preparation of the various standards.

The work of the association is under the general direction of a main committee, which appoints a chairman, two vice chairmen, and an honorary secretary. These constitute the executive committee. The detailed work is handled by a paid secretary and staff. Nominations for membership on the main committee are received from

such bodies as the Canadian Manufacturers' Association, Canadian Electrical Association, the Institution of Civil Engineers, the Engineering Institute of Canada, the Canadian Institute of Mining and Metallurgy, National Research Council of Canada, McGill University, Univeristy of Toronto, and the University of Montreal. Representatives of various departments of the Dominion Government are ex officio members, and other members are selected from engineering schools, railways, important industrial firms and associations, and consulting engineers.[c]

Under the authority of the main committee various sectional committees are formed, representing the different branches of engineering. Membership on these committees is approved by the main committee, and special care is taken to see that representation on each committee adequately covers the particular field of engineering concerned. At the present time, sectional committees of the association cover the following branches of engineering:

A. Civil engineering and construction.
B. Mechanical work.
C. Electrical work.
D. Automotive work, including aircraft.
E. Railway work.
G. Ferrous metals.
M. Mining machinery.

Under these sectional committees, the work is handled by committees, each dealing with some particular problem in the field covered by the sectional committee to which they report. Members of these committees are selected from the interests directly concerned and comprise representatives of both manufacturers and users, with a sufficient number of technical advisers to insure a thorough review of the work undertaken. Membership, as before, is subject to confirmation by the main committee.

If necessary, the chairman of any committee may appoint one or more subcommittees, called "panels," to make a detailed study of any question or to prepare draft specifications for the consideration of the committee as a whole.

With the exception of the secretary and his staff, the officers of the association and the members of all committees give their services without remuneration of any kind.

The association does not assume the rôle of a dictator, but rather of a cooperative body, and, therefore, must be guided in its operations by the requirements of the manufacturing or industrial interests represented on its committees.

It endeavors to follow as closely as practicable the standards prepared by the British Engineering Standards Association, but in many cases, on account of established business interests, it is found advisable to follow other standards which have been generally adopted in Can-

ada. In all cases, however, the specifications prepared are drafted to meet the requirements and operate for the best interests of Canadian industry, and are adopted as Canadian standards. Cooperation with the British Engineering Standards Association and with the American Engineering Standards Committee is naturally much closer than with other bodies. In the case of the B. E. S. A., tentative specifications and published standards as received are submitted to interested members of the C. E. S. A. for criticism. Comments received are sent to the secretary of the B. E. S. A. for transmission to the various committees concerned. It has been found that in many cases these have been very helpful. A small stock of the publications issued by the B. E. S. A. is kept on file, and copies are on sale by the secretary.

The association has already formulated 20 standard specifications which have been widely adopted, and in many cases are Dominion Government standards. It has under way work on 27 additional specifications, as shown in the accompanying table.

	Standardization projects	
	Total	Complete
A. Civil engineering	19	7
B. Mechanical engineering	7	3
C. Electrical engineering	11	6
D. Automotive work	3	2
E. Railway work	1	1
G. Ferrous metals	5	1
M. Mining machinery	1	
Total	47	20

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 scheduled for early consideration. The association has adopted an official trade-mark for goods manufactured in accordance with its specifications.

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

The Danish Standardization Commission consists of 21 members appointed by the Ministry for Industry, Trade, and Shipping. Six

of the members represent Government departments, and the others technical, industrial, and trade bodies, each organization being privileged to recommend for appointment from one to five members. Its organization was preceded by four years of activity on the part of technical and trade associations in ascertaining the need for standardization, the extent of the sentiment in favor of it, and the manner in which a standardizing body could best function. A petition for its organization was presented to the ministry in March, 1924, and after passage of legislation to provide for approximately one-half of the total estimated expense, the commission was formally organized in January, 1926.

Standards are adopted by a two-thirds vote of the whole commission, two months or more after publication of the proposal. The Ministry for Industry, Trade, and Shipping appoints a secretary and the commission an engineer, who serves as technical secretary and has immediate charge of its activities. No standards had been adopted, but committees were working on the following projects at the beginning of the year 1927: Doors and windows, including designations for "right" and "left" in these building details; wire rope for industrial purposes; and bolts and nuts. Two other matters being given attention are standards for technical drawings and standardization of agricultural implements and of parts used in agricultural machinery.

Finland.—Finlands Standardiseringskommission, A. Willberg, secretary, Mikaelsgatan 19, Helsingsfors, Finland.

The central standardization committee of Finland was organized in June, 1924. It is made up of official representatives of the department of national defense, the Government railroads, the department of commerce and industry, the board of directors of public buildings, department of agriculture, the national association of wood utilization, national agricultural products association, national industrial products association, national technical societies, and the national university.

About two-thirds of the funds for the committee's expenses are provided by the Government and the remainder by other interested organizations.

Subject committees and subcommittees have been appointed by the central committee to carry on standardization work in the following fields: Mechanical engineering, paper industry, electrical engineering, packing for export, and tar and turpentine. A general editorial committee has also been organized.

The central committee has approved more than 50 standards which are now in use in Finland.

France.—Association Française de Normalisation, J. Tribot-Laspière, general secretary, 25 Boulevard Malesherbes, Paris, France.

From 1918 to 1924 much standardization work was accomplished in France by the Permanent Commission of Standardization which functioned under the French Minister of Commerce to establish a large number of standards relating principally to metallurgy, wood and other building materials, ship building, and mechanical equipment. The use of these standards by the Government departments was made obligatory by ministerial orders. This governmental organization has been inactive for the past three years.

In 1926, the national organizations representing the metallurgical industry, the street railways, the radio industry, shipbuilding industry, and structural steel contractors created the French Association of Standardization. These associations have been joined by organizations representing the electrical industry, the coal mining industry, electrical contractors, and manufacturers of railway material. This association is not a standards making body, and it is definitely prohibited from either establishing or publishing a standard of any kind. It serves merely to coordinate the activities of the standardizing groups in France.

Several other organizations have been active for many years in standardization work in various fields.

The French Association of Standardization has three kinds of members which may be designated as federation, collective associate, and individual associate. A federation member consists of a supporting trade association; a collective associate member is an interested association or organization other than a trade association, such as a governmental or large private administrative body; an individual associate member is a person interested in the standardization movement and taking an active part in the work of the association.

All work of the association is conducted by a general assembly made up of individual associates and representatives of the federation and collective associate members. Each individual associate has 1 vote, each collective associate member 5 votes, and each federation 10 votes, without regard to the actual number of persons present in each delegation.

Standardization projects relating to steel shapes, screw threads, bolts, nuts, screws, machine parts, steel rails, and nonferrous metals have been acted upon by the association which has also given consideration to a standard series of "preferred numbers."

Germany.—Deutscher Normenausschuss, W. Hellmich, assessor, 47 Dorotheen Strasse, Berlin N. W. 7, Germany.

The German Industrial Standards Association was organized in 1917 as a federation of trade associations, technical societies, and departments of the Government. It employs two basic methods of developing standards. According to one method there are organized representative autonomous industry committees which report

directly to the main organization without the intermediary of a "sponsor"; according to the other there are organized committees for general standardization, also representational, which report to the main organization through its standards editing and reviewing office, likewise without a sponsor.

In 1927 there were in operation a total of 104 autonomous industry committees, each being supported by the interested industry or industries. In the case of many of these committees the support comes from a large number of industries or associations. For example, the household appliances committee is supported by 15 organizations, the committee on piping, flanges, and fittings, and the iron and steel committee by 12 organizations each.

Dimensional standardization forms the greater part of the work of the industry committees, and relatively few of the publications of the associations relate to quality standards or specifications. Standards are generally published in loose-leaf form, each published standard covering usually certain definite dimensions of a single device or commodity. The number of the standards issued by the German organization must be interpreted in the light of this fact when making comparison with the number issued by standardizing associations in other countries where a single publication may cover a great number of dimensions, grades, and quality specifications for a large group of commodities.

The dimensional standardization work has been so conducted as to result in the elimination of excess sizes and varieties of numerous commodities, such as business papers and the related office furniture, bricks, steel pens, automobile tires, piston rings, belts, flanges, gaskets, kitchen sinks, pocketknives, colors for felt hats, handwheels (interchangeable for numerous devices), nuts, bolts, and similar supplies, equipment, and apparatus.

In 10 years the association has established a total of 2,011 standards (or printed standard leaflets) relating to 1,006 commodities. Of these commodities, 179 are machine elements, 130 are locomotive parts, 283 are building materials, 87 are electrical equipment, 118 are automobile parts, and 63 are tools. General and technical rules are dealt with in 271 of the standardization leaflets under 165 main headings. The association has adopted an official trade-mark for goods complying with its specifications.

Great Britain.—British Engineering Standards Association, C. le Maistre, C. B. E., secretary, 28 Victoria Street, Westminster, London, S. W. 1, England.

This is the oldest national standardizing body in existence, having been formed 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.

In 1918 the committee was incorporated under English law as the British Engineering Standards Association, the constitution and articles of association being approved by the board of trade.

Up to the time of the World War the work of standardization progressed somewhat slowly but since the war, due in large measure to the advent of better technical and trade organization, industrial standardization in Great Britain has made immense strides, and from this small beginning there have now arisen over 500 sectional committees and subcommittees and over 2,500 members—engineers and business men throughout the country who are giving their time and their services to this national work free of all expense.

The work of the association covers the engineering and allied industries and embraces quality of materials, dimensions where interchangeability is concerned, and the unification of tests, and is divided into 11 sections, viz, aircraft, automobile, chemical engineering, civil engineering, colliery requisites, electrical, mechanical, metallurgical, petroleum products, ships materials and fittings, and transport.

The association does not initiate standardization but waits for pressure from outside before undertaking such work. In fact, it is only on the request of a representative technical or trade organization, or a Government department that the main committee of 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 their report, if favorable, that the main committee takes definite action by the appointment of what is called a sectional or departmental committee. The main committee reserves to itself the right to nominate the chairman, but in other respects the sectional committee has full authority. The sectional committee in some cases represents a whole industry such as does the sectional electrical committee, at other times it is representative of materials as in the case of the sectional committee on nonferrous materials.

The general funds are provided partly by industry and partly by government, but by far 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; probably a conservative estimate of the monetary value of industry's contribution both direct and indirect is somewhere in the nature of 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 also 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 source of supply, but to adopt as Government requirements what is best in present industrial practice.

The main committee of the B. E. S. A., upon which devolves the whole of the executive work, the raising of the necessary funds, the controlling of the expenditure and the ratification of the numerous reports, consists of 30 members drawn from the leading technical institutions of the country, with a certain number of members selected because of their eminence as engineers, a representative from the board of trade and from the department of scientific and industrial research, as well as from the National Physical Laboratory.

In carrying on its activities the sectional committee discusses the broad policy and indicates the lines upon which the work should proceed. Subcommittees also fully representative are then formed to deal with different branches of the work; they have power to add to their number and may appoint what are termed "panel committees," which usually consist of experts, to study any particular subject. When a proposed specification has been prepared by a subcommittee, and before the proposed draft specification goes to the sectional committee, it is referred by the representatives on the subcommittee to the respective authorities appointing them. Consequently, when a proposed specification is adopted by a sectional committee it implies that in putting that national specification into practical operation it will have every chance of being employed very widely. It may be considered that this is a somewhat cumbersome procedure; it has nevertheless proved increasingly to be the most satisfactory procedure for drawing up national specifications.

Great Britain has to depend largely on its export trade and in order to assist industry the association has nominated a local committee in certain of the trading centers of the world. These local committees consist of British engineers and traders and are established in various centers, more particularly in South Africa, India, the Argentine, Brazil, and Uruguay, and one is in process of formation in Peru. 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, translated into the appropriate languages—for example, French, Spanish, Italian, and Portuguese—have been widely disseminated and are at the disposal of the foreign purchasers who desire to acquaint themselves with British practice.

In the electrical industry national standardization has progressed to a greater extent than in the other industries, and under the auspices of the International Electrotechnical Commission, international

standardization in electrical matters has also made considerable progress, especially since the war. The B. E. S. A. sectional electrical committee is the British section of that commission.

About 300 publications covering general engineering standardization topics have been issued by the association. In addition, there are 24 publications covering ship and ship-machinery fittings, and 36 covering automobile materials and parts.

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.

Holland.—Centraal Normalisatie Bureau, W. H. Tromp, director, Koningskade 23, The Hague, Holland.

The General Committee for Standardization in the Netherlands was founded in 1916 by joint action of the Society of Industry and Commerce and the Royal Institute of Engineers. The Netherlands was thus the second country in which such a national committee was established. The first project undertaken was the standardization of rivets and bolts.

The organization took definite form by the establishment in Haarlem, in January, 1919, of the "Fund for standardization in the Netherlands." This fund is provided by voluntary contributions from departments of the National Government, local governments, chambers of commerce, and individual industries and private firms. In the year 1926 the total income was about 43,000 florins, contributed by the above-mentioned interests, in the order in which they are named, 22, 17, 8, and 53 per cent. Efforts are made to arouse as widespread interest as possible in the work and to secure definite annual subscriptions.

The committee consists of 20 members, 5 of whom constitute the executive committee. Among the organizations represented are the Royal Institute of Engineers, the Society of Industry and Commerce, the Electrotechnical Committee, the Trade Association of Metal Manufacturers, the Chamber of Commerce at the Hague, the Union of Dutch Employers, and the Union of Dutch East Indian Sugar Producers. Provision is made to invite associations and concerns which support the work to designate representatives.

The detail work of the committee is done by a paid staff of eight, known as the Central Standardization Bureau. The director of the bureau serves as secretary of the general committee and of the various special committees appointed to consider specific projects. The membership of the special committees and their subcommittees totaled about 400 in 1926, all serving without pay. The course of a particular project is as follows: A proposal is received by the general committee from one or more interested bodies. If the committee

deems that the project should be undertaken, it is assigned to an existing or a newly appointed special committee. The Central Standardization Bureau collects all available information and submits a report to the special committee, which then prepares a tentative specification or program of standardization. This is submitted to the general committee with the recommendation that it be published for criticism. It is published in several trade and technical journals and also sent out to all parties known to be interested. After due consideration the special committee prepares the first text and submits it to an editorial committee, after which it is published in its final form, unless major changes have been made, in which case it is returned to the general committee and again published for criticism.

The application of the specifications or programs of standardization is not mandatory in any case, but it is entirely voluntary. So far as possible the work follows the standards of other countries and special emphasis is given by the committee to the furtherance of international standardization.

The work of the committee has found only limited application in the Dutch colonial possessions but efforts are being made to expand in this direction. To this end the cooperation of the Dutch East Indian sugar industry has lately been obtained.

In March, 1927, the chairman of the general committee reported that in the 10-year period since standardization work was begun in the Netherlands, 250 projects had been completed, 96 had been published in tentative form, and 51 were then in preparation.

Hungary.—Magyar Ipari Szabványositó Bizottság, Ed. Gellert, secretary, Reáltanoda u. 13–15, Budapest, IV, Hungary.

Attempts to organize a central standardizing agency in Hungary were first made in 1918, but no real progress was made until 1920 when the Minister of Commerce, at the suggestion of the Society of Hungarian Engineers and Architects, appointed a committee to prepare a constitution for a national standards committee. At a meeting of interested organizations in April, 1921, the constitution was adopted and the Hungarian Engineering Standards Committee was created as an independent autonomous body.

Its plan of organization calls for a main committee, executive committee, sectional committees, a council, and the general office staff. The duties of the main committee, which is thoroughly representative in its membership, are chiefly executive, including the supervision of the standardization programs, and of the organization of the executive committees for supervising the routing of standardization projects and making public the findings of the sectional committees. In the membership of each sectional committee are representatives of producers, consumers, and scientific

institutions appointed by the executive committee at the request of the interested organizations.

Proposed standards prepared by the sectional committees are examined from both the scientific and the practical standpoint by the council which is composed of the chairmen of the various sectional committees, the members of the executive committee and of specially qualified individuals appointed by the Minister of Commerce.

Standards approved by the council and issued by the executive committee as Hungarian engineering standards are revised at least once a year for the purpose of making such revisions as may be found desirable.

As shown in the accompanying table, the committee has completed 14 standardization projects, and has 42 additional projects under way.

	Standardization projects	
	Total	Completed
A. Civil engineering and building industry	7	
B. Mechanical engineering	18	
C. Electrical engineering	11	11
D. Mining	6	
E. Drawing	6	
F. Miscellaneous	8	3
Total	56	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, director general, via Tommaso Grossi 2, Milano, Italy.

According to its by-laws approved in 1921 the general committee for standardization in the mechanical industry is composed of national associations in the mechanical industry and also certain nonmembers; representatives of the Government, and technical societies; and scientific and commercial men. The general committee organizes certain technical committees and a central technical commission.

The chairman of the technical committees, a president and two vice presidents and certain experts selected by the general committee form the central technical commission. This commission examines proposals made by the different technical committees, and acting as a coordinating agency, submits the proposals to the general committee for approval or refers them to the technical committees for reconsideration.

Proposed standards approved by the central commission are published in the official organ, "L'Industria Meccanica," to elicit

comments, objections received being submitted for examination by the general committee.

Both the chairmen and the members of the technical committees are appointed by the general committee. They are selected as representatives of the mechanical industries, or from the groups directly interested in the proposed standards, and also from specially qualified experts. Preliminary studies are often conducted by local subcommittees of the technical committees.

Prior to the formation of a technical committee or subcommittee a plenary meeting of those interested in the proposed standardization is held. Members of the technical committee are chosen by the general committee chiefly from those present at the plenary meeting or upon nomination by those present.

To become effective, decisions of the general committee, the central technical commission and the technical committees concerning standardization must be approved by a three-fourths vote of those present, or by at least two-thirds of the registered members.

Expenses and headquarters for the general committee are provided by the National Association of the Mechanical Industry.

Seventy-nine standards covering such items as tolerances, screw threads, nuts and bolts, machine parts, metallic materials, pipes, automobile parts, ship details, and tools have been approved and published. Work is now going forward on 136 additional standards.

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

The first work of engineering standardization in Japan was the establishment of testing methods of Portland cement for the contract of the Government purchase of the material in 1905.

The Japanese Electrotechnical Commission, established in 1908, has been engaged since 1910 in the work of standardizing the nomenclature, rating, etc., of electrical machinery and instruments and not a few of the standards have been established by the committee.

In 1913 the standard specification of cast-iron water pipes was drawn up by the Japanese Water Supply Association, which has been followed by the majority of the municipal water supply works and to which some amendments are to be made in the near future.

In June, 1919, a committee was organized by the Government for the investigation of the unification of weight and measure as well as engineering standards, in view of the situation which prevailed at home and abroad during and after the World War. After careful deliberation the committee decided on the adoption of the metric system as the standard in Japan. The committee deemed it necessary to establish a standing committee for deliberating on the engineering standardization.

Thus, the committee was discontinued at the end of 1920 and the Japanese Engineering Standards Committee was organized in April, 1921.

The Japanese Engineering Standards Committee is under the superintendence of the Minister of Commerce and Industry, and is charged with the responsibility of establishing the engineering standards.

The committee is required to report its opinions in response to inquiries submitted by the minister of state concerned.

The committee can make representation to the minister of state concerned.

The committee is composed of a president, a vice president, and members not more than 70 in number. Temporary members may be appointed, if necessary, in addition to the regular members.

The Minister of Commerce and Industry is the president of the Japanese Engineering Standards Committee. The vice president and the regular members are appointed among the officials of the department of state concerned and those with profound knowledge and experience, and their appointments are submitted to the cabinet by the Minister of Commerce and Industry.

There are several secretaries of the committee, appointed among the officials of the department of state concerned, their appointments being submitted to the cabinet by the Minister of Commerce and Industry. The secretaries manage the general affairs of the committee under the direction of the president.

The committee is divided into four sections under which there are 28 subcommittees. There is also a joint committee on terms and wording, made up of representatives of the four sections.

Following are the sections and subcommittees:

Section I. Metals (four subcommittees).

Section II. Nonmetallic materials (eight subcommittees).

Section III. Electrical machinery and instruments (eight subcommittees).

Section IV. Mechanical equipment and supplies seven subcommittees).

Progress of Work.—Since the committee held its first general meeting on October 3, 1921, five general meetings and as many as 638 sectional and subcommittee meetings have been held. To date 54 standards have been approved and 50 are under debate, leaving in the hands of the committee 29 standards to be established in the future.

The standards which have been approved by the committee have been submitted for consideration to the Government offices, scientific societies, trade associations, and manufacturers; and the necessary revisions having been made, they have been submitted to the

general meetings after having been examined by the sectional committee. When approved at the general meetings, the standards are reported to the Minister of Commerce and Industry.

In view of the importance of the utilization of the approved standards both by the Government and the general public, the department of commerce and industry consulted with other departments as to the standards for forms of tensile test pieces and diameter of wire, thickness of sheet metal and their designations, and issued on March 5, 1925, a notice, signed by all the ministers, requiring that the standards should be applied whenever possible to all commodities to be made or ordered by the Government. In 1924, 11 standards were issued; in 1925, 13 standards; and in 1926, 27 standards were approved and issued. Probably all of these will be handled in a similar way. Moreover, the standards will be used in the specifications prescribed in the state regulations for the protection, encouragement, and control of industry, so that they will apply to articles made for the public in addition to those used by the Government.

As a means of distribution, the approved standards printed on single sheets of uniform style are distributed among the Government offices concerned, scientific societies, trade associations, and manufacturers, and the work of spreading the practice of the standards is intended to be carried out more effectively and systematically in the future.

Norway.—Norges Industriforbunds Standardiseringskomite, Kaare Heiberg, secretary, Graendsen 17–IV, Oslo, Norway.

The Norwegian Standardization Committee was organized in 1923 on the initiative of the "Industriforbund" (Industrial Alliance), and consists of 35 member representatives from Government departments and technical, industrial, and trade associations. The Government and the municipality of Oslo contribute nearly one-half 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 and an assistant engineer appointed by the committee. The various projects are handled by sectional committees having a total membership of 130.

Up to the beginning of the year 1927 one standard on paper sizes and one on marine steam condensers had been adopted by the committee, and work was in progress on 30 technical projects, including building details, such as windows; doors and their hardware; stairs; roofing and bricks; machine details and parts, including standard diameters; machine and pipe threads; bolts; nuts; pins; keys and rivets; shaft diameters; bearings; couplings; pillow blocks; hangers; belts; pulleys and piston rings; pipes and fittings; ship hardware and fittings; specifications and tests for iron and steel; agricultural

implements; shipping containers; standard sizes for paper, envelopes, and periodicals; and standards for technical drawings.

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

This organization which was formed in 1924 has undertaken standardization in the building and mechanical engineering fields, including Portland cement, screw threads, cast-iron pipe, rivets, and the testing of iron and steel. It has also undertaken the establishment of standard sizes for paper. No information is available concerning the present status of its standardization activities.

Russia.—Standards Committee, Council of Labor and Defense, Union of Socialist Soviet Republics, Z. A. Papernoff, secretary, First Line Third Stock 41, Krasnaya, Plotchad, Gum, Moscow, U. S. S. R.

Standardization activities in Russia are undertaken in the order of their importance from the point of view of economics under the auspices of the standards committee organized in 1923. For this reason considerable work has been done on standards for raw products and for the chemical industry.

In former years commercial grain standards have been established annually, but consideration is now being given to a permanent standard for commercial grain based on the existing standard classification of grain.

Standards for the quality and conditions of smoking mixtures from the plant "machorka" were approved by the standards committee in 1924. In 1927 standards were approved for rags for paper manufacture, including quality specifications and grades.

The following standards recently approved have been translated and distributed to foreign standardizing bodies: Sizes of timbers, sizes of metric screw threads, sizes of spanner wrench openings, sizes and qualities of hemp ropes, sizes and qualities of common bricks, and sizes of bottles.

A considerable amount of standardization has been done in the chemical fields, including gas, coke, by-products, acids, oils, paints, and explosives for industrial purposes.

Including the above-mentioned standards, the committee has formally approved and issued more than 100 standards.

Standards for flax fiber, woolen goods, pneumatic tires, and mechanical rubber goods are under preparation.

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

As a direct result of the increasing interest in standardization shown by Swedish industrial organizations and the Government begin-

ning in about 1919, the Swedish Industrial Standards Committee was organized in 1922 at the initiative of the Swedish Industrial Association.

During the first year of its existence the committee was financed exclusively by the Swedish industrial organizations without Government aid. Realizing the importance of the work the Government provided funds for 1924 and has increased its payments since then by about 25 per cent each year.

A central committee, the chairman of which is appointed by the Government, directs the work of standardization. Its members are nominated by the following organizations: Swedish Industrial Association, Engineering Academy of Science, Swedish Engineering Association, Department of Communications, Department of National Defense, Department of Commerce, Government testing laboratory, Swedish Paper Manufacturers Association, Swedish Mechanical Industrial Association, and Swedish Electrical Industries Association.

Rapid progress had been made in standardization, especially in the mechanical industries. During 1923, about 60 standard specifications were adopted; during 1924, 11 more were adopted, and during 1925, 69 additional. During 1926, 12 of 14 proposals made by the committees were adopted as national standards. Work is also going forward actively on standards in the electrical, agricultural, and sanitary fields.

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

The Swiss Standards Association, organized 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.

IV. FEDERAL STANDARDIZING AGENCIES

(Executive Departments)

DEPARTMENT OF AGRICULTURE

The Department of Agriculture is represented on the executive committee of the Federal Specifications Board by the chief, division of purchases, sales, and traffic.

In addition to the department representation on technical committees of the Federal Specifications Board from bureaus separately mentioned, members of various other department activities serve on 37 technical committees, as department representatives.

The Department of Agriculture is represented on five committees of the American Engineering Standards Committee, in addition to those mentioned under the individual bureau activities.

BUREAU OF AGRICULTURAL ECONOMICS

Members of the bureau represent the Department of Agriculture on five technical committees of the Federal Specifications Board.

Marked interest has been shown during the past year in the bureau's program of standardization. The standards promulgated or recommended by the bureau have been made the legal standards in a large number of States, and in many instances cooperative organizations have adopted the standards as a basis of pooling their products.

In addition to the extensive check list of commodities for which standards have been issued (in mandatory, permissive, or tentative form) as given in the Standards Yearbook for 1927, standards have since been issued as follows:

Permissive standards:
- Fruits and vegetables –
  - Carrots, topped.
  - Shallots, bunched.
- Hay—Grass hay.
- Honey.
- Wool top—Diameter of fiber.

Tentative standards:
- Livestock—Vealers, slaughter.
- Tobacco—
  - 19 different types.
  - Type classification of American-grown tobacco.
  - United States standard tobacco sizes.

Besides the work on new standards, several of the standards in previous use have been revised and reissued either in printed or in mimeographed form. Copies of standards and specifications can be supplied on request and a check list of standards for farm products

which have been formulated by the bureau is kept up to date and is always available. Circular 8, National Standards for Farm Products, which outlines the standardization work of the bureau to date in a rather popular way, has been published.

FOOD, DRUG, AND INSECTICIDE ADMINISTRATION

Effective July 1, 1927, the regulatory work of the former Bureau of Chemistry and the Insecticide Board have been combined as the Food, Drug, and Insecticide Administration.

Members of this activity represent the Department of Agriculture on one technical committee of the Federal Specifications Board.

Food Inspection Decision No. 210, embodying a definition and standard for cultured buttermilk, promulgated April 13, 1927, is as follows:

> Cultured buttermilk is the product obtained by souring pasteurized skimmed, or partially skimmed, milk by means of a suitable culture of lactic bacteria. It contains not less than 8.5 per cent of milk solids not fat.

FOREST SERVICE

The Forest Service is represented on 4 technical committees of the Federal Specifications Board, 4 sectional committees of the American Engineering Standards Committee, 3 committees of the American Society for Testing Materials, 1 committee of the American Railway Engineering Association, 1 committee of the American Chemical Society, 1 committee of the American Wood Preservers Association, and 1 committee of the Technical Association of the Pulp and Paper Industry.

American Lumber Standards Program.—The Forest Products Laboratory has contributed during the year to the following projects of the American Lumber Standards program: (*a*) Softwood yard lumber standards, (*b*) hardwood factory lumber standards, and (*c*) structural timber standards.

Work in these fields on the part of the Forest Products Laboratory has initiated from specific requests from the General Lumber Standardization Conference, from the Central Committee on Lumber Standards, and from the latter's two consulting committees.

Such specific requests during the year have involved technical studies in the laboratory and in the field of: (*a*) Moisture content and shipping weights as a basis for the application of size standards, and (*b*) basic grade or quality descriptions which classify the product of the log according to its highest use value and minimize waste in manufacture.

To get the basic data required, sawmill studies along various specific lines have been conducted in each lumber-producing region. Construction and fabricating industry requirements have been secured by

building and factory studies and by conferences with leading technical representatives of the industry.

The principal work this year had to do with the thickness and moisture content standards for softwood yard lumber and the basic grade descriptions for hardwood factory lumber. A special committee of the central committee on lumber standards has been set up to deal with the moisture-thickness project. Basic grades for hardwood lumber have been prepared both by the Forest Products Laboratory and by the inspection rules committee of the National Hardwood Lumber Association. Those suggested by the latter have been accepted by the central committee on lumber standards as the American lumber standard for hardwoods, but official indorsement by the National Hardwood Association must be received before they are put into actual use.

Committee on Tree Names.—A revised edition of the Check List of Forest Trees of the United States was published. It contains common tree and lumber names adopted as standard by the Forest Service for use in its publications and recommended for general use throughout the United States and elsewhere.

Forest Service Policy in Selecting Standard Names for Trees and Woods.—In the interest of good trade practice and of protecting the consumer from obtaining inferior woods under the guise of misleading names, it is important that so far as practicable different trees and woods bear distinctive common names, that the names be uniformly used, and that concerted efforts be made to prevent adding to the present confusion through getting into circulation further misleading or ill-chosen names. In selecting standard common names of trees and woods for its own use, as well as for the purpose of furnishing helpful guidance to the interested public, the United States Forest Service has used the following principles:

1. The names of different trees and woods should be clear-cut and distinctive. They should not be ambiguous, confusing, or misleading.

2. So far as possible a tree and the lumber cut from it should be called by the same name.

3. Attempts to standardize common names are met at the outset by preexisting common names for most trees and woods—names that are hard to change and that must be given much weight. Preference should be given to the most widely used common name, provided it is not misleading. Artifically coined names should be adopted only as a last resort. This principle applies not only to native but to foreign woods. Aboriginal or native names, like mahogany and teak, should, when practicable, be used for imported woods instead of artificial or borrowed names, whose purpose often is to mislead the consumer.

4. Common names of trees and woods should, so far as possible, follow the major botanical groupings of trees. These groupings are based on inherent, recognizable resemblances; they constitute a logical, coherent, and universally recognized order and system. To base common names on superficial, often fluctuating, resemblances between botanically unrelated groups can only lead to confusion.

There are limits, however, beyond which common names can not follow botanical grouping. The botanical distinction of species may be based on characteristics too minute or inconspicuous to be easily recognized as the basis for distinct common names, as in the numerous species and varieties of basswood. Or an improper common name may have become too firmly entrenched in usage to be upset, as, for instance, the name cedar applied to *Juniperus*, *Chamaecyparis*, *Thuja*, and other genera.

5. When botanical differences among species and varieties of a genus are too slight to serve as a basis for distinctive common names, a group common name should be applied. Examples are found in the basswoods, willows, hickories, oaks, etc.

Within certain genera there are groups of species having common characteristics distinct enough to differentiate them as whole groups from other groups within the same genus. Examples are the red and white oak groups, the white and black ash groups, and the white and yellow pine groups. These group distinctions should be preserved in the names used for the individual members of each group, so far as possible.

It is natural and legitimate that group common names should be more extensively used for lumber than for the corresponding trees, because the trees with their bark, foliage, flowers, and other characteristics are often more readily distinguished than is the lumber cut from them.

6. Ordinarily a distinct generic common name should be used for each member of a botanical genus, as spruce (*Picea*), pine (*Pinus*), oak (*Quercus*), elm (*Ulmus*), etc., unless (*a*) firmly established usage of the same common name for two or more genera (such as the name cedar for *Juniperus*, *Thuja*, *Chamaecyparis*), or of two or more generic common names for different members of the same genus (as butternut and walnut for members of the genus *Juglans*), prevents the adoption of the principle but does not lead to deception; or unless (*b*) two or more genera are so closely related botanically and their woods are so nearly identical in structure, properties, appearance, value, and usefulness as to be to all intents and purposes the same. This latter exception rarely applies to native woods, but conceivably might apply to certain closely related woods of tropical genera, if they are not readily distinguished in practice, and if no deception results from the use of a group generic name. This principle is

simply an extension of the principle of the group common name, as used in related species and varieties, to the larger groups known as genera. It is recognized that generic classification is not always fixed and unalterable, separate genera having sometimes been combined into one genus and single genera having sometimes been split up into two or more genera. When practicable, however, it would be preferable to follow the principle of a distinct name for each genus.

7. The common name of one species, group of species, or genus should not be used for that of another species, group or genus in such a way as to be misleading, nor should it be used otherwise than as provided in paragraphs 5 and 6 above. Even a close superficial resemblance between woods widely separated botanically is no warrant for violating the principle of adhering to botanical groupings. The use of modifying terms, such as the State, region, or country in which the wood grows, or of some word descriptive of the wood itself, does not alone atone for borrowing a name, nor does it safeguard the consumer against confusion or even deception. The tendency is for artificially borrowed names (as distinguished from those borrowed through popular ignorance) to be used to create a market for unknown and very often inferior woods. The use of borrowed names must be guarded against more and more carefully as the importation of new and unknown woods increases; otherwise there will be endless deception. An example of such misleading practice is the name "swamp walnut" which has been applied to furniture made of willow lumber. It seems fair for each to stand on its own merits and to make its way under its own colors.

BUREAU OF HOME ECONOMICS

Members of the Bureau of Home Economics represent the department on four technical committees of the Federal Specifications Board.

The bureau is cooperating with the American Society for Testing Materials in establishing standard methods of testing textiles and with the American Home Economics Association in its efforts to bring about standardization of certain household commodities.

Though the Bureau of Home Economics conducts no regulatory work and consequently sets up no "official" or "mandatory" standards, the descriptions of household equipment and supplies contained in its bulletins are in the nature of specifications, in the broad sense of the word, for the woman purchaser. The following branches of work tend toward the establishment of uniform practices where similar research is in progress.

The Bureau of Home Economics is cooperating with the State experiment stations and other agencies concerned in the national project on the factors affecting the quality and palatability of meat,

in the development of standard methods of cooking certain cuts from experimentally produced animals for palatability tests. Standard directions for lamb have been submitted by this bureau to the national committee in charge of this phase of the project.

For use in analysis of food consumption data and similar studies made by the State colleges and other organizations, the dietary scales and standards for measuring a family's nutritive needs were reviewed. A new double scale that allows for the protein and mineral as well as energy requirements of individuals varying in age, sex, and activity, has been proposed (United States Department of Agriculture, Technical Bulletin 8). This, it is hoped, will bring more uniformity in food consumption studies so that results will be comparable.

BUREAU OF PUBLIC ROADS

Members of the bureau represent the Department of Agriculture on seven technical committees of the Federal Specifications Board, and three sectional committees of the American Engineering Standards Committee.

During the past year work has been continued on the standardization of highway methods and materials through membership on committees of various national technical organizations, particularly those of the American Association of State Highway Officials and the American Society for Testing Materials, and in connection with this work considerable research work has been done in the laboratories of the bureau.

In cooperation with the American Association of State Highway Officials a manual and specifications for the manufacture, display, and erection of United States standard road markers and signs has been issued. It is anticipated that these highway signs with the exception of the United States highway markers, which are to be used only in designating the United States numbered routes, will come into general use on all public highways.

Work is now in progress in cooperation with this association on a revision of the publication dealing with tentative standard methods of sampling and testing highway materials.

Bureau representatives have taken an active part in the formulation of tentative standard sizes of crushed stone by the American Society for Testing Materials, and these tentative standards have been adopted by other national organizations. It is proposed that a number of standard sizes be selected for commercial production to replace the great number of sizes now demanded from producers.

In the subgrade-soil investigations of the bureau, promising progress had been made in the development of tests by which the properties of the soils which affect their value as subgrade materials may be measured, and plans have been perfected for extensive road

condition and soil surveys. It is hoped that this work will result eventually in standard methods of evaluating soil properties as they relate to roads.

Reports have been issued as a result of highway transportation studies in Ohio, Vermont, New Hampshire, and Cook County, Ill., by the bureau in cooperation with the respective highway authorities. In this work there has been no attempt to set up fixed standards of procedure, but it is believed that the methods developed for determining highway requirements can be used as a general guide in planning future highway development.

WEATHER BUREAU

Members of the Weather Bureau represent the Department of Agriculture on two technical committees of the Federal Specifications Board, and two sectional committees of the American Engineering Standards Committee.

The Weather Bureau has cooperated with the committee on submarine configuration and oceanic circulation of the division of geology and geography, National Research Council, in the development of standard forms of ocean thermographs and standard methods of their installation on seagoing vessels. The findings of the committee are published in their report, Appendix E.

DEPARTMENT OF COMMERCE

The Department of Commerce is represented on the Federal Specifications Board by the Deputy Commissioner of Lighthouses.

In addition to the department representation on Federal Specifications Board technical committees mentioned under the sources below, representatives from the following additional activities represent the department, on the following number of technical committees:

Office of the Secretary, 1.
Coast and Geodetic Survey, 1.

Representatives from the Department of Commerce are members of one committee of the American Engineering Standards Committee in addition to those mentioned under the individual bureau activities.

BUREAU OF THE CENSUS

Standardization of Vital Statistics.—Everywhere in vital statistics, the key word is standardization. Standard certificates of birth and death, standard tables, standardized rates, and standardization of State bureaus of vital statistics are instances of its application and importance.

If physicians are to certify causes of death so that comparable statistical data will be obtainable from death certificates, physicians

must use a standard medical language. An attempt to meet this need resulted in the publication by the Bureau of the Census in 1919 of the Standard Nomenclature of Diseases and Pathological Conditions, Injuries and Poisonings for the United States. A reprint of this first edition has already been made and a second edition is now being prepared, as was the first, with the hearty cooperation of a large committee of eminent lexicographers and medical men.

If Federal vital statistics are to be comparable with the vital statistics compiled by State and city officials, and if vital statistics compiled in the United States are to be comparable with vital statistics compiled by foreign countries, it is essential that a standard plan of compilation be followed. This need is being met in this country under the lead of the Census Bureau by the general adoption by most of the States of good registration laws patterned after the model law, and of standard certificates of birth and death and by the general adoption of the International List of Causes of Death for the presentation of mortality data. As still further aids toward standardization the Bureau of the Census has published 3 editions of the Manual of the International List of Causes of Death, 2 editions of the Manual of Joint Causes of Death, and 7 editions of the little booklet known as the Physicians' Pocket Reference.

Revision of the standard certificates for use in the next decade are now being considered by the Bureau of the Census in cooperation with the American Public Health Association.

A revision of the International List of Causes of Death for use in the next decade has already been considered in 1927, in preliminary conferences held in this country and abroad, a representative of the Census Bureau having participated in such conferences in 1927 in New York, London, Geneva, and Paris. The final conference on this subject is scheduled to take place in Paris in 1929.

BUREAU OF FISHERIES

Although the functions of the Bureau of Fisheries, as originally outlined, did not specifically include standardization activities, several such activities have become necessary as a means of carrying out the principal functions. The bureau has only advisory functions in this respect.

Nomenclature of Fishes.—Common names of fishes in ordinary usage are very confusing. Of over 100 commercial fishes many are known by different names in various localities and the same common names have been applied to different species of fish. The bureau has found it necessary, particularly in its statistical publications, to adopt standard names.

Standardization of State Fishery Statistics.—As a necessary supplement to statistical information collected by the Bureau of Fisheries, the various States have been encouraged to adopt standard

practices in collecting statistics. The bureau is effecting such standardization (1) by the encouragement of standard legislation by States requiring the statistics to be collected in the uniform method, (2) by a personal contact with State agencies collecting statistics, and (3) by supplementing in certain regions the statistics collected by the States by field work on the part of its own agents. During the past year standardization was sufficiently effected to permit the compilation of fishery statistics of the Pacific Coast States and the Great Lake States.

Standardization of Packages and Containers.—The bureau has recently undertaken several investigations among the commercial fisheries of the Atlantic Coast with the object of helping the producers to eventually handle fisheries products without waste. Such economy will mean better fish for the public and greater conservation of our fisheries resources.

During the year the Bureau of Fisheries made a study of the packages and containers used in shipping shucked oysters. It was found that the only solution of the difficulties experienced in shipping this product lay in the standardization of methods, materials, packages, and shipping containers.

In recent years there has been developed a method of preparing fresh and frozen fish for shipment known as "package fish." Heretofore practically all fresh fish were shipped throughout the country loosely iced in boxes and barrels. No standardization of shipping packages had been effected, nor did it seem possible that there could be under those conditions. The development of the "package fish" trade, which consists of packing trimmed and boned portions of fresh fish either as fillets, steaks, or pan fish, has reached the stage of perfection which clearly promises to revolutionize the distribution of fresh fish. This development permits greater standardization in packages and encourages standardization of quality, since cartons and wrappers may bear trade-marks and thus permit producers to establish reputations for their particular brands of package fish. A survey made during the past year revealed that 27 firms on the Atlantic Coast prepared nearly 20,000,000 pounds of package fish in 1926, and their containers were largely of a standard nature.

Design and Equipment of Fishing Vessels.—In order to permit the efficient discharge of cargoes of fish at receiving ports, it is being found necessary to have a certain uniformity in the deck plan and fish holds. This situation is developing most rapidly in New England, where it appears probable that improvements in methods of handling fish on the Boston Fish Pier will compel such standards in order to effect proper coordination with the dock equipment. As a part of this problem the bureau is designing a collapsible dumping box for handling fish on boats, which is to be of standard nature and size for use on all vessels in this fishery.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE

Members of the bureau represent the department on six technical committees of the Federal Specifications Board. Through the initiative of this bureau and with the valuable assistance of an advisory board, there was promulgated during the year a series of recommendations dealing with standard practices adapted to packing for domestic shipment. These recommendations, published in seven pamphlets,[3] deal with methods of manufacture, design, style, service, testing, and specifications for materials for fiber containers, cleated plywood boxes, wire-bound boxes, cooperage, steel barrels, wooden boxes, nailed wooden crates, and bales.

Standard contract terms and conditions for general merchandise and cold-storage warehouses were published.[4] These terms and conditions were adopted and put into use as a result of a general conference of representatives of the warehouse industry, banking interests, shippers and receivers of freight, and railway men, the Chamber of Commerce of the United States cooperating in the work.

During the year eight numbers in the Industrial Standards Series were added to the Portuguese language group. All of these were standard specifications for steel products, prepared by the American Society for Testing Materials. Portuguese translations were made for additional specifications and these will be published and released early in 1928.

A new series of foreign-language editions covering standard specifications for electrical machinery, equipment, and apparatus was inaugurated. Seventeen specifications, prepared and translated by the American Institute of Electrical Engineers, were published in the Spanish-language edition. A few of these are approved American Standards in accordance with procedure of the American Engineering Standards Committee.

Steps of marked interest were taken in simplifying and standardizing the presentation of economic reviews and statistical data of foreign countries, the dissemination of which is a major function of this bureau. This year, for the first time, the Commerce Yearbook was published in two volumes. The second volume contains, in summary for each of 61 foreign countries, and 4 noncontiguous territories of the United States, data relative to agriculture, mining, manufacturing, transportation, communications, foreign trade, labor conditions, price movements, public finance, currency, foreign exchange, and other matters affecting the general business situation. Data are included as to area, population, education, births, deaths, climate. There are also some 40 to 50 summary tables. All matter is presented uniformly and is converted into terms of common denominators facilitating analogy and comparison.

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[3] Domestic Commerce Series Nos. 10, 11, 12, 13, 14, 15, and 16.
[4] Domestic Commerce Series No. 18.

During the year representatives of the bureau took active part in an interdepartmental committee which, with the help and consent of the wool trade in the United States, has prepared standard terms and classifications for reporting international statistics on wool production, distribution, consumption, and stocks. These recommended terms have been promulgated as tentative standards and the criticism of the larger wool producing and consuming countries is being solicited.

Likewise, as a result of a series of conferences, in which bureau representatives participated, the confusion in converting statics relative to production, consumption, and stocks of various types of sugars produced in different parts of the world was somewhat minimized. Tentative standard conversion factors for "hard refined equivalent" were established tentatively for the output of major sugar-producing areas, namely, Cuba, 93.58; Hawaii, 93.58; Porto Rico, 93.93; Philippine Islands, 95; muscovado sugar-producing areas, 82.40; and all others, except muscovado, 93.20. These factors are being applied in the reports of United States governmental departments this year and efforts are being made to have them adopted internationally.

The larger part of this bureau's activities in the field of simplification and standardization was cooperative. Aid was extended to the division of simplified practice of the Department of Commerce and to the National Committee on Wood Utilization. In association with representatives of the tanners in the United States the appropriate division of the bureau cooperated with the Department of Agriculture in a plan (national in scope) to develop standard practices in the take-off and grading of hides and skins, particularly leather raw stock.

In order to bring about common understandings as to interpretations of trade terms, conditions of sale, and the like, the bureau offers a forum for the development of standards of commercial practice. A specific item of this nature now under consideration for simplification is the question of when the cash discount should be deducted on bills of goods sold "f. o. b. named shipping point, freight allowed."

Increasing efforts were made in the development of information leading to the elimination of waste in distribution and marketing. The bureau has endeavored to help domestic commerce in this respect through the preparation and publication of regional marketing surveys, analyses of wholesale distribution costs, and wholesale trade atlases.

An example of another type of activity is shown by the bringing together in conference of representatives of the dry-cleaning industry and laundries with representatives of spinners, cloth makers, dyers, clothing manufacturers, and finishers for the purpose of preparing and adopting trade standards relating to the description and marketing of qualities of goods, materials, and clothing.

Another important activity was the participation in international conferences where standards of business practice or international business codes were either a part of the purpose of the meeting or the principal objective. Of the former, the International Economic Conference at Geneva and the meeting of the International Chamber of Commerce at Stockholm are examples, while the Third International Conference of Scientific Management at Rome, Italy, the Pan American Commission on Simplification of Consular Procedure at Washington, and the Second Pan American Standardization Conference at Washington are examples of the latter.

BUREAU OF LIGHTHOUSES

Members of the bureau represent the department on five technical committees of the Federal Specifications Board, and on one sectional committee of the American Engineering Standards Committee.

Improvements in Apparatus and Equipment.—Work was continued on the installation and use of radiobeacons for the protection of navigation in fog, as stated elsewhere. The use of tube transmitters and of lower power for many stations is being extended. Investigation is being made of the interference between radiobeacons, which sometimes causes difficulty in taking bearings. As respects the clear-weather operation of signals at fixed periods each day, this type of interference has been overcome during the year by introducing a time schedule arranged so that adjacent stations operate at different periods in the day. For operation during fog, a clock-control system is being tried out, to prevent overlap of the sending minutes of adjacent stations; also consideration is being given to separating the frequencies or wave lengths of adjacent stations, and this method is soon to be tested. Much radio-construction work for the service at large was accomplished at the Detroit Lighthouse Depot during the year; about 25 transmitters were built and delivered, and work on about 60 additional transmitters has made material progress. This has been found economical and of benefit in the development of improvements.

An effective type of small acetylene-gas buoy has recently been designed and put in service for use in shallow waters inaccessible to lighthouse tenders. It is light and can be handled by a heavy launch, and it is of quite moderate cost. An efficient launch, which can be carried on the deck of a tender, has been built for handling these small gas buoys. A number of these buoys are already in successful operation.

The substitution of inexpensive iron buoys (special type) for wooden-spar buoys is being constantly extended. These buoys have great advantages over the wooden spars in being more conspicuous,

in permitting distinction of shape for the two sides of a channel and better indication and retention of the color for the same purpose, in being much less destructible by ice and collision, and in not being affected by worms. In the third district in the last six years the number of wood buoys has decreased by 149, or 18 per cent, and the number of iron buoys has increased by 224, or 80 per cent.

The use of gong buoys is being extended where they will be of service in preventing confusion with bell buoys in the neighborhood, and improvements in the gongs are being investigated.

The work of converting oil-gas buoys to acetylene buoys was continued during the year.

Vibratory-disk types of fog signal, operated both electrically and by compressed air, have been tried out in actual service during the past year with good results.

The work of removing old steam fog-signal plants and whistles and replacing them with compressed-air plants and sirens is being extended as rapidly as funds permit. Ten such replacements were made during the year, and there are now only 68 steam plants in service as compared with 131 in 1911.

The extension and improvement of automatic lighting apparatus was continued during the year. The system of two independent automatic light installations for increasing the reliability of more important unattended lights, mentioned in the last annual report, has been developed to a stage where it will be tested at an important isolated light station. The use of double pilot burners for unwatched acetylene lights for the purpose of reducing extinguishment has proved successful and is being extended. A method of automatic control of compressed-acetylene tanks at unwatched stations, whereby but one tank of a battery will be in service at a time, has been developed and is being tried at an important unwatched, isolated light on the Pacific coast.

The policy has been continued of converting minor lights in certain localities from oil or incandescent oil vapor to acetylene and having them cared for in groups, increasing their efficiency and reducing the cost of maintenance.

The use of electric current for illumination, both commercial and that generated at the stations, has been extended during the year, a number of lights using either oil, oil vapor, or acetylene having been converted to electric, for the reason that commercial current is now available or that the introduction of radiobeacons makes it practicable and economical to make the change.

A new type of day beacon has been installed on the Florida Reefs. This consists of a solid wrought-iron pile driven into the coral reef, with its head about 2 feet above water; to this is fastened a wrought-

iron socket into which is stepped a wooden column with day mark; this foundation pile will not be destroyed if the day mark is carried away.

A quadruple-mouth cast-iron horn was developed during the year for replacing the old copper mushroom horn used on one of the lightships, increasing range of audibility and reducing the noise of the siren on the ship itself.

The installation of tanks at light stations for storage of kerosene in bulk was extended during the year.

A loose-leaf sketchbook showing various apparatus in use in the service has been continued and extended, and this is now being arranged so that it can be used in connection with the price list of standard articles when ordering.

On June 30, 1927, 330 light stations were provided with telephone communication.

The development of improved airway apparatus and structures has been accomplished. The 24-inch rotating airway beacon has been improved by the addition of flashing mechanism for identifying lights, using the motor of the beacon for the driving mechanism, thereby synchronizing the supplementary lights with the flash of the beacon. An improved and reliable lamp exchanger has been developed commercially for airway beacons. Airway structures have been numbered on a mileage basis for identification of location with respect to the airway. This numbering system has been incorporated in the lighting system in order that the distinctive characteristic may identify location of the beacon. The standard airway tower has been improved so as to be entirely suitable for the purpose. A flashing electric beacon, using a 360° Fresnel lens and top section showing from the horizon to the zenith and designed in such a manner that equal candlepower is visible to the pilot approaching the light, has been developed and is now being tried out on the Los Angeles-Salt Lake Airway Beacon No. 6. Astronomic time clocks have been introduced for the control of automatic airway lights. Improvements have been made in the design of the internally lighted wind cone, making the device more reliable and eliminating the slip rings carrying current to the lights. The first commercial installation of radio range beacon has been installed at Hadley Field.

BUREAU OF MINES

Members of the bureau represent the department on 7 technical committees of the Federal Specifications Board and on 20 sectional committees of the American Engineering Standards Committee. The bureau is also a member of the A. E. S. C. Mining Standardization Correlating Committee and the Safety Code Correlating Committee.

Among the investigations in which the bureau was especially active 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, in cooperation with the American Society for Testing Materials.
3. Methods of determining sulphur in coal and coke.
4. Standard testing of permissible explosives and permissible equipment.
5. Standardization of materials used for rock dusting coal mines to prevent explosions of coal dust and gas.
6. Preparation of standard annual reports on mine accident statistics.
7. Standardization of specifications for lubricants and liquid fuels and methods of testing.
8. Standardization of mine rescue methods and rescue apparatus.
9. Standardization of method of first-aid instruction.
10. Standard methods of reporting mineral and metal statistics.

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:

1. Recommending the use of permissible electric mine lamps for illumination in all coal mines and that permissible magnetically locked flame safety lamps, or equivalent device, be used for gas detection.
2. Recommending that permissible explosives fired electrically be exclusively used in all coal mines.
3. Classification of coal mines by methane given off and specifications for determining the class to which a mine belongs, viz, class 1, nongassy, class 2, slightly gassy, class 3, gassy.
4. Recommends that auxiliary fans or blowers should not be used in coal mines as a substitute for methods of regular and continuous coursing of the air to other places in the mine.
5. Recommends rock dusting of all coal mines except anthracite mines and rock-dust barriers as supplementary defenses and not a substitute for general rock dusting.
6. Recommends that all workings and sections of mines that can not be well ventilated or inspected regularly be sealed by strong fireproof stoppings.

Rock Dusting of Coal Mines.—The Bureau of Mines has developed methods for the rock dusting of coal mines to prevent coal-dust explosions which are becoming standard practice through their adoption by the mining industry.

Standard Rock-Dust Barriers.—A systematic study of the operation of rock-dust barriers was continued. The results in connection with previous tests of barriers will permit publication of a list of barriers found most effective under various conditions. It has been found that the efficiency of a barrier will vary widely with the type of explosion which reaches it and consequently a barrier must be designed to meet the most severe conditions.

Ventilation Requirements of Coal Mines.—The bureau has also 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. This has the general result of standardizing the ventilation requirements of coal mines and placing ventilation requirements on a comparable and exact basis, rather than basing them on empirical formulas.

Explosibility of Coal Dust.—At the experimental mine at Bruceton, Pa., near Pittsburgh, tests relating to gas and dust explosions were continued and other special investigations were conducted. One hundred coal-dust explosion tests were made in the mine and 90 gas-explosion tests were made in a special gallery 1 foot in diameter by 100 feet long. Tests were made of the explosibility of dust prepared from four samples of semianthracite coal from the Valley of Virginia.

Standardizing Explosion Hazards of Different Coal Mines.—Standard methods of testing the explosibility of different coal dusts, alone and in mixture with different percentages of gas, have been applied in the testing of coal dust prepared from coal samples, and testing of samples of mine dust, from hundreds of mines. As a result of this testing work, the bureau is standardizing the gas-and-dust explosion hazards of different coal mines.

Mine Stoppings.—The work on methods for testing the strength of mine stoppings originated during the preceding year was continued. The information obtained will be used by the leasing section of the United States Geological Survey, which was formerly a section of the Bureau of Mines. The present year's work was in cooperation with the Bureau of Standards, on whose grounds a testing chamber was built. Concrete slabs of different designs representing mine stoppings were fastened in one side of this chamber and tested to destruction by explosions of black blasting powder in the chamber. Further work awaits an analysis of the test results obtained by the Bureau of Standards engineers.

Specifications for Lubricants and Liquid Fuels.—The principal activity of the division of petroleum and natural gas relating to standardization during the calendar year 1927 was the preparation for publication of United States Government master specifications for lubricants and liquid fuels and methods for sampling and testing (Bureau of Mines Technical Paper 323 B). This paper was prepared by the technical committee on lubricants and liquid fuels of the Federal Specifications Board in cooperation with an advisory board made up of representatives of outside (nongovernmental) interests, including the American Society for Testing Materials. The department representative from the Bureau of Mines on the technical committee was the secretary of the committee.

At the petroleum experiment station of the bureau at Bartlesville, Okla., work has been going on for several years on the standardization of measurements of natural gas by means of orifice meters. This work is in cooperation with the National Bureau of Standards and the American Gas Association (formerly the Natural Gas Association of America). Another problem is an attempt to standardize the method of determining the open-flow capacity of gas wells.

Explosives Testing.—The following explosives have passed the tests for permissibility since January 1, 1927:

Explosive	Manufacturer
Coalite M, L. F	Atlas Powder Co.
Coalite T, L. F	
Collier C, L. F	Hercules Powder Co.
Gel-Coalite X, L. F	Atlas Powder Co.
Gel-Coalite Z, L. F	
Peerless No. 4	Peerless Explosives Co.
Tristate Special No. 1	Union Explosives Co.
Tristate Special No. 2	
Trojan Coal Powder P–2	Trojan Powder Co.
Trojan Coal Powder P–3	

In addition to the above explosives, as a result of tests on 17 types of permissible explosives, changes in the liquid explosive ingredient were permitted in 83 explosives.

The substitution of a mixture of not more than 25 per cent of ethylene glycol dinitrate with nitroglycerin for a similar quantity of nitroglycerin has been authorized in three of the explosives now on the Bureau of Mines' list of permissible explosives. A similar mixture has been authorized as a substitute for nitroglycerin and nitropolyglycerin in 68 explosives, and for nitroglycerin or nitroglycerin and nitropolyglycerin in 12 explosives. Authorization has been granted also for 20 of these same explosives using a mixture of not more than 25 per cent nitrated sugars in combination with nitroglycerin and ethylene glycol dinitrate for nitroglycerin and nitropolyglycerin.

Standardization of Coal Dust for Permissibility Tests.—During the past year special attention has been given to the standardization of coal dust for use in testing permissible explosives at the explosives testing station in gas and dust gallery No. 1, for it is of the first importance that the coal dust used throughout all these tests shall, in its chemical composition and physical characteristics, be constantly uniform. In this investigation a review has been made of all the records of the explosives testing station on this matter from its foundation. The information thus collected has been analyzed and discussed and specifications have been drawn covering the source and method of selection of the bituminous coal from which the dust is obtained, the method of comminuting this coal, the collecting,

sampling, and storage of the coal dust, and the standards and tolerances of its chemical and screen analyses. These specifications, as finally agreed upon, are to constitute Appendix No. 44 of T. P. 186 covering "Methods for Routine Work in the Explosives Physical Laboratory of the Bureau of Mines."

Photographic Method of Determining Detonation.—A new method of determining rate of detonation has been developed in which the image of the detonating column of explosive is photographed on a rapidly moving film. This method gives the velocity at every point in the path of the detonation wave and is considerably more valuable for many purposes than the method employing the Mettegang recorder.

Sensitivity to Explosion by Influence.—In order to devise standard means of determining the relative sensitivity of explosives when used in blasting, a comparison has been made of distance over which detonation will be propagated from one cartridge to another across an air gap when (1) the cut ends of the cartridges face the gap, and (2) when the crimped ends face the gap. It was found that the gap in the latter method, which is the one employed in practice, was considerably less than the gap obtained by the first method. In order to learn more about the mechanism of this phenomenon the velocity of the shock wave in the gap is being measured.

Standardization of Gas Mask Specifications.—Gas masks are used in the mining and metallurgical industries to protect men from noxious gases and fumes. A schedule has been published for testing gas masks as to their effectiveness, mechanical construction, materials, design, and methods of designation. The kind of protection afforded by various gas masks is indicated by the color of the canister. A scheme suggested by the Bureau of Mines has been adopted by a number of manufacturers and is being considered for adoption by technical and safety societies, including the National Safety Council.

Standard for Determining the Capacity of Low-Pressure Heating Boilers.—The mechanical division fuel section 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.

NATIONAL BUREAU OF STANDARDS

The director of the bureau is ex officio chairman of the Federal Specifications Board, and a senior engineer physicist of the bureau is vice chairman and technical secretary.

Members of the bureau represent the Department of Commerce on 58 technical committees of the Federal Specifications Board, and on 69 committees of the American Engineering Standards Committee.

For details of the activities of the Federal Specifications Board, see page 97.

The director of the bureau is chairman of the National Screw Thread Commission, and a senior physicist of the bureau, is secretary. For details of the work of the National Screw Thread Commission, see page 112.

For details of the work of the National Bureau of Standards, see page 118.

STEAMBOAT INSPECTION SERVICE

Representatives of the service are members of two sectional committees of the American Engineering Standards Committee.

The Supervising Inspector General is a member of the American Marine Standards Committee. At the request of this service the division of simplified practice of the department is working with the bureau in the matter of the revision of the boiler rules. This office has also detailed certain of its supervising inspectors to work up the revision of these boiler rules, with a view to making a comparison between those promulgated under the direction of the American Marine Standards Committee and those promulgated by the representatives of this service, and when this comparison shall have been made and agreement is reached as to the best rules to be adopted, the whole matter will have the attention of the board of supervising inspectors.

This service has also undertaken the revision of its rules covering the manufacture of valves and fittings, and in its work it has invited the comment of the leading valve manufacturers of the country, and in addition to this, there was held a meeting in Cleveland, Ohio, on December 1, 1927, to further consider the matter. The subject will now be considered by the board of supervising inspectors, which has authority to legislate in the premises.

For some time this office has been working upon the standardization of examination questions that may be given to applicants who apply for licenses, with the thought that while standard sets of examination questions would be prepared, the local inspectors would still have authority to propound such additional questions as necessary to meet any local conditions that might present themselves, and yet carry into effect a procedure that would obtain absolute uniform conditions in the examination of applicants for licenses.

DEPARTMENT OF THE INTERIOR

The Department of the Interior is represented on the executive committee of the Federal Specifications Board by an engineer of the Bureau of Reclamation.

In addition to the membership on the technical committees of the Federal Specifications Board mentioned below, members of the follow-

ing additional activities represent the department on the technical committees mentioned:

Office of the Secretary, 1.
Geological Survey, 4.
Office of Indian Affairs, 10.
St. Elizabeths Hospital, 6.
National Park Service, 1.

In addition to the memberships on committees of the American Engineering Standards Committee, mentioned under the individual bureau activities, the department is represented on two committees.

GENERAL LAND OFFICE

The General Land Office has fixed certain standards governing the instruments and methods to be used in the surveys of the public lands, for the control and guidance of such activities within the bureau itself.

Through membership of the Board of Surveys and Maps of the Federal Government and representation on certain committees thereof, this office is cooperating in the coordination of the map making and surveying activities of the Government, and the standardization of maps and mapping practice.

BUREAU OF RECLAMATION

Members of the bureau represent the department on two technical committees of the board, and on two sectional committees of the American Engineering Standards Committee.

Standardization work that has been approved this calendar year, or that is now in process or have been completed during the year, is as follows:

1. 3 feet 6 inches by 3 feet 6 inches high pressure gates, comprising eight drawings.
2. 3 feet 6 inches by 3 feet 6 inches high pressure gate, conduit lining, comprising two drawings.
3. 12-inch hydraulic hoist, comprising two drawings.

Designs are also practically completed and will soon be issued for the following:

1. Standard timber highway bridges, comprising 24 drawings.
2. Standard concrete inclined drops, comprising 18 drawings.
3. 42-inch balanced needle valves, comprising 30 drawings.

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 on its several projects. In this the interests of this bureau are the controlling factors and cooperation with outside interests in the matter have been largely incidental. Standard designs have been prepared and are now in use for 15 groups and classes of machinery and structures, including 373 drawings.

DEPARTMENT OF LABOR

The department is represented on the executive committee of the Federal Specifications Board by a member of the Bureau of Labor Statistics, and the department is represented on the technical committees of the board. The department, as such, is represented on 28 technical committees of the American Engineering Standards Committee.

CHILDREN'S BUREAU

The Children's Bureau is primarily a research bureau in the whole field of child welfare, and it is a center of information useful to all the children of America, to ascertain and to popularize just standards for their life and development, to serve all children, and to endeavor to work out the standards of care and protection which shall give to every child his fair chance in the world.

UNITED STATES CONCILIATION SERVICE

Section 8 of the organic act creating the Department of Labor provides in part "that the Secretary of Labor shall have power to appoint commissioners of conciliation in labor disputes whenever in his judgment the interests of industrial peace may require it to be done." Such commissioners act in an informal manner, endeavor in general to be helpful, and to bring together both parties in dispute for purpose of conciliatory agreement. So far as practicable they endeavor to bring about an accord before strike or lockout occurs. These commissioners may be assigned at request of either or both parties directly interested.

UNITED STATES EMPLOYMENT SERVICE

The United States Employment Service surveys the field of employment; cooperates with State and municipal employment offices in placement of workers; conducts a farm labor bureau for the recruiting and movement of seasonal labor; publishes a monthly report of employment conditions in the United States by districts, and cooperates in placement of junior workers, or young people who have not yet fixed upon a career.

BUREAU OF IMMIGRATION

The immigration laws set standards and outline procedure relating to admission of aliens into the United States. Likewise, they state for what causes aliens in the United States shall be deported therefrom, and provide machinery to effect expulsion. The administration of these laws is intrusted to the Bureau of Immigration.

BUREAU OF LABOR STATISTICS

The Commissioner of Labor Statistics represents the Department of Labor on the executive committee and the main committee of the

American Engineering Standards Committee. By arrangement with the latter organization the workers' representatives on safety-code committees are selected and appointed through the Department of Labor.

The Commissioner of Labor Statistics is secretary-treasurer of the International Association of Industrial Accident Boards and Commissions, and appoints representatives of that association on American Engineering Standards Committee safety-code committees.

The bureau is represented on the American Engineering Standards Committee safety-code correlating committee.

NATURALIZATION BUREAU

The Bureau of Naturalization administers the naturalization laws. These laws fix certain standards for length of residence, character, education, and attachment to the principles of the Constitution of the United States. After hearing the witnesses presented and examining petitioners, naturalization officers make suitable recommendations to the courts as to whether alien should or should not receive citizenship.

WOMEN'S BUREAU

It is the duty of the Women's Bureau, in the interest of health measures for women workers, to study the problems surrounding their employment and to draw up standards designed to make industry safe for women.

NAVY DEPARTMENT

The Navy Department is represented on the executive committee of the Federal Specifications Board by the Assistant Chief of the Bureau of Engineering and on 11 technical committees of the Federal Specifications Board in addition to those mentioned below, under the separate bureaus.

BUREAU OF CONSTRUCTION AND REPAIR

The Bureau of Construction and Repair represents the department on 32 technical committees of the Federal Specifications Board, and on 5 committees of the American Engineering Standards Committee.

The Bureau of Construction and Repair during the past year has cooperated closely with the following organizations, as well as with other Government departments and bureaus:

Federal Specifications Board.
American Engineering Standards Committee.
American Marine Standards Committee.
American Society for Testing Materials.
Fine Arts Commission.
Division of simplified practice, Bureau of Stanards.
National Lumber Manufacturers' Association.
National Screw Thread Commission.

The most important standardization activities of the past year are outlined as follows:

Rubber.—Intensive study is being made in connection with the use of reclaimed rubber in various rubber materials specified by the Navy. This study is being made in collaboration with the rubber committee of the Federal Specifications Board and The Rubber Association of America.

Hemp.—Through cooperation with the American Hemp Brokers Association, the Navy Department's method of purchasing hemp has been improved and standardized, and specifications for such purchases have been put upon a satisfactory basis. Purchase of all hemp is now being made under Philippine grading rules and inspection is being made under the jurisdiction of the American Hemp Brokers Association.

Kapok.—Through cooperation with the leading manufacturers and importers of kapok, the Navy Department specifications for this commodity have been prepared which will permit the purchase of a grade commercially obtainable and recognized as standard, and at the same time be satisfactory for Navy use.

Joiner Hardware.—The entire question of joiner hardware used on board ship is under investigation, and steps are being taken toward the elimination of unnecessary sizes and types and the adoption of standard commercial types where applicable.

Padlocks.—Investigation on the standardization of padlocks used in the Navy has resulted in steps to eliminate many sizes.

Rivet Standardization.—The bureau has been closely cooperating with the American Engineering Standards Committee in the standardization of rivets. Standard forms, dimensions, and specifications for structural, boiler, and ship rivets have been formulated for adoption by the A. E. S. C. as American standards.

Paints.—The bureau is conducting extensive research in connection with ship-bottom paints, aluminum paints, nitrocellulose lacquers and enamels, tank coatings, varnishes, and pigments. The standard Navy formula for aluminum varnishes has been revised and replaced by a more efficient product. In cooperation with the paint committee of the Federal Specifications Board, an investigation is under way to determine the satisfactory quality of spar varnish being purchased under the requirements of United States Government master specifications with a view to improving the quality of the product now being obtained. In collaboration with the Food, Drug, and Insecticide Administration, Department of Agriculture, the bureau is investigating the possible use of *o*-dichlor-benzine and *p*-cymene, both in liquid and resin forms. These materials can be made commercially available in large quantities and at a low price from waste material incident to paper manufacture.

Laundry Machinery.—Specifications for various types of laundry machinery covering standard commercial articles are being prepared.

Mechanically Chilled Refrigerators.—A study has been made on the subject of mechanically chilled refrigerators and various types commercially available have been under investigation.

Lumber.—The bureau has continued its standardization of lumber and utilizes standard commercial specifications and certified commercial inspection in the procurement of practically all of its lumber.

National Screw Threads.—The new national form of thread established by the National Screw Thread Commission is being put into effect on all threaded products used by this bureau and Navy Department specifications for threaded products have been prepared to conform to the national form of thread.

Flag Standardization.—The bureau has continued its cooperation with the flag standardization committee and the Commission of Fine Arts in standardizing proportions and colors of the national ensign, and has conducted numerous exposure tests on various types of colors and materials.

Miscellaneous.—Much headway has been made by the bureau during the past year in revising the standard stock catalogue and reducing the multiplicity of sizes, shapes, and grades of stock items carried at various yards.

In obtaining the technical data necessary for the purpose of standardizing and improving materials, such as those outlined above, many tests, both laboratory and service, are conducted at the various navy yards and stations and on board ship. Many important laboratory investigations are conducted for the bureau by the Bureau of Standards, among them being the investigations on manila rope and hemp, strength and design of riveted joints, elastic qualities of shipbuilding steels, behavior under load of blocking in dry docks, and spar varnishes.

BUREAU OF ENGINEERING

The bureau has membership on 16 technical committees of the Federal Specifications Board, and the following additional committees and societies:

American Engineering Standards Committee: Main, executive and 35 sectional committees.
American Society for Testing Material: 15 committees.
American Society of Mechanical Engineers: 4 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 Electro-Technical Commission and the joint committee on investigation of the effect of phosphorous and sulphur in steel.

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 during the past year effected the standardization for Navy use of:

Heat insulating materials.

Corrosion resisting steels.

Electrical resisting steels.

Tubing sizes for all types of tubing, thereby reducing the number of different outside diameters of tubing and enabling the standardization of fittings.

Seventy-five watt vacuum tubes.

Recording meters for radio apparatus.

The bureau is conducting—

Tests at various navy yards and laboratories for the purpose of obtaining data for further standardization and improvement of materials, such as tool steels, gaskets, packing, cutting oils, lubricating oils, boiler refractories, condenser tubes, spark plugs, and cylinder materials.

Experimental work in conjunction with the Bureau of Standards on the subject of corrosion fatigue.

Constant revision of the standard stock catalogue with consequent reduction in the number of sizes, shapes, and grades of the various items.

Research work in the radio field, including such items as high-frequency receivers and transmitters; the theory of wave propagation; materials having piezo-electric effects; instruments for measuring high frequencies; traps; device for measuring and recording the direction of static; ignition interference; equipment for the transmission of photographs, and the writing of maps and sketches and the measurement of airplane and submarine antenna constants.

BUREAU OF MEDICINE AND SURGERY

Officers of the bureau serve as members on technical committees of the Federal Specifications Board, and have acted in an advisory capacity to other committees charged with matters of interest to the medical department. The Naval Medical Supply Depot, Brooklyn, N. Y., has by means of its chemical, physical, bacteriological, and electrical laboratories tested medical supplies and equipment purchased for the Navy and Veterans' Bureau for conformity to specifications as given in data previously submitted.

BUREAU OF ORDNANCE

The Bureau of Ordnance, Navy Department, has long recognized the importance of standardizing ordnance drawings, specifications, and ordnance material in general. With this in view, standard ordnance drafting-room regulations in pamphlet form have been

prepared for the purpose of standardizing and systematizing the preparation of ordnance drawings and the manufacture and procurement of standard ordnance parts. These regulations are based on the practice of the bureau extending over a number of years and are strictly enforced in the preparation of ordnance drawings at all navy yards and stations under the jurisdiction of the Bureau of Ordnance.

In the case of small detail parts and assemblies that are in common use and continuously called for on navy yard and shop requisitions, these are standardized wherever practicable and purchased in large quantities at considerable saving in cost and placed in stock in quantities which are regulated by demands of the service. Stock material is divided into two classes, commercial material and special ordnance material.

Commercial material consists of such material as can be obtained in the open market on Government requisition at a saving in cost over material manufactured in Government plants, and consists primarily of standard machines, tools, fittings, and fastenings, such as bolts, nuts, screws, keys, ball bearings, and commercial valves and fittings.

Special ordnance material, not commercial, represents standard material that has been designed especially for ordnance use. Such material may be acquired either by manufacture on shop job orders or by purchase on Government requisition, and consists primarily of ordnance accessories, ordnance tools, ordnance fastenings, and ordnance fittings.

Standard stock material drawings, showing material of both classes carried in stock, are prepared for the information and guidance of various Bureau of Ordnance drafting rooms. Such drawings are known as stock material drawings. These drawings show single or assembled parts with pertinent dimensions and information necessary to manufacture or purchase such material. Designing draftsmen are required to thoroughly familiarize themselves with all stock material when preparing details of any ordnance design. Fastenings of the nearest stock size larger than that required by computations are selected for use. When, for any reason, it appears desirable to depart from stock sizes indicated on stock material drawings the matter is brought to the attention of the supervisory draftsman, who, after investigation of the case, submits recommendation for inclusion of the part under consideration in the stock list. This procedure tends to encourage the use of parts which are carried in stock and serves to keep the number of such parts to a minimum.

BUREAU OF SUPPLIES AND ACCOUNTS

Members of the bureau represent the department on 10 technical committees of the Federal Specifications Board.

The Bureau of Supplies and Accounts has issued during the calendar year 1927, 169 new and revised specifications and 4 revisions of the

Index to Specifications. Sixty-six of the new and revised specifications are in conformity as to technical requirements with United States Government master specifications.

A representative of the Bureau of Supplies and Accounts is preparing in cooperation with representatives of other Government departments a Federal stock catalogue which will supply a common nomenclature for all stock items in common use.

A representative of the Bureau of Supplies and Accounts is a member of a Joint Navy and Coast Guard Board to determine upon standardization of methods in order to facilitate the amalgamation of the Coast Guard with the Navy for a national emergency.

Considerable progress has been made during the year through contact with business firms in standardizing Navy purchasing methods.

BUREAU OF YARDS AND DOCKS

Members of the bureau represent the department on 12 technical committees of the Federal Specifications Board.

The bureau also has membership on the following standardizing committees:

Federal Specifications Board: Metals.
Navy Department Specifications Board: Division of simplified practice, four committees.
American Engineering Standards Committee, eight committees.
American Society for Testing Materials, three committees.

The A. S. T. M. test rack for long-time exposure of galvanized materials at Key West Naval Station is under the cognizance of this bureau.

The bureau is conducting at Portsmouth, N. H., and Hampton Roads, Va., experiments to establish standards for concrete in sea water, the former for Portland cement and the latter high alumina cement. It is also conducting experiments on copper bearing steel sheet piles at Key West.

UNITED STATES MARINE CORPS

The assistant, Quartermaster Department of the Marine Corps, represents the Marine Corps on the Federal Specifications Board, and the Marine Corps is represented on 10 technical committees of the Federal Specifications Board. The master specifications promulgated by that body are used in making purchases, when applicable. During the year 1927, Marine Corps specifications have been revised where necessary to make them conform to United States Government master specifications promulgated by the Federal Specifications Board.

An effort is being made to standardize passenger carrying motor vehicles to three types; likewise to standardize trucks to three types—heavy, medium 1 to 2 ton, and light delivery, three-fourths to 1 ton.

POST OFFICE DEPARTMENT

The Post Office Department is represented on the executive committee of the Federal Specifications Board by the superintendent of the division of equipment and supplies.

Members of various divisions represent the department on 21 technical committees of the Federal Specifications Board, and 1 sectional committee of the American Engineering Standards Committee.

SECOND ASSISTANT POSTMASTER GENERAL

Continued progress was made during the year just passed in the standardization of railway post-office cars.

Three steel full mail cars, 33 steel apartment mail cars, and 25 wood steel-reinforced apartment mail cars, a total of 61 cars, were standardized, and, in addition, 1,119 full and apartment mail cars were made to meet more nearly standard construction requirements and 52 mail cars were equipped with electric lights in place of gas and oil.

The Postal Laws and Regulations were amended so as to require that new apartment mail cars for service in fast or heavy trains shall be of all-steel construction; to require the operation of an all-steel apartment mail car in a train where a majority of the cars in the train are of steel construction; to forbid the operation of steel underframe mail cars between adjoining steel cars or between steel car adjoining and the engine, and to forbid the operation of wooden mail cars where the majority of the cars in the train are of steel or steel underframe construction; thus insuring better protection to the clerks and the mails. Electric fans are required in all new full and apartment mail cars and in such cars now in operation if deemed essential by the Railway Mail Service.

FOURTH ASSISTANT POSTMASTER GENERAL

This bureau has standardized on four-wheel balance type platform trucks for use in the Postal Service. The design for these trucks was made by an employee of the department.

Heavy-duty baggage trucks have likewise been standardized, the important features of the specifications for which were taken from trucks of this type used by the Washington Terminal Co.

Carriers' all-leather satchels equipped with split leather partition have been adopted as standard equipment, the leather portion of the specification being that promulgated by the Federal Specifications Board.

Heretofore chrome green paint has been used on letter-box equipment. Olive green letter-box enamel has been made standard in lieu thereof.

A list has been prepared and adopted, standardizing the name and abbreviation of all railway trains carrying the mails.

DEPARTMENT OF STATE

The Department of State is represented on the executive committee of the Federal Specifications Board by the chief of the Foreign Service Administration.

FOREIGN SERVICE BUILDINGS

The standardization work in which the office is engaged consists of the preparation of specifications for furniture and furnishings, including china and glassware, for use in the Government-owned buildings acquired under the act of May 7, 1926, entitled, "An act for the acquisition of buildings and grounds in foreign countries for the use of the Government of the United States of America." The policy has been adopted of standard furnishing, so far as practicable, and with due regard to the rank of the establishment, of buildings similarly situated geographically and climatically, and of supplying standard china and glassware to all diplomatic missions.

TREASURY DEPARTMENT

The Treasury Department is represented on the executive committee of the Federal Specifications Board by the superintendent of the computing division of the Supervising Architect's Office.

In addition to the department representation on the technical committees of the Federal Specifications Board mentioned below, the department is also represented on 14 Federal Specifications Board technical committees.

In addition to the department memberships on the American Engineering Standards Committee sectional committees mentioned below, the Coast Guard holds membership on 2 sectional committees.

GENERAL SUPPLY COMMITTEE

The General Supply Committee is represented on the executive committee of the Federal Specifications Board by the superintendent of supplies, and is represented on 38 technical committees of the Federal Specifications Board.

The only change, of general consequence, in the activities of the General Supply Committee's activities during the calendar year is the participation of the District government in the committee's contracts.

The act making appropriations for the municipal government of the District of Columbia 1927–28 requires that the District government purchase its supplies whenever possible under General Supply Committee contracts, and the committee is now making contracts under the definite quantity to supply the needs of the various district institutions.

PUBLIC HEALTH SERVICE

The Public Health Service represents the department on 16 technical committees of the Federal Specifications Board, and 8 sectional committees of the American Engineering Standards Committee.

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OFFICE OF INDUSTRIAL HYGIENE AND SANITATION

Standardization of Technique of Prone-Pressure Method of Resuscitation.—Completed and adopted at conference in April, 1927, by the American Gas Association, National Electric Light Association, United States Bureau of Mines, Bethlehem Steel Corporation, National Bureau of Standards, American Red Cross, National Safety Council, American Telephone & Telegraph Co., United States Army, United States Navy, and United States Public Health Service.

Standardization of Industrial Sanitary Code.—Second draft of this code has been completed for submission to the American Engineering Standards Committee.

HYGIENIC LABORATORY

Official Standards and Standard Tests.—Continuation of standardization of scarlet fever streptococcus toxin and scarlet fever streptococcus antitoxin.

SUPERVISING ARCHITECT

Members of the Supervising Architect's Office represent the department on 33 technical committees of the Federal Specifications Board, and 7 sectional committees of the American Engineering Standards Committee.

The standardization work during the year has consisted largely in the expansion of the application of general standardization work previously started.

In structural work the sizes of reinforcing rods and steel spiral rods and also the grades of steel of which these are made now conform to the simplified practice recommendations promulgated by the Department of Commerce.

The office is using the standard contract and bond forms which were approved by the Interdepartmental Board of Contracts and Adjustments for use on and after January 1, 1927.

In connection with the purchase of supplies and the maintenance and repair of buildings under control of the office, there has been no further expansion of standardization, in view of the fact that advantage has heretofore been taken of every opportunity to standardize both in specifications and in purchases.

WAR DEPARTMENT

The War Department representative on the Federal Specifications Board is detailed from the office of the Assistant Secretary of War.

Procedure for Adoption of United States Government Master Specifications by the War Department.—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.

The following supply branches of the Army have members representing the War Department on the number of technical committees of the Federal Specifications Board as indicated:

Quartermaster Corps, 51.
Ordnance Department, 6.
Air Corps, 3.
Corps of Engineers, 6.
Medical Corps, 8.
Signal Corps, 5.
Chemical Warfare Service, 2.

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 specification 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.)

Specifications covering items which are of a strictly military and confidential nature are not considered by the Federal Specifications Board.

American Engineering Standards Committee.—The War Department is a member body of, and has three representatives and three alternates on, the American Engineering Standards Committee. This representation is divided as follows:

From the Office of the Assistant Secretary of War, 1.
From the supply branches, 5.

The War Department is represented on 24 sectional committees of the American Engineering Standards Committee, this representation being divided among the various supply branches as follows:

Quartermaster Corps, 5.
Ordnance Department, 8.
Air Corps, 1.
Corps of Engineers, 5.
Signal Corps, 5.

Division of Simplified Practice.—The War Department participates constructively in the work of the division of simplified practice. Active liaison in maintained with the division through the office of the Assistant Secretary of War. As each project is outlined and submitted the War Department assigns it to the supply branch most closely interested for study and participation, and is thereby represented at all conferences involving its activities.

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 (Watertown Arsenal) on the joint committee on investigation of the effect of phosphorus and sulphur in steel.

Present Status of War Department Standardization and Results Accomplished During 1927.—The Quartermaster Corps issued 182 new or revised specifications during 1927.

The Ordnance Department during the year ended June 30, 1927, issued 49 new or revised specifications. The technical requirements of these specifications followed those of the United States Government specifications wherever the latter were available. In cases where there were no United States Government specifications available, standard commercial practice was embodied in the Ordnance Department drafts to the extent that such procedure was consistent with War Department needs.

The Ordnance Department has continued its work on various technical committees of the Federal Specifications Board, and its representatives on the American Engineering Standards Committee and the National Screw Thread Commission have taken an active part in the deliberations of these bodies.

Many of the recommendations of the division of simplified practice, Department of Commerce, have been adopted by the Ordnance Department and much work is being done within the department with a view to eliminating waste by limiting the sizes, compositions, etc., of articles and materials used in munitions manufacture.

The activities of the Air Corps have included the adoption of common standards by the Army and Navy air services. Agreement was reached during the year on 6 important items and tentative agreement on 40 on which final action is expected during the present year.

The Corps of Engineers' standardization activities cover certain commodities entering into the construction of highway, pontoon, and foot bridges, locks, dams, revetments, fortification work, including searchlights; also lumbering, mapping, railroads, and road building equipment, and other items used for military purposes.

The Board on Engineer Equipment designs and develops equipment for military purposes, and prepares specifications for same. In addition, other specifications are prepared in the supply section, Office, Chief of Engineers, and the coordination, numbering, and standardization of all specifications are accomplished by the supply branch technical committee known as the Technical Committee of the Board on Military Engineering, which consists of such representatives as may be detailed by the chief of branch and of a represen-

tative from each of the other supply and combatant branches. These specifications are finally adopted as standard for the United States Army. During the year 1927, 20 specifications were approved and adopted as standard, and 22 additional specifications have been prepared, 10 of which have been coordinated, numbered, and standardized, ready for final adoption before the end of the calendar year.

The Medical Department has issued 252 specifications during the year and have 362 in course of preparation.

A board of officers on duty in the medical section, New York General Depot, has been appointed to review all existing specifications and to scrutinize all drafts of proposed specifications with a view to determining their suitability, and the work of this board will materially facilitate the development of future specifications as well as perfecting those now in use.

The standardization of tests for surgical instruments and for heat-resisting glassware is regarded as being of vital importance in the procurement of these classes of medical supplies and is therefore receiving considerable thought at the present time.

The Medical Department has adopted the standards of the American Chemical Society, as shown in the society's catalogue, and these will be followed in the future, in the procurement of laboratory supplies.

The Signal Corps is endeavoring to conform to general commercial standards as far as possible in its present design practice as relating to communication equipment. Ninety-three specifications have been issued during the year.

The Chemical Warfare Service standardized 10 of its technical specifications to harmonize with specifications of the Federal Specifications Board.

INDEPENDENT ESTABLISHMENTS

BUREAU OF THE BUDGET

The Bureau of the Budget was created by the act approved June 10, 1921. It is under the immediate direction of the President. Under rules and regulations prescribed by the President, the bureau prepares for him the annual Budget and such supplemental or deficiency estimates as the President may recommend from time to time to Congress. To this end the bureau has the authority, under the act, "to assemble, correlate, revise, reduce, or increase the estimates of the several departments and establishments." The act requires the head of each department and establishment to appoint a budget officer whose duty it is to prepare, under his direction, the departmental estimates of appropriations and such supplemental or deficiency estimates as may be required. These officials are liaison

officers between the department and the Bureau of the Budget. The bureau deals directly with them in the routine work of preparing the Budget. The estimates are prepared and submitted to the bureau in such form, manner, and detail as the President prescribes. On or before September 15 of each year the head of each department and establishment revises his estimates and submits them to the bureau.

OFFICE OF THE CHIEF COORDINATOR

The Office of Chief Coordinator was created by Circular No. 15, Bureau of the Budget, July 27, 1921, and the duties of the office were later enlarged by Budget Circulars Nos. 22, 23, 25, 26, 35, 41, 42, 47, 52, 54, and Executive Order No. 3578, dated the White House, November 8, 1921.

Subject to general supervision by the Director of the Bureau of the Budget, the Chief Coordinator handles all questions of coordination arising through the application of the policies of the President and of the Congress to the routine business activities of the executive branch of the Government.

The Federal coordinating boards and agencies form an integral part of the Federal Budget system, and they are under the supervision of the Chief Coordinator.

COORDINATOR FOR PURCHASE

At the invitation of this office several departments or activities thereof will obtain their requirements of lubricants next year under participating contracts entered into by the Navy Department.

Arrangements were perfected whereby hack-saw blades required by several departments after July 1, 1927, will be obtained through single combined purchases negotiated by the Navy Department and by subsequent transfers from stock to be maintained by that department. Aside from the probable price advantages arising from coordinated purchases of hack-saw blades, this procedure should eliminate much duplication of effort in determining work values of the numerous trade makes offered in competition and in conducting subsequent tests and inspections of actual deliveries.

Attention was given to the various methods of purchase of coal, and the lack of uniformity, especially as between departments or establishments operating under very similar conditions. An exhaustive analysis and digest of the various purchase forms led to a series of weekly meetings attended by representatives of the larger coal-consuming activities and the Federal Specifications Board, during which there was developed a tentative standard set of basic specifications, instructions, and contract conditions, all contemplated for use in conjunction with the proposed standard supply contract and purchase forms under consideration by the Interdepartmental Board of Contracts and Adjustments.

Using as a basis the inventory of motor vehicles compiled during the previous year, efforts have been largely successful in securing for those departments having but few vehicles the same concessions in the procurement of repair parts as are generally given to owners of large fleets. This was in recognition of the fact that title to all vehicles held by the several departments is vested in a single owner, the United States, and to the further fact that the total number so owned was sufficient to entitle the possessor to be classed as a so-called "fleet owner."

A comprehensive survey was made of the conditions under which pneumatic tires and tubes are used and also of the relative performance thereunder. This will serve as a guide in determining the advisability of revising specifications and will aid in choosing the types of tires and tubes most adaptable for use under certain general classes of road or surface conditions.

FEDERAL PURCHASING BOARD

During the calendar year, a standard procedure for the forecasting of future requirements in the purchase of consumable supplies and expendable equipment was approved by the board and issued in the form of a bulletin from the office of the Chief Coordinator to all Government departments and establishments.

The question of standardizing the requirements of the various Government departments and establishments in regard to the amounts of bid and performance bonds filed by contractors with contracts for supplies and services was studied by the board. A tabulation of the present requirements of the several activities was made which disclosed wide variations in the amounts of the bonds. Uniformity in this respect would greatly facilitate business between contractors and the Government, but must await legislation before it can be attained.

The method of collecting and disseminating information regarding dealers debarred from bidding on Government business because of unsatisfactory performance under contract has been standardized and one list is now prepared and sent at regular intervals to all Government activities requiring this information.

The board now has under consideration the practicability of reducing the large variety of purchase order forms used by the several branches of the Government to one form and making that the standard for the entire Government.

FEDERAL SPECIFICATIONS BOARD

During the calendar year 1927, the Federal Specifications Board has formed one new technical committee—motor-propelled vehicles.

During the year, two departments have made changes in their representatives on the board, as follows:

War Department:
Maj. E. C. Kelton, vice Lieut. Col. John E. Munroe, July 21, 1927.
Maj. Henry L. Rice, vice Maj. E. C. Kelton, October 18, 1927.
Marine Corps: Maj. Jeter R. Horton, vice Maj. John Potts, May 13, 1927.

Ninety-six new United States Government master specifications, and 45 revisions of existing specifications, have been promulgated during the year, as follows:

452. Materials for top-soil or sand-clay road surfaces.
453. Gravel for gravel roads.
454. Coarse aggregate for Portland cement concrete pavement or base (stone, slag, and gravel).
455. Broken stone, broken slag, or gravel for bituminous surface treatment.
456. Broken stone and broken slag for waterbound base or wearing course.
457. Broken stone and broken slag for bituminous macadam base on surface course.
458. Broken stone and broken slag for bituminous concrete base or surface course.
459. Broken stone and broken slag for binder course, sheet asphalt pavement.
460. Sands for use in sheet asphalt or bituminous concrete pavements.
461. Sand for cement grout filler, brick and stone block pavements.
462. Sand for cement mortar bed for brick, stone block, or wood block pavements.
463. Mineral filler for sheet asphalt or asphaltic concrete pavements (Portland cement, limestone dust, and dolomite dust).
464. Fine aggregate for Portland cement concrete pavement or base (sand, etc.).
465. Materials for cushion course, brick, stone block, or wood block pavement (sand, slag, limestone screenings, etc.).
466. Belting, conveyor (stitched duck).
467. Copper rods, bars, shapes, plates, sheets, and strips.
468. Silver, nickel, rods, bars, shapes, plates, sheets, and strips (German silver).
469. Steel, structural, for ships other than naval vessels.
470. Calcium carbide.
471. Cupboard and locker equipment, steel.
472. Thermometers, industrial.
473. Scales, weighing, general specification for.
474. Ladles, plumbers'.
475a. Oil, linseed, boiled.
476. Chrome yellow (lemon, medium, and orange; dry, paste in oil, and paste in Japan).
477. Desks, steel.
478. Tables and stands, wood.
479. Frames, hack-saw.
480. Saws.
481. Jacks.
482. Leather, bag.
483. Leather, rigging.
484a. Paper, manifold, 50 per cent rag, white and colored, unglazed.
485. Gaskets, metallic encased.
486. Packing, hard fiber sheet.
487. Packings, asbestos wick and rope.
488. Knives, drawing.

489. Pipe fittings, cast-iron (threaded).
490. Tubes, seamless steel, for aircraft purposes.
491. Fans, electric, desk and bracket type.
492. Boots, rubber, hip.
493. Boots, rubber, short, light.
494. Boots, rubber, short, heavy.
495. Pipe, concrete, plain.
496. Leather, hydraulic packing (vegetable tanned).
497. Bunting, wool.
498. Oilcloth, table, white.
499. Burlap, jute.
500. Tablecloths, cotton.
501. Carpets, velvet, plain.
502. Carpets and rugs, Axminster.
503. Carpets and rugs, Wilton.
504. Brick, clay, common.
505. Brick, sand-lime, common.
506. Tile, hollow, clay, floor.
507. Tile, hollow, clay, load-bearing wall.
508. Tile, hollow, clay, fireproofing, partition and furring.
509. Drills, hand, with hollow handle.
510. Block for granite, recut granite, and durax granite pavements.
511. Brooms, metal case.
512. Brushes, flowing, badger hair.
513. Brushes, flowing, camel hair.
514. Brushes, flowing, fitch or skunk hair.
515. Brushes, paint, flat metal bound (high-grade).
516. Brushes, paint, flat metal bound (medium bound).
517. Brushes, radiator bronzing.
518. Brushes, roof, knotted style, three knots.
519. Brushes, stencil (flag ends cut).
520. Brushes, stencil (flag ends preserved).
521. Brushes, varnish flat (high-grade).
522. Brushes, varnish, flat (medium grade).
523. Brushes, wall stippling.
524. Brushes, whitewash.
525. Dusters, painters', flat.
526. Dusters, painters', round.
527. Hose, fire, unlined linen.
528. Cord, sash, cotton braided.
529. Twine, cotton seine.
530. Twine, cotton.
531. Zinc plates, sheets, and strips.
532. Wire, spring, phosphor-bronze.
533a. Lumber, softwood, yard and factory.
534. Nails, spikes, tacks, and staples.
535. Pipe fittings, malleable iron (threaded) (150-pound).
536. Metal, antifriction, ingots and castings.
537. Pipe, water, centrifugally cast-iron.
538. Receptacles, waste-paper, fiber, office and lobby.
539. Erasers, steel.
540. Netting, mosquito (unbleached bobbinet).
541. Goggles for protection against flying particles and chips.
542. Goggles, rubber frame.

543. Goggles, welders'.
544. Helmets, welders'.
545. Masks, babbitting.
546. Helmets, sandblasting.
547. Shields, welders' hand.

Revisions of specifications promulgated by the Federal Specifications Board since January 1, 1927:

1a. Cement, Portland.
2d. Lubricants and liquid fuels and methods for sampling and testing.
3c. Tires, pneumatic and solid rubber, and inner tubes.
4a. Oil, linseed, raw.
10b. Paint, white, and tinted paints made on a white base, semipaste and ready-mixed.
13b. Paints, iron oxide and iron hydroxide.
14b. Paint, black semipaste: and ready-mixed.
21b. Paint, lithopone, interior, white and light tints, flat or eggshell finish (semipaste and ready-mixed).
23b. Lamps, electric, incandescent, large, tungsten filament.
25c. Feeds and forage.
52a. Screws, wood.
58a. Cells and batteries, dry.
91a. Zinc, slab (spelter).
94b. Packing, asbestos metallic cloth sheet.
96b. Packing, asbestos sheet, compressed.
97b. Gaskets, asbestos metallic cloth.
101b. Packing, flax.
137a. Paint, olive drab (semipaste and ready-mixed).
161a. Coffee, tea, and cacao products.
162a. Pipe, steel, welded (black and galvanized).
167a. Ribbons, typewriter.
168a. Ribbons, hectograph.
169a. Ribbons, computing and recording machine.
172a. Bronze castings.
186a. Beds, hospital.
187a. Beds, surgical.
195a. Brushes, dauber, long paddle.
254b. Denim, brown (shrunk).
259a. Rags, cotton, colored, for wiping machinery (sterilized).
261a. Rags, cotton, white, for wiping machinery (sterilized).
265a. Ink, drawing, black waterproof.
290a. Bronze ingots (for remelting).
315a. Sugar and sugar products.
331a. Paper, manifold, 50 per cent rag, white and colored, glazed.
333a. Brooms, corn.
358a. Desks, wood.
359a. Furniture, office sectional, cabinets and trays, wood.
365a. Sea food (fresh, salt, smoked and canned).
367a. Shades, window, shade cloth, rollers, slats, cords and accessories.
381a. Dairy products.
399a. Brushes, flat fitch.
401a. Brushes, glue, round.
404a. Brushes, marking.
406a. Brushes, sash tool, oval.
413a. Padlocks.

FEDERAL TRAFFIC BOARD

The Federal Traffic Board has full authority, subject to review by the Chief Coordinator, to pass on all questions pertaining to—

(*a*) Establishment of uniform classifications for all commodities shipped by the Government.

(*b*) Drafting of plans for improving and standardizing methods of making shipments and settlement of accounts.

(*c*) Adjustment of all questions which require application of remedial measures such as freight rates, switching and terminal charges, etc.

The board functions by means of committees appointed by the chairman, who is also the coordinator for traffic, and, as such, the operating head of the board. All movements of Government freight, consisting of two carloads or more, from any department, are routed by the coordinator for traffic, who undertakes to provide the cheapest possible route for the shipment.

The coordinator for traffic has routed, for eight months of the current year, a total of 21,394 carloads of Government freight, or an average of 2,678 carloads per month.

The routing of traffic to secure the lowest rates to the Government, adjusting freight rates, obtaining new and lower classifications for commodities frequently shipped by the various governmental departments, are all included in the duties and accomplishments of the Federal Traffic Board.

INTERDEPARTMENTAL BOARD OF CONTRACTS AND ADJUSTMENTS

The board has completed during this year 13 standard Government contract forms which have been approved by the President. Six of these forms were officially promulgated by Bureau of the Budget Circular No. 197, on November 19, 1926, and are as follows:

Standard Government form of invitation for bids, construction contract (Standard Form No. 20).

Standard Government form of bid, construction contract (Standard Form No. 21).

Standard Government instructions to bidders, construction and supply (Standard Form No. 22).

Standard Government form of contract, construction (Standard Form No. 23).

Standard Government form of bid bond, construction or supply (Standard Form No. 24).

Standard Government form of performance bond, construction or supply (Standard Form No. 25).

The departments and establishments of the Government were directed by this circular to use these forms on and after January 1, 1927, in connection with every formal contract for the construction or repair of public buildings or works, and if it should be considered necessary to deviate from these forms they were required to submit the proposed deviation to this board for consideration and recom-

mendation to the Director of the Bureau of the Budget for his approval.

Standard Forms Nos. 22, 24, and 25 were so drafted that they could also be used in connection with the proposed standard Government forms of contract for the procurement of supplies.

Standardization of the language of the new contract, making clear the exact obligations of the contractor, will avoid disputes and litigation. No longer will it be necessary for a contractor to protect himself by making a gratuitous addition to the cost of the contract to meet unreasonable requirements of the Federal Government or to cover obscure provisions in the contract which may be subject to many interpretations. Federal construction contracts will now contain the same general conditions and stipulations, irrespective of the branch of the Government making the contract or the location of the project.

The contract board first collected from the departments and establishments the contract forms in use and discovered there were several hundred of them varying in size, terms, phraseology, and embodying many unreasonable requirements. The board then made a study of the laws governing Federal contracts and found there were 224 Federal statutes relating to these contracts. One of its first undertakings was the compilation, classification, and publication of these laws, followed later with a digest of the decisions of the courts and opinions of the Attorney General relating to public contracts. This rather formidable task required a great expenditure of time and talent, and in the meantime the board sought the advice and cooperation of business and professional men interested in and familiar with construction. Tentative contract forms were sent to leading contractors, architects, and engineers throughout the country. Criticism and constructive suggestions were invited. The Associated General Contractors of America, the American Institute of Architects, and leading bonding companies of the country all appreciated immediately the tremendous importance of this work and cooperated heartily and helpfully in the revision of these forms.

The remaining seven standard contract forms for the procurement of supplies have only recently been completed and approved by the President. They are as follows:

Standard Government form of bid, supply contract (Standard Form No. 30).

Standard Government form of bid, supply contract (Standard Form No. 31).

Standard Government form of contract, supplies (Standard Form No. 32).

Standard Government short form contract, supplies (Standard Form No. 33).

Standard Government form of annual bid bond, supplies (Standard Form No. 34).

Standard Government form of annual performance bond, supplies (Standard Form No. 35).

Standard Government form of continuation schedule for Standard Form 31 or 33, supplies (Standard Form No. 36).

Bureau of the Budget Circular No. 207, dated June 29, 1927, provides that these supply contract forms shall be used by the departments and establishments on and after September 1, 1927, in connection with every formal contract for the procurement of supplies, except coal, and that they may be used prior to that date.

There shall be no deviation from these forms except in the same manner as above indicated for the construction contract forms.

Contemporaneously with the work of standardizing Government contract forms, the board has made a further revision of the proposed new public contract law. The draft as now finally revised embraces in 18 sections the essential provisions of law to safeguard the Government's interest, keeping in mind the proper interest of the contractor as well, and to make Government contract procedure uniform as far as possible. As stated in the last report of this board, this proposed revision of contract laws contemplates the repeal of many of the 224 existing statutes, prescribing different formalities and different methods of procedure.

The importance of securing standardization of contract forms and of obtaining revision of existing provisions of law relating to Federal contracts is not confined alone to the administrative procedure of the Federal service, but obtains with regard to the accounting side of Federal operations. This has been fully appreciated by the Comptroller General of the United States, who has rendered valuable assistance to the board in the matter of revising the contract forms and the existing contract laws.

INTERDEPARTMENTAL BOARD ON SIMPLIFIED OFFICE PROCEDURE

During the current fiscal year the Interdepartmental Board on Simplified Office Procedure has been divided into subcommittees on forms, office procedure, office equipment, office supplies, interdepartmental regulations, and proposed legislative enactments, in order to facilitate progress within its field of activities.

The board is now engaged in the study of a proposed interdepartmental regulation on leave of absence for Federal employees. The administration of the laws on this question is not uniform throughout the services. The board contemplates the inclusion of a cumulative provision in the leave regulation which will allow all Federal employees to accumulate sick leave, and permit those Federal employees on duty outside the continental limits of the United States to accumulate annual leave.

Another project now being considered by the board is the study of a correspondence manual and the classification of correspondence in order that useless executive papers and records of the United States Government may be periodically destroyed as provided by law.

The board has before it for consideration a standard method of listing Government activities in commercial telephone directories.

It is at present contemplated that the listing will be alphabetical under the caption "United States Government," in the subscribers' section, with a few cross references to direct attention to the standard method of listing instead of the present manner of listing.

The board's study of envelopes for use in the departments of the Government has continued from the previous year with special reference to a more general use of window envelopes limited to the standard sizes accepted generally in the commercial world. The standard list of envelope item numbers has been decreased from 116 items available during the fiscal year 1927 to 80 items now available, 12 of which are window envelopes. This takes care of the estimated requirements of the Government—

For plain envelopes	17, 048, 000
For printed envelopes	224, 042, 500
Making a total of	241, 090, 500

at an estimated cost of $396,429.77, averaging $1.64 per thousand.

These figures indicate an increase in the number of envelopes used in the Government services at a saving of 15 per cent in their cost, despite a rising paper market at the time bids were opened for the fiscal year 1928, due materially to the fact that the departments are adhering to the standard list of envelopes.

FEDERAL LIQUIDATION BOARD

During the past fiscal year the attention of the board has been occupied principally with the question of the establishment of a reserve of Federal property at large. It is probable that some means may be found to conserve for the use of the Federal Government that portion of the current surplus which consists of property in general demand and which is not subject to deterioration rather than to permit it to be sold with the recovery of only a small percentage of its actual value. The board is considering suggestions as to the manner in which this may be accomplished.

FEDERAL BOARD FOR VOCATIONAL EDUCATION

STANDARDIZATION OF VOCATIONAL EDUCATION METHODS

Traditionally, education has concerned itself with what was considered to be the value of its services rather than with the efficiency with which those services were performed.

Within the last few years this attitude has been changing, and what may be called the engineering or efficiency approach to education has been receiving increasing attention.

Vocational education, as encouraged by Federal and State subsidies under the terms of the national vocational education act and the State acts complementary thereto, has been in process of development for 10 years. A corresponding program dealing with civilian

vocational rehabilitation has been in operation about six years. Both of these activities, while essentially educational in character, present both in their objectives and in their operation conditions very different from those existing in general education.

During the last year, both on the part of the Federal Board for Vocational Education and on the part of the cooperating State organizations, increased attention has been given to the question of the establishment of standards and to methods for applying those standards in a reliable way.

At the present time the development and use of standards in vocational education and in civilian vocational rehabilitation are in an embryonic condition. It can not be said that such standards as have been set up are or have been universally accepted, or that such standards as have been established have been shown to be the most desirable standards. Such as they are, however, they represent the present stage of development in the attempt to approach problems of vocational education and civilian vocational rehabilitation from the standpoint of efficiency engineering.

It is now very definitely recognized, however, and it has been shown that it is possible to establish standards by which the efficiency of such factors as administrative organization, courses of study, qualifications of teachers, nature of subject matter, and the various types of vocational schools can be measured with some degree of accuracy.

Many of these standards apply to what may be called operating conditions, such as courses of study, administrative organizations, and qualifications of teachers. Up to the present time, the most advanced work has unquestionably been done in this operating field. A very vital matter and one which, owing to its inherent difficulties has not been developed to the same extent, is the question of the efficiency of various programs in terms of the return to the community for the money expended by the community and by its employees. It is evident that a school, for example, might be extremely efficient in training individuals for the successful pursuit of a certain occupation, yet from the standpoint of the social return it might be extremely inefficient, because very few of the individuals so trained ever pursue the occupation. On the other hand, the theoretical return to the community of a certain program might be high, but owing to inefficient operation, what may be called the practical return might be low. All of these considerations have entered into the development of such work as has been done up to the present time.

During the past year the Federal Board for Vocational Education, as a part of the studies which it is authorized to make under the terms of the national vocational education act, has given attention to the matter of the development of reliable standards and tests. These

standards and tests have not as a rule been incorporated into the administrative standards of the board, but have been discussed with State officers and have been given a certain amount of consideration at the various regional conferences, through which there has been brought to the attention of the State offices various standards which have been proposed, not only by representatives of the Federal Board for Vocational Education but by other workers in the field of education with which the Federal board is primarily concerned. A number of such standards have been suggested. As an example, the characteristics of an efficient course of study dealing with a wage-earning occupation may be catalogued as follows:[5]

1. Instruction in order to be effective with vocational students must be given to groups selected on the basis of actual employment or upon ability to profit by the training and probability of subsequent utilization as a means of livelihood.
2. The subject matter to be taught must be such as directly functions in the work for which the learner is being trained.
3. Instructors must have been occupationally trained in the trade or occupation they are to teach and are equipped to professionally train others in that occupation.
4. Individual instruction should be given whenever necessary to the most efficient progress of any member of the group.
5. Each individual member of the group should be permitted to progress as rapidly as his or her ability will permit and promotions should be made at any time on the basis of ability to do the work required.
6. Effective training for work should be given on real jobs, not on imitation jobs.
7. All subject matter and training should be arranged in the most effective instructional order of difficulty from the standpoint of acquisition by the learner.
8. The student while being trained should be surrounded by the occupational atmosphere and environment of the occupation in which he is being instructed and trained.
9. The instruction and training should be based upon prevailing occupational standards.
10. Repetitive training in the various operations should be given sufficiently to enable the student to begin work as an economic asset rather than as an economic liability to his employer, or to society.

In a similar way the following have been suggested as to the characteristics of an efficient administrative organization:

1. All official channels are clearly defined.
2. There is no overlapping of assigned responsibilities.
3. There are no unassigned responsibilities.
4. Responsibilities are assigned to the individuals best qualified to discharge them, by virtue of their experience and interest.
5. Red tape is reduced to a minimum.
6. Maximum simplicity of administrative machinery compatible with the administrative job.

In the same way a number of other efficiency criteria have been proposed, but the two given above will serve as examples of what is meant by standards.

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[5] Modified from Administration of Vocational Education, Wright and Allen. Wiley.

It has been found possible to follow a definite procedure of setting up standards, determining the reliable functioning information on which scoring is based, and to secure scores in a number of fields among the more important of which are—

1. Administrative organizations.
2. Courses of study.
3. Programs for the training of teachers.
4. The social return to a community of a given vocational or civilian vocational rehabilitation program.
5. Types of programs.
6. Qualifications of supervisors and of teachers.

It is evident that in its present stage of development this work represents little more than a recognition of the fact that the methods of the efficiency engineer can be successfully applied in the field of vocational education and civilian vocational rehabilitation. The Federal Board for Vocational Education is greatly interested in the subject, and this is true of many State officials who are connected with the promotion and development of State and local programs. The chief significance of this movement is the recognition of the fact that in the field of education in which the Federal board is concerned, we are passing out of the stage where we are concerned only with finding out how to get the job done, into the stage of finding out how to get the job done efficiently through the development and application of reliable standards and workable tests.

UNITED STATES CIVIL SERVICE COMMISSION

Filling 40,000 vacancies in the Federal civil service with qualified workers in a wide variety of occupations is the annual task of the United States Civil Service Commission. Approximately that number of appointments are necessary each year to fill vacancies caused mainly by promotion, resignation, removal, retirement, or death.

The Civil Service Commission is engaged primarily in establishing and making practical use of standards for the measurement of the relative capabilities of applicants for Federal employment. Obviously, such standards can not be established with the definiteness possible in determining standards of linear measure or of weight. There is no such thing as a perfect civil-service examination, one that will in all cases differentiate exactly among all applicants according to their relative abilities. There is such a thing, however, as an examination which is better than another examination. An essential part of the functions of the Civil Service Commission is to conduct constant research and investigation as to the appropriateness of its examinations with a view to their improvement.

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In recent years the commission has made rapid strides in improving its examinations, due to the provision by Congress of funds for use in maintaining a division of personnel research.

General Adaptability Tests.—The division of research has made marked progress toward the standardization of scales for measuring general adaptability. Of the measurable qualities which an individual must possess in order to achieve proficiency, one of the most important in many positions is the ability to learn new duties and to adapt to new conditions.

The importance of testing special ability is not minimized. For example, those who are to be employed as stenographers must demonstrate through practical tests their ability in stenography. For many lines of work, however, a measure of ability to acquire knowledge and to apply it is more important than a measure of acquired knowledge.

Tests for the Bureau of Prohibition.—The division of research was preparing to make final trials of the series of general adaptability tests when, as a result of legislation bringing the entire Bureau of Prohibition under the civil service law, it became imperative that the selection of the personnel of that bureau receive immediate attention. When Congress passed the bill creating the Bureau of Prohibition and requiring that all employees of that bureau acquire a civil-service status through the usual channels of competitive examination, a heavy responsibility was placed upon the Civil Service Commission.

The act brought approximately 2,500 positions in the Bureau of Prohibition under the provisions of the civil service law of 1883. The positions range in importance from warehouse watchman to assistant commissioner, the office of Commissioner of Prohibition being the only one in the bureau not brought into the competitive classified service.

The fact that the incumbents of the 2,500 newly classified positions, trained in the work of the bureau, were required to enter the open competition, added to the difficulties in the way of establishing, for the various grades of work, test standards which would be fair to all applicants and at the same time achieve the purpose of the examinations; that is, to grade the competitors as nearly as possible according to their worth.

The commission endeavored to set its standards for these examinations so as to insure absolutely fair and unquestionably just selection of eligibles under the new law. All applicants were required to take an open competitive examination. No one was rated solely on the basis of experience. For executives, it is true, the careful investigation of experience records took the place of the written part of the examination, but these applicants were given a special oral examination. All applicants other than those for executive positions were

required to take a specially devised written examination in addition to the oral examination. No applicant for any of the positions was exempt from a most thorough character investigation.

The development and use of the standards of measurement provided for the Bureau of Prohibition are discussed at length in the report of the director of personnel research, printed in the Civil Service Commission's annual report for the year ended June 30, 1927.

Spelling Tests.—Further development and standardization of nondictated spelling tests has been another undertaking of the division of research. The problem was to construct a spelling test which would lose none of the testing value of the dictated form yet which would, in so far as possible, avoid the unfairness of that form and the difficulties involved in administering it.

A spelling test that is dictated varies widely in difficulty when it is administered under differing conditions and by different examiners. It is practically impossible to make a dictated spelling test uniformly fair, not only because of differences in examiners, but also because of variations in examination rooms. Disturbances outside the examining room, or the position of the competitor with relation to the dictator, may make it impossible for some competitors to hear clearly the dictated test. The proper administration of the dictated test is both difficult and costly.

The nondictated test adopted for use in civil-service examinations consists of printed words contained in sentences which show the meaning of the test words. The test words are italicized and are spelled phonetically. The competitor recognizes the meaning and the sound of the word, and in effect, dictates it to himself. He is not influenced by suggestions of correct or incorrect spelling.

THE COMMISSION OF FINE ARTS

The Commission of Fine Arts is interested in standardization in several particulars:

First. The term "United States standard bronze" is often used in specifications for statuary. In so far as this commission can find out there is no standard bronze, and the term is misleading. Each foundry has its own formula.

Second. It is desirable to ascertain some method (whether in the composition of the bronze or by cleaning) by which bronze statues can be protected against "pitting," caused presumably by the gasses in the air.

Third. Permanent colors to be used by the Government in the manufacture of the flag of the United States. This subject is now under investigation by the Bureau of Standards in cooperation with officials of the Army and the Navy and members of the Commission of Fine Arts.

This commission has consulted the National Bureau of Standards in regard to the durability of the marbles proposed to be used for the Lincoln Memorial, and in various other like matters.

GOVERNMENT PRINTING OFFICE

The Government Printing Office is represented on the Federal Specifications Board by the technical director, and is represented on nine technical committees of the board.

During the past year standard specifications have been adopted for three grades of glue, covering all requirements of the office for adhesive purposes and the manufacture of press rollers. These specifications have proved satisfactory for the work of the office and also to glue manufacturers. These specifications are also being adopted by commercial bookbinders and printers. The investigational work on methods for testing glue and the preparation of specifications was carried out in cooperation with the National Association of Glue Manufacturers.

The work on the standardization of paper based on technical quality being conducted in cooperation with the United Typothetæ of America and paper manufacturers has been continued during the year. The tentative specifications for bond and ledger papers have been revised and a conference is pending for the purpose of considering the adoption of these standards by the paper manufacturers and printers. The specifications recommended as a result of this investigation have been adopted by the Joint Committee on Printing for the respective grades of these papers purchased by the Government Printing Office.

This standardization program is now being extended to cover all qualities of book papers. In carrying out this work the paper manufacturers are cooperating by furnishing samples of their standard mill brands of these papers which will be subjected to all available technical methods of paper testing. Tests will be developed for measuring the relationship of printing paper to printing inks, and any additional tests necessary for determining the suitability of these papers for printing purposes.

As a result of an extensive investigation on kraft wrapping paper conducted in cooperation with manufacturers of kraft paper, standard specifications have been developed for No. 1 and No. 2 kraft paper, which have been adopted by the Joint Committee on Printing for the use of the Government Printing Office. Further work in cooperation with the paper manufacturers will be conducted in connection with these papers.

The committee on paper specifications of the Joint Committee on Printing meets each year for the purpose of revising the standard

specifications for paper for the use of the Government Printing Office in order to furnish the most satisfactory qualities required by the Government.

Standard formulas have been adopted for type-metal alloys used by the Government Printing Office covering linotype, monotype, and stereotype metals. This work has proved to be one of the most important technical investigations conducted by the chemists of the office, since the Government Printing Office has approximately 6,000,000 pounds of type metal alloys in service. The results of the technical control type-metal alloys has proved of vital importance to the office and has effected a very appreciable economy. The results of this work has proved of considerable interest to the commercial printers and type-metal manufacturers, and the standards adopted by this office are being adopted to a large extent.

The investigational work on type-metal alloys is now being extended in cooperation with the commercial printing plants of the country and the type-metal manufacturers, in order to determine the most satisfactory composition alloys for each kind of type metal and the normal deterioration or changes in the composition of type-metal alloys in use. Also to determine the best methods for maintaining the standard composition of these metals.

Important technical work has been started during the year relative to the standardization of printing inks. This work is being carried out by the development of standard specifications for the vehicles and pigments used in the manufacture of printing inks and standard formulas for various kinds of printing inks. As a result of this work the number of kinds of printing inks necessary for the various types of presses in the office will be reduced to a minimum and standard colored inks will be adopted for all printing work.

During the past year the Public Printer established in the Government Printing Office a "Division of tests and technical control," which takes over the section formerly known as the "testing section" of the office. In addition to the technical laboratory this new division also includes the metal, roller and glue, and ink sections of the office. This division conducts all work relative to the technical standardization, inspection, and testing of materials purchased by the office and also exercises technical control over materials produced in the office, such as printing inks, type metals, press rollers, adhesives, and the like. One of its most important duties is technical investigation and standardization work conducted in cooperation with commercial printing and binding manufacturers, and also the manufacturers of raw materials used by these industries. This division is in charge of the technical director formerly designated chief of tests.

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. The 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 commission leads the way for the industry itself to set them up.

NATIONAL SCREW THREAD COMMISSION

The National Screw Thread Commission is represented on two technical committees of the Federal Specifications Board.

During the past year the National Screw Thread Commission has given its attention to minor revisions of the standards previously adopted and to consideration of supplementary material to be included in the next edition of the report.

The minor diameter of tapped holes has been revised to allow a smaller percentage of depth of thread engagement than that previously specified. This change will tend to result in more economical tapping and a reduction of tap breakage. It will necessitate a revision of the tables of minor diameters and recommended tap drill sizes contained in the report.

The commission has cooperated with manufacturers and users of taps and has approved a series of dimensions for taps, both ground thread and cut thread, which experience indicates will produce tapped holes within the limits of class 3 and class 2 when used in normal equipment under properly standardized operating conditions. It should be understood, however, that the commission is concerned primarily with the finished product (bolts and tapped holes) and that the information on threading tools is suggestive only and there is no guarantee, either express or implied, that the recommended tap dimensions will actually produce threaded holes within a given class of fit under any and all conditions of use.

That section of the commission's report dealing with threads of special diameters, pitches, and lengths of engagement has been extensively revised to bring it into more complete harmony with the regular coarse thread and fine thread series. The section as revised will also include special threads for specific purposes; for example, threads for electrical fixtures and fittings, a special 12-pitch series, threads for cutting and welding torches, threads for metal barrels and drums, and threads for base plates and tripod heads.

The section on gauges and gauging has also been extensively revised.

Several mimeographed reports of interest to special groups have been issued during the year. These include Federal Specifications Board purchase specifications for bolts, nuts, and screws, and comments on the specifications for slotted head screw products as approved by a sectional committee organized under the American Engineering Standards Committee.

The commission is now taking up the question of instrument threads and an analysis is being made of the threads now in use by instrument manufacturers with a view to recommending a standard series of diameters, pitches, and tolerances for screw threads of this general class.

THE PANAMA CANAL

The inspecting engineer of the Panama Canal represents that activity on the executive committee of the Federal Specifications Board.

The Panama Canal is represented on 34 technical committees of the Federal Specifications Board.

The Panama Canal is represented on the main and executive committees of the American Engineering Standards Committee. It is also represented on the American Society for Testing Materials committees on cement and screen-wire cloth.

Originally, the Panama Canal made use of Navy and War Department specifications to a considerable extent, but later it was found that on certain materials for which no specifications had been issued the Panama Canal was obliged to draft its specifications as above mentioned.

Under the present regulations, it is usual to present any data relating to a new specification to the Federal Specifications Board, and if more than one department is interested, a committee is appointed to draft a tentative specification. When such specifications have been drafted in a tentative form, they are then referred to the Canal Zone for any constructive suggestions.

The Panama Canal makes use of these United States Government specifications as far as they are applicable; but where no Federal specifications are in existence and no other department is interested, it is then necessary for the Panama Canal to compile the proper data as a basis for specifications. This often entails considerable research work.

THE OFFICE OF PUBLIC BUILDINGS AND PUBLIC PARKS

The Office of Public Buildings and Public Parks of the National Capital was established by the act of February 26, 1925, consolidating the Office of Public Buildings and Grounds under the Chief of Engineers, United States Army, and the Office of the Superintendent of the State, War, and Navy Department Buildings into a single

office. The head of the office is designated as the Director of Public Buildings and Public Parks of the National Capital, and is assigned by the President from the officers of the Corps of Engineers for duty in this position.

The functions of the office pertain to the maintenance, operation, alteration, and protection of the buildings, memorials, shops, and parks placed under the custody of the director by law and include the care of the grounds, heating, lighting, repairing, altering, and cleaning of the buildings, memorials, shops, and parks, and the operation of the guarding and fire protection force under regulations designed to protect the parks, the public using them, the personnel housed in the buildings, the buildings, and all Government property within their confines.

The work of the following commissions of which the director is executive officer is, for economy of operation, done under the Office of Public Buildings and Public Parks of the National Capital:

Arlington Memorial Bridge Commission.
National Capital Park and Planning Commission.
Public Buildings Commission.
Various other commissions connected with construction of memorials and buildings.
Coordinator of Motor Transport.

Standardization has been promoted by standardizing the methods of maintenance and operation of buildings, parks, and motor vehicles maintained and operated by the office.

Purchases for the office and for the various commissions of which the director is executive officer are made through one office. United States Government master specifications promulgated by the Federal Specifications Board are used where they are applicable.

The office is represented on the Interdepartmental Board of Contracts and Adjustments; the Interdepartmental Board of Simplified Office Procedure; the General Supply Committee; several technical committees of the Federal Specifications Board; and the office has cooperated with the division of simplified practice of the Department of Commerce.

UNITED STATES SHIPPING BOARD MERCHANT FLEET CORPORATION

This organization is represented on the executive committee, Federal Specifications Board, by the assistant director of supplies. It is also represented on 26 technical committees of the Federal Specifications Board and, therefore, collaborates with all other Government departments and independent establishments in standardization work. It also has membership on sectional committee of the American Engineering Standards Committee.

Federal specifications are being used where they are applicable and where the conditions of purchase are such as to make their use

possible. Now that the standards of the American Marine Standards Committee are being promulgated, their use is being extended throughout the Fleet Corporation organization.

The work of the Fuel Conservation Committee continued along the lines outlined in the 1927 Yearbook. An important project followed during the year was that in connection with the development of a practical pulverized coal-burning apparatus for use on seagoing vessels. An exhaustive series of tests were conducted at the Naval Fuel Oil Testing Plant, Navy Yard, Philadelphia, through the courtesy and cooperation of the Navy Department. These tests were brought to a successful conclusion. They were transferred to the S. S. *Mercer*, where an actual seagoing installation is being installed and is approaching completion. The successful consummation of these tests will be of importance far reaching in steamship operation and tend to considerable economy in the operation of steamships.

Laboratories are operated by the Merchant Fleet Corporation as follows:

Fuel Laboratory, Pier No. 3, Hoboken, N. J.
Materials Laboratory, 45 Broadway, New York, N. Y.

UNITED STATES VETERANS' BUREAU

The United States Veterans' Bureau is represented on the Federal Specifications Board by the assistant chief, purchase and issue subdivision, and members of the staff represent the bureau on 30 technical committees of the board.

Standardization of quality of subsistence supplies furnished United States veterans' hospitals is being accomplished by:

1. Compilation of standard specifications composed of adequately detailed descriptions of the articles desired.

2. Buying the total quantity of an item necessary for all hospitals in central office. Central purchase is being gradually extended and eventually will cover all items, the centralized procurement of which is practicable.

3. Expert comparison of deliveries against standard specifications. In central office this is accomplished in close collaboration with the food, drug, and insecticide administration of the Department of Agriculture. In the field, packing house and dairy products are graded by the Bureau of Agricultural Economics of the Department of Agriculture, where the inspection service of that bureau is available. Where it is not available, grading is done by bureau employees, and these employees are being educated through correspondence and personal instruction through traveling central office representatives to the end that they will eventually be fully qualified to do this grading. Deliveries of other articles purchased locally are also inspected by bureau employees.

4. Specifications for fresh meats and meat food products, poultry, eggs, etc., warrant special mention, in that they have been developed to their present form by several revisions in collaboration with the Bureau of Agricultural Economics of the Department of Agriculture, the Institute of American Meat Packers, and with 50 United States veterans' hospitals.

5. Standards of quality of canned fruits and vegetables are secured and maintained through the adoption of a system of score-card grading in which there is devised a score card for each of the different items and on which card each of the characteristics described in the specifications is given numerical values. The total score possible is 100 and the minimum score under which the item will grade in is fixed for each item. The bidder's quoted price is considered only after the sample has scored up to the minimum required to grade it in. Samples that are being scored are examined in all instances without identification of any kind excepting a number which is affixed to sample by an outside party at the time other identifications are removed. Thus the graders do not know whose sample is being examined.

6. After exhaustive tests of coffee, a standard best suited for the needs of the United States veterans' hospitals was set. A small supply of this standard coffee in the green was then secured and with each invitation to bid there was forwarded to the prospective bidder a sample taken from this control stock. Each bid to receive consideration was required to be accompanied by a sample of the coffee which the bidder intended to deliver and only those bids contemplating delivery of coffee matching the control coffee by cup test were considered. Each three months since the standard was set, the control stock has been replaced by purchase from the contractor to whom the last award has been made. The coffee submitted for replacement is accepted only after exhaustive tests and comparison with the coffee remaining in the control stock.

7. A standard for tea was set after close collaboration with tea experts of the Department of Agriculture, and a control stock sufficient for one year was purchased and carefully stored to guard against deterioration. The purchase of tea is made in essentially the same manner as that described for the purchase of coffee.

8. A standard for the procurement of nut margarine and salad oil has been set with a view to insuring the delivery of nonrancid products. This standard is maintained by subjecting all samples submitted in connection with bids and all deliveries from successful bidders to the Kreis test which is made as follows:

To 10 cc of the oil or melted fat in a large test tube (8 by 1 inches) add 10 cc of HCl (sp. gr. 1.19). Close the tube with a rubber stopper and shake vigorously for approximately 30 seconds. Add 10 cc of a 0.1 per cent solution of phloroglucin in ether, close the tube, and shake as before. Allow it to stand and separate. A red or pink color in the acid layer indicates rancidity.

9. A standard for gelatin has been set; this standard requiring that gelatin to be accepted by the bureau shall be an intimate mixture of about 85 per cent sugar (sucrose), and 10 per cent or more of gelatine flavored with pure fruit flavor, distinct and true to name, and shall contain from 2 to 4 per cent of citric or tartaric acid, with certified color or pure vegetable color. The gelatin used shall be odorless, tasteless, light in color, of high jelly strength, and shall produce a clear solution. It shall be ground to pass a 30 to 50 mesh to the inch sieve, and shall be as free from metallic impurities as best commercial practice makes possible. The gelatin shall be of such strength that 20 grams of the finished powder dissolved in 100 cubic centimeters of distilled water will yield a jelly strength of 24 to 28 grams on the Bloom gelometer after 16 hours chilling at 10° C. Jelly strength determinations are to be made according to the method adopted by the National Association of Glue Manufacturers.

V. 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 1927 annual report of the director will give 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

New research results or discoveries are announced in printed bureau publications. Nearly 1,450 pamphlets have been published to date. Releases to the daily press give briefly the outstanding news of the bureau's activities. Technical abstracts are prepared for dissemination to the technical journals. New knowledge of general or pure science is published in "Scientific Papers." Results of direct application in the industries are printed as "Technologic Papers." These two series are bound in volumes of approximately 750 pages. About 21 volumes have been issued of each series. Compiled technical or administrative matter is issued as a "Circular," for example, the standard gasoline tables, test schedules, tests, specifications, and the like. Codes and reference texts, for example, the codes of electrical, and logging practice, which must be carried about by the expert in his daily work, are issued as "Handbooks." This series is 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 giving items concerning pending or completed work of the bureau. The bureau also prepares "letter circulars" on specialized subjects for use as replies to inquiries by mail. The 239 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.

Bureau publications are sold by the Superintendent of Documents. Subscriptions may be placed in advance for the Scientific Papers and for the Technologic Papers. The bureau issues a descriptive list (Circular 24, together with annual supplement) of its published

material. Announcement cards giving titles of all new publications are sent regularly on request to those concerned with the bureau's work.

RESEARCH AND TESTING

RESEARCH

Research on problems arising in connection with standards is by act of Congress a primary function of the Bureau of Standards. 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 [6] 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 is one of peculiar trust on problems of concern to an entire industry. 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.

[6] For further details, see B. S. Circular No. 296.

Research Associates

Assigned by—	General field research	Specific project	Research associate
Allegheny Observatory, Allegheny, Pa	Optics	Spectroscopy	Burns, Keivin.
Allwood Lime Co., Manitowoc, Wis	Fuel	Fuel research	Hendries, V. K.
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 the 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 naterials	Welded rail joints	Olsson, E.
American Chemical Society, rubber section, Mills Building, Washington, D. C.	Rubber	Physical testing of rubber	Rupert, F. E.
American Electroplaters Society, George Gehling, Secretary-treasurer, 5001 Edmund Street, Philadelphia, Pa.	Electroplating	Spotting out of plated finishes	Barrows, W. P.
American Face Brick Association, 130 North Wells Street, Chicago, Ill.	Structural materials	Prevention of stain on brick structures	Palmer, L. A.
American Gas Association, 342 Madison Avenue, New York, N. Y.	Gas engineering	Methods of testing gas appliances to determine their safety	Cash, G. H.
		Design of burners	Tow, Chas. O.
American Oil Chemists Society, H. P. Trevithrick, president, 2 Broadway, New York, N. Y.	Colorimetry	Standardization of Lovibond glasses	Walker, G. K.
American Petroleum Institute, 250 Park Avenue, New York, N. Y.	Petroleum	Thermodynamic properties of petroleum hydrocarbons	Harrington, E. A.
		Separation, identification, and determination of the chemical constituents of commercial petroleum fractions	Bruun, J. H.
American Railway Association, 30 Vesey Street, New York, N. Y.	Railway materials	Safety valves for tank cars	Stroop, D. V.
American Scandinavian Foundation, 25 West Forty-fifth Street, New York, N. Y.	Metallurgy	Metallographic work; investigation of the structure of iron.	Berglund, T.
American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, N. Y.	Thermal properties of materials.	Properties of water and steam	Osborne, N. S.; Stimson, H. F.
	Lubrication	Investigation of journal bearing lubrication	McKee, T. R.
Asphalt Shingle and Roofing Association, 285 Madison Avenue, New York, N. Y.	Structural 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, A. W.; Rapp, P.
Banner Rock Products Co., Alexandria, Ind	Heat transfer	Thermal conductivity of insulating materials at high temperatures.	Semple, H. S.
Breit, G	Optics	Experiments in scattering of gamma rays in radioactivity.	Breit, G.
Brush, Charles F., Cleveland, Ohio	Thermal properties of materials.	Spontaneous generation of heat	Harrington, E. A.
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	Durability of currency paper	Gottschalk, V. H.; Hamill, G. K.; Worthington, V.
Carnegie Institute of Technology, Schenley Park, Pittsburgh, Pa.	Carbohydrates	Carbohydrates	Leavell, Gladys.
Cast Iron Pipe Research Association, 566 Peoples Gas Building, Chicago, Ill.	Soil corrosion	Research on cause of soil corrosion of cast-iron pipe.	Holler, H. D.

Celite Products Co., Lompoc, Calif.	Rubber Structural materials	Use of Celite in rubber compounds Workability of concrete	Endress, H. A.; Overman, Charles B. Conahey, G.; Noonan, P. W.
Celotex Co., 645 North Michigan Boulevard, Chicago, Ill.	Heat transfer	Heat transmission of insulating materials at ordinary temperatures.	Schmidt, L. D.
Common Brick Manufacturers Association, 2121 Guarantee Title Building, Cleveland, Ohio.	Structural materials	Sound measurements and compression tests on brick walls.	Chrisler, V. L.; McBurney, J. W.
Commonwealth Fund, The, 1 East Fifty-seventh Street, New York, N. Y.	Carbohydrates	Chemistry of carbohydrates	Purves, C. B.
Continental-Mexican Rubber Co., 1775 Broadway, New York, N. Y.	Rubber	Research on guayule rubber	Spence, D.
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.; Lankford, J. W.; Lloyd, D. B., jr.
Cotton Textile Institute (Inc.), 320 Broadway, New York, N. Y.	Textiles	Study of specific uses for cotton material	Mercier, A. A.
Crucible Steel Casting Co., The, Lansdowne, Philadelphia, Pa., and the Dodge Steel Castings Co., 6501 Tacony Street, Philadelphia, Pa.	Metallurgy	Heat treatment of cast steel	McCrae, J. V.
Eichlin, C. G.	Optics	Heat treatment of glass	Eichlin, C. G.
Elevator Safety Code Committee, subcommittee on research, approval, and interpretation, American Engineering Standards Committee, 29 West Thirty-ninth Street, New York, N. Y.	Safety engineering	Elevator safety equipment development of instruments and methods, construction, maintenance, operation, etc.	Brown, L. W.; Burnham, J. H.; Dickinson, J. A.; Seaquist, W. H.
Gypsum Industries, 844 Rush Street, Chicago, Ill.	Structural materials	Gypsum	Dailey, M. C.
Hollow Building Tile Association, Conway Building, Chicago, Ill.	Fire resistance	Fire resistance of clay hollow tile	Foster, H. D.
Horological Institute of America, Academy of Sciences Building, Washington, D. C.	Time measurements	Certification of watchmakers	Miller, M. M.
Indiana Limestone Quarrymen's Association, Bedford, Ind.	Structural materials	Properties of Indiana limestone, including waterproofing, discoloring, etc.	Dutton, H. H.; Newcomer, H. E.
International Association of Electrotypers of America, H. G. Guiteras, secretary, Leader Building, Cleveland, Ohio.	Electrotyping	Nickel electrotyping	Winkler, J. H.
Magnus Metal Co., 2234 West Forty-third Street, Chicago, Ill.	Metallurgy	Bearing metals	Harbaugh, W. LeC.
Mead, Johnson & Co., Evansville, Ind.	Biochemistry	The antiricketic effect of cholesterol irradiated at low temperature.	Bills, Charles E.
Midvale Co., The, Nicetown, Philadelphia, Pa.	Metallurgy	Properties of steel at high temperatures	Eagan, T. E.
Moore, Howard R.	Optics	Atomic physics	Moore, Howard R.
Munsell Research Laboratory, 10 East Franklin Street, Baltimore, Md	Colorimetry	Hue discrimination, saturation and purity of colors.	Judd, D. B.; Riley, J. O.
National Association of Dyers and Cleaners, Silver Spring, Md.	Dyeing and cleaning	Development of special detergents as an aid to dry-cleaning processes.	Eichlin, A. S.; Faling, Mable F.; Goldman, M. H.; Heckethorn, H.; Hubbard, C. C.; Michelsen, E. M.
National Association of Glue Manufacturers, J. R. Powell, secretary, care of Armour Glue Works, 1355 West Thirty-first Street, Chicago, Ill.	Adhesives and coating of papers.	Glue for use in paper sizing	Gottschalk, V. H.; 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.	Schenke, E. M.
National Association of Marble Dealers, Rockefeller Building, Cleveland, Ohio.	Structural materials	Use and care of marble for interior installations	Kessler, D. W.
National Knitted Outerwear Association, 347 Fifth Avenue, New York, N. Y.	Textiles	Methods of measuring outer-wear garments	McGowan, F. R.
National Lime Association, 918 G Street, Washington, D. C.	Structural materials	Development of quick-setting lime plaster	Bury, P. A.
National Research Council	Carbohydrates	Carbohydrate research Atomic physics	Wolfrom, M. L.; Dale, J. K. Langer, R. H.; MacNair, W. A.
The Medical Fellowship Board	do	Carbohydrate research	Austin, W. C.
National Slag Association, 933 Leader Building, Cleveland, Ohio.	Structural materials	Properties of blast-furnace slag	Muskopf, M. A.

Research Associates—Continued

Assigned by—	General field research	Specific project	Research associate
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.; Smith, J. C.
Portland Cement Association, 111 West Washington Street, Chicago, Ill.	do	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.
Research Service (Inc.), 810 Eighteenth Street NW., Washington, D. C.	do	Compression tests of interlocking tile	Pisarra, A. M.
Riverside Portland Cement Co., 800 Corporation Building, Los Angeles, Calif.	Cement	Research in cement	Woods, Hubert.
Shaw, H. S., jr. (through National Research Council)	Radio	Radio-wave phenomena	Parkinson, T.
Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y.; American Petroleum Institute, 250 Park Avenue, New York, N. Y.; and National Automobile Chamber of Commerce, 366 Madison Avenue, New York, N. Y.	Automotive research (operating through joint steering committee).	Research on fuels	Bridgeman, O. C.; Brooks, D. B.; Burr, R. A.; Hicks, R. L.; Eisinger, J. O.; King, H. K.; Ragsdale, W. H.
Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y., and National Automobile Chamber of Commerce, 366 Madison Avenue, New York, N. Y.	Automotive research (operating through Society of Automotive Engineers Research Committee).	Research on headlighting from the motorist's point of view.	Allen, H. H.; Bishop, C. B.; DeBruin, M. H.
Spanish Artillery Academy, Segovia, Spain	Metallurgy	Pearlitic cast iron	Soto, A. G.
Tappan Stove Co., Mansfield, Ohio	Gas engineering	Study of gas appliances	Taylor, Russel.
Weinstein Research Laboratories, 233 West Forty-second Street, New York, N. Y.	Dental research	Physical properties of dental materials	Coleman, R. L.; Poppe, W. A.
		Analysis of dental gold alloys	Snover, D. R.
Yale University, New Haven, Conn	Optics	The absorption of ultra-violet light at low temperatures by benzene, toluene, and the three xylenes.	Austin, J. Bliss.
Department of Pathology	do	Radiometry	Thompson, W. R.

Coordination with Other Research Laboratories.—With the aid of the National Research Council, the A. S. T. M. Committee E–9 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 time pieces; 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 engines, 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.

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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 Department of Commerce through its Bureau of Standards 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 more than 80 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, a group known as "commercial standards." 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 Secretary Hoover at the inception of simplified practice, is comprised of the following:

W. L. Chandler, 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 and 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 Engineering Standards Committee; 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 do ination 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 controlled 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. Occasionally 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 is 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 is 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 to 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 (guarantee of quality in delivered commodities which may or may not be labeled) and labeling applied to national standard commodities (for identification; may or may not carry a guarantee).

(*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 construction 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 encourages stability in land values and property uses, and thereby contributes 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 are 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
Society of Automotive Engineers Research Committee.	To assist in formulating program on automobile headlighting research.	H. C. Dickinson (chairman), National Bureau of Standards, Washington, D. C.	Society of Automotive Engineers; National Automobile Chamber of Commerce.
Building Code Committee.	To formulate and recommend provisions for municipal building code regulations.	George N. Thompson, division of building and housing, Commerce Department, Washington, D. C.	Prominent architects and engineers.
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 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.
Advisory Committee on Cotton.	To advise on technical questions dealing with cotton.	R. T. Fisher, 80 Federal Street, Boston, Mass.	Manufacturers of cotton textiles.
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 committees—Continued

Name	Purpose	Secretary	Membership
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.
Research Committee of American Electroplaters' Society.	To advise on research work on electroplating problems.	R. J. O'Connor (chairman), 1228 Noble Avenue, Bridgeport, Conn.	Foremen electroplaters.
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.
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 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 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.
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.
Advisory Committee on Investigation of Acid in Leather.	To assist and advise relative to the program of work started during the year regarding effects of various acids on the life and properties of leather.	T. Blackadder (chairman), care of Charles Lennig & Co. (Inc.), Bridesburg, Pa.	American Leather Chemists' Association; Tanners' Council of America.
Advisory Committee on Investigation of the Properties of 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.
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.
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.
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.
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.	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.

Advisory committees—Continued

Name	Purpose	Secretary	Membership
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.
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.
Committee on Program on Transverse Fissures in Rails.	To study the causes of segregation of rails.	J. R. Freeman, jr., National Bureau of Standards, Washington, D. C.	Associations of civil and railway engineers and rail 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. D. Dickinson (chairman), National Bureau of Standards, Washington, D. C.	Society of Automotive Engineers.
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.
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, shipbuilding 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 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 Underwear.	To advise on technical questions dealing with underwear.	Roy A. Cheney, Associated Knit Underwear Manufacturers, Union Station, Utica, N. Y.	Underwear manufacturers.
Advisory Committee on Wool.	To advise on technical questions dealing with wool.	Walter Humphreys, 80 Federal Street, Boston, Mass.	Manufacturers of wool textiles.
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.	Ten engineers, lawyers, realtors, and housing experts.

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 groundwork 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 radio-frequency or wave-length measurements, now a vital part of our radio communication system, though an undreamed requirement of 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

Aeronautic Research.—The Bureau of Standards is conducting a number of investigations for the purpose of providing improved equipment and more reliable design data in aeronautics. This work is being carried out in cooperation with the aeronautics branch of the Department of Commerce, the Bureau of Aeronautics of the Navy, and the National Advisory Committee for Aeronautics, with the aid of funds provided by these organizations. The bureau is designated by law as the research agency of the aeronautics branch.

Research for the Aeronautics Branch.—The current work for the aeronautics branch is divided into three groups:

1. Radio aids to air navigation.
2. Airport and airway lighting.

3. Problems of airplane construction and equipment (reduction of noise, standardization of fittings, improvement of stability and control, etc.).

Aircraft Radio Research.—This project has for its object the improvement of the radio aids which have begun to be installed on the airways in the United States. These aids are (*a*) directive radiobeacon; (*b*) marker beacons; and (*c*) radiotelephony from ground to aircraft. The operation of all of these aids requires the use of no apparatus on the airplane other than a simple receiving set.

The directive radiobeacon was originally developed by this bureau in 1921 for the War Department, was further improved in subsequent years by that department, and has now undergone some additional development. This beacon sends out a directive type of radiation by means of which the aviator can follow a set course. The pilot hears alternately two sets of distinctive code signals, the letter "a" and the letter "n." When these signals are of equal intensity the pilot is flying on a course directly toward (or away from) the radiobeacon. If one signal is stronger than the other, the pilot knows that he is off his course and in which direction it is necessary to turn in order to maintain his course. With the present directive beacon these signals have been found effective for distances up to approximately 175 miles from the beacon.

The marker beacons are low-power radio transmitting outfits which are to be placed on the emergency landing fields, and which will serve as milestones to indicate how far the flight has progressed along a course marked out by the directive radiobeacon.

Radiotelephony is one of the most important radio aids to air navigation, and one which is immediately needed. By means of fixed ground stations it is expected that the Department of Commerce will be able to broadcast important weather information to airplanes in flight, and thus facilitate landing and navigation.

The research work now in progress is concerned mainly with refinements in the three radio aids to air navigation mentioned above, trials of some supplementary devices, such as field localizers, and investigation of some alternative uses of radio as navigational aids.

The objectives may be listed as follows:

1. Improvements in Directive Radiobeacon.—The substitution of visual reception for aural reception on the airplane, the indicator consisting of two vibrating reeds which show equal amplitude of vibration when the pilot is on the course; research on directive properties of short waves with a view to developing a more efficient beacon, as well as simpler apparatus on the airplane; application of piezoelectric frequency control.

2. Field Localizer and Altimeter.—Continuation of research on electrical devices to mark out the boundaries of a field and to

indicate the height of an airplane above the field as aids in the landing of airplanes arriving during a fog. The devices include modifications of the directive beacon antenna system, audio-frequency coils, and adaptations of the leader cable system.

3. Radiotelephony from Aircraft.—The research is being restricted at present to telephony to aircraft. Progress in aviation, however, will soon require two-way telephony, necessitating the study of the efficiency and performance of various types of aircraft transmitting apparatus, antenna arrangements, power supply, and distance range at various frequencies.

A further discussion of this subject will be found in "Applications of radio in air navigation," by J. H. Dellinger, Engineers and Engineering, volume 43, page 301, November 15, 1926, and Mechanical Engineering, volume 49, page 29, January, 1927.

Lighting of Airports and Airways.—The work on lighting during the current year has been largely in cooperation with the air services of the Army and Navy and with manufacturers of lighting equipment. Particular attention has been given to the properties of neon lamps and their possibilities as beacons for use in foggy locations. While the neon lamp has the advantage of a characteristic color, the observations so far made of the effectiveness of these lamps in fog have not led to favorable results. However, a new type of neon lamp now under development by one of the manufacturers may prove to have important advantages over those now in use.

Measurements have been made in the laboratory on various types of lenses and reflectors which are used for field lighting and for running lights. These laboratory measurements have also been supplemented by measurements on landing fields.

Work now in progress includes the study of the effect of size, shape, color, and length of flash on the visibility of beacons under various weather conditions, as well as the most desirable distribution of the light from beacons for airway purposes.

Airplane Equipment.—This work includes the standardization of aircraft fittings and the study of types of construction designed to reduce airplane noise and to secure the necessary stability of aircraft requisite for safety.

Standardization of Airplane Fittings.—The purpose of this work is to determine the safe load to which airplane fittings of various kinds may be subjected and to develop as far as possible a standardized line of fittings. Minor repairs can quickly be made at an airport when such fittings are standardized. The work includes the investigation of the strength of welded fittings of various kinds, standard bolts and eyes, control cables, and streamline wires.

RESEARCH FOR THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS AND FOR THE BUREAU OF AERONAUTICS OF THE NAVY

The research work being carried out for these two organizations along aeronautic lines will be considered jointly as these services are contributing jointly to a number of the investigations.

Embrittlement of Duralumin.—The light alloy duralumin is exceptionally valuable in aircraft structures because it combines the lightness of aluminum with the strength of steel. The chief drawback to its use in exposed parts of aircraft has been its susceptibility to intercrystalline corrosion. While more resistant to corrosion than ordinary steels, it is used in such thin sections that this susceptibility to corrosion has proved a serious limitation to its use. Investigations of various protective coatings have been carried on at the Bureau of Standards. Any coating which could be maintained impervious to water was found to prevent the corrosion completely. All the paints, varnishes, and other dopes which were tried deteriorated on exposure and required constant renewal to maintain protection. A coating of pure aluminum, however, was found to afford an entirely different order of protection. Corrosive media which would destroy duralumin protected in any other way within a relatively short time, produced no noticeable effect on aluminuim-coated specimens in laborarotry tests. Aluminum-coated duralumin has been exposed on the seacoast for about a year with no further protection. So far no deterioration has been found in these specimens. Following this demonstration by the Bureau of Standards, the Aluminum Co. of America has worked out a method of producing aluminum-coated duralumin on a commercial scale. Tests on this material are now in progress at the Bureau of Standards.

If, as there is every reason to believe, this commercial material duplicates the results of the laboratory product, this will constitute the most noteworthy advance in light structural alloys since the discovery of duralumin.

Standardization of Wind-Tunnel Measurements.—In order to secure a high degree of accuracy in wind-tunnel measurements of forces on models of airplane wings, and especially in measurements on airship hulls or other streamline bodies, it is desirable that the velocity of the wind tunnel air stream be uniform and steady over the cross section. A satisfactory degree of uniformity can be secured by the aid of suitable honeycombs, and, in any case, the average velocity at various points in the air stream can be readily measured. The investigation and control of steadiness are far more difficult.

The conditions of flow in all wind tunnels are such that some degree of turbulence is necessarily present; that is to say, that at any point the velocity varies both in magnitude and direction, in most cases, with great rapidity. Experiments on "standard"

models sent to various wind tunnels throughout the world, including those at the Bureau of Standards, lead to the conclusion that in some cases there are differences in the measured forces attributable to differences in turbulence. It has not been possible, however, to correlate the differences in the forces with differences in turbulence, since no satisfactory method of measuring turbulence is known.

For several years the Bureau of Standards in cooperation with the National Advisory Committee for Aeronautics has been studying methods of measuring the instantaneous speed, direction, and pressure of air streams. Methods dependent on the transmission of pressures through tubing have been found to give highly misleading results due to motions set up in the air columns in the connecting tubes. During the past year attempts have been made to use the hot-wire type of anemometer. This is the most promising of all the methods tried, although the wire does not respond fully to frequencies greater than a few cycles per second.

In this method, a very fine platinum wire is heated by means of a constant electric current, and the varying voltage drop across the wire due to the varying air speed is amplified until an oscillograph can be operated. The problems of sensitivity and freedom from serious distortion in the amplifier have been solved and the theory of the response of the wire to fluctuations of different frequencies has been worked out and experimentally checked. Measurements of turbulence behind a cylinder are in progress. Satisfactory methods of giving a quantitative measure to the irregular fluctuations observed have not yet been developed and the apparatus is very bulky so that the problem of measuring turbulence is not solved, although substantial progress has been made.

High-Frequency Fatigue Machine.—Metals which are subject to a cyclical stress, such as that arising from vibration, will eventually fail unless the maximum stress applied during each cycle is kept below a certain limit, which is known as the fatigue limit of the material in question. The extended use of duralumin in aircraft structures, where vibration is always present, makes it necessary to determine the fatigue limit of this material. The characteristics of duralumin and some of the other light alloys are such that it is necessary, in determining the fatigue limit, to subject the test specimens to alternations of stress running into hundreds of millions of cycles.

To reduce the time required for making such observations, a high-frequency fatigue method has been developed at the bureau. The test specimen, which consists of a rectangular bar, is supported at its nodal points on either pivots or air cushions. It is kept in vibration by an air drive, consisting of one or more compressed air nozzles ending in circular plates. The nozzles are mounted so that the plates are close to the vibrating bar but not touching it. The escaping air

causes a reduction in pressure between the nozzle and the bar, causing the latter to deflect toward the nozzle. The resulting reduction in flow and the restoring force of the bar in turn cause the bar to move in the opposite direction and a vibration of constant amplitude is soon built up. Frequencies from 200 to 450 cycles per second have been obtained, depending on the dimensions of the bar, and extreme fiber stresses as high as 23,000 lbs./in.^{2} have been used. At these high stresses a bar will fail in an hour or so, a minute crack developing across the mid section which stops the vibration.

The ratio of the amplitude of the center of the bar to that of a free end and the observed frequency check well with values calculated from Rayleigh's theory, which provides a basis for computing the fiber stress for a given amplitude. Fatigue limits determined by this method give lower values than those obtained at low frequencies. The cause of this discrepancy has not yet been determined.

Investigations of Aircraft Structures.—Since the beginning of the construction of the *Shenandoah* the Bureau of Standards has been engaged in an extensive series of investigations on the strength of aircraft structures and more particularly on airship structures. Bureau engineers were called in consultation on the design of the ship. After the wreck of the *Shenandoah* the Navy Department requested the bureau to make a thorough investigation of the wreckage to see if the structure had deteriorated in service sufficiently to weaken the ship. The report of this work and the testimony of a bureau engineer was made part of a paper, "Technical aspects of the loss of the *Shenandoah*," published by the Journal of American Society of Naval Engineers, Volume XX, No. 3, August 3, 1926. As a part of this investigation (completed after publication of the paper), two full-size girders salvaged from the wreck subjected to the same tests carried the same loads as comparable girders tested during the construction of the ship. The tests showed that the ship was structurally sound at the time of the wreck.

A popular presentation of some aspects of this investigation is contained in "Making airships safe," L. B. Tuckerman, Popular Science Monthly, Volume XXIII, pp. 74–77, July, 1926.

Supercharging of Aircraft Engines.—An important standard with which to compare the performance of aircraft engine superchargers is obtained by means of altitude chamber tests under ideal supercharging conditions; that is, with air supplied to the carburetor at sea-level pressure while the pressure at the exhaust ports of the engine is reduced to the standard pressure corresponding to any altitude. Tests of this kind were first made two years ago, but the test plant did not then have sufficient capacity to permit full throttle operation of 400 horsepower engines when completely supercharged at altitudes in excess of 15,000 feet. Results for 20,000 and 25,000

feet have been computed from part throttle tests, but it is planned to extend the full throttle measurements to at least 25,000 feet.

Tests have been made for the Army Air Corps of a Curtiss D–12 engine equipped with a gear-driven centrifugal supercharger designed for low altitude work (critical altitude 7,500 feet at 2,000 r. p. m.). Horsepower increases with altitude up to the critical altitude while beyond that point it decreases rather rapidly. Up to the rated altitude, the power output with this supercharger was between 5 and 10 per cent less than attained with the same engine under ideal supercharging conditions. This difference is due in part to the power required to drive the supercharger. Tests of a second supercharger, similar in type but designed for high-altitude work, were not completed owing to mechanical failure of the supercharger.

Friction of Aviation Engines.—Friction data from numerous tests of aviation engines in the altitude chamber and a study of piston friction as affected by radical modifications in piston design will be found in National Advisory Committee for Aeronautics Technical Report No. 262, on "Friction of Aviation Engines," by S. W. Sparrow and M. A. Thorne.

Phenomena of Combustion.—An immense amount of work has been done (especially abroad) on the rate of flame travel in tubes and in constant volume bombs filled with explosive gaseous mixtures. Accurate kinetic and thermodynamic data on the gaseous explosive reaction are required both for determining the ideal efficiency of internal combustion engines and for correctly evaluating such factors in engine performance as charge composition, ignition timing, and detonation. Work with the soap bubble as a constant pressure bomb has continued to receive support from the National Advisory Committee for Aeronautics.

That reaction velocity is proportional to the molecular concentrations of the reacting gases has been verified for known mixtures of (1) carbon monoxide and methane with oxygen and (2) carbon monoxide and hydrogen with oxygen. The effect of inert gases (nitrogen, helium, and carbon dioxide) on the carbon monoxide, oxygen reaction, and on the methane, oxygen reaction has also been studied. N. A. C. A. Technical Report No. 280 on "The Gaseous Explosive Reaction: The Effect of Inert Gases," by F. W. Stevens, shows that the effect of an inert gas on the reaction rate may be accounted for by adding to the formula a term directly proportional to the molecular concentration of the inert gas. The proportionality constants for different inert gases evidently depend on their thermal properties.

An attempt to correlate what is known about the phenomena of combustion with the observed performance of actual engines has also received support from the National Advisory Committee for Aeronautics. This work is described in N. A. C. A. Techincal Report

No. 276, on "Combustion Time in the Engine Cylinder and Its Effect on Engine Performance," by C. F. Marvin, jr.

Other lines of investigation for the Navy Department and the National Advisory Committee for Aeronautics include the development of aircraft instruments, cotton substitutes for silk for parachutes, airship fabrics, gaseous fuel carbureters, carbureter-altitude control, and the strength of steel and duralumin tubes in compression.

AUTOMOTIVE ENGINEERING

Measurement of Detonation.—The marketing of numerous antiknock motor fuels and the production of high-compression engines as standard equipment for several automobiles has called general attention to the fact that there is no accepted standard method for rating fuels on the basis of their detonation characteristics. A study of the methods and equipment used for this purpose [7] led to the following conclusions: (*a*) Nearly all the methods in use consist of engine tests or depend on engine tests for their interpretation; (*b*) knock intensity is measured in various ways and with differing degrees of definiteness; (*c*) the antiknock value of a fuel may be expressed in a variety of terms according to the particular method of test; and (*d*) the rating of fuels by existing methods is usually not independent of test conditions.

As part of the cooperative fuel research program, the bureau has made comparative engine tests on two groups of fuels. The first group comprised about 15 gasolines submitted by various refiners as typical of current production. The second group comprised six composite samples, each of which represented as closely as practicable the average gasoline sold to the public in a certain group of States. The first group indicated large differences in antiknock value between gasolines from different crudes, but the second group showed rather small differences between most of the composite samples. Several laboratories have submitted identical sets of fuels to groups of laboratories for rating, and the results of these tests indicate with some accuracy the over-all effect of differences in test equipment and procedure. More comparative data will be required before the question of adopting a standard method of knock rating should be seriously considered.

Economic Volatility of Motor Fuels.—Further study of motor-fuel volatility in cooperation with the American Petroleum Institute, the National Automobile Chamber of Commerce and the Society of Automotive Engineers has led to the conclusion that a definite correlation exists between the usual A. S. T. M. distillation curve of a

[7] Methods of measuring the antiknock value of fuels, H. K. Cummings, J. Soc. of Auto. Engrs., 20 p. 599; 1927.

motor fuel and the volatility of fuel-air mixtures, such as are delivered by the automobile carburetor. Analysis of the engine starting tests showed that the lowest temperature at which it is possible to start an automobile engine with a given fuel, as well as the temperature necessary for satisfactory starting, can be obtained from the A. S. T. M. distillation curve of the fuel. No evidence was found for the claim that cracked gasolines differ as regards starting performance from straight-run gasolines of equal volatility. Tests have also been undertaken to ascertain the factors of importance in automobile engine acceleration. The effect of fuel volatility on acceleration is now being studied. The following papers relating to this project have been published during the year:

The Cooperative fuel research at United States Bureau of Standards 1922–1925, H. C. Dickinson, Bull. Am. Pet. Inst., p. 141; January 31, 1927.

Fuel characteristics and engine starting, J. O. Eisinger, Bull. Am. Pet. Inst., p. 143; January 31, 1927.

Fuel research summarized, H. C. Dickinson, J. Soc. Auto. Engrs., **20**, p. 193; 1927.

Fuel requirements for engine starting, C. S. Cragoe and J. O. Eisinger, J. Soc. Auto. Engrs., **20**, p. 353; 1927.

Lean explosive limits for cracked and straight-run gasolines and other motor fuels, D. C. Ritchie, J. Soc. Auto. Engrs., **21**, p. 15; 1927.

Engine acceleration tests, J. O. Eisinger, J. Soc. Auto. Engrs., **21**, p. 184; 1927.

Automobile Brakes and Brake Testing.—The Safety Code for Brakes and Brake Testing for which the Bureau of Standards and the American Automobile Association were joint sponsors was approved in May by the American Engineering Standards Committee as a Tentative American Standard on this subject.

Riding Qualities of Vehicles.—For various purposes, such, for instance, as ambulance service, it is desirable to have a standard means of comparing the riding qualities of vehicles.

Considerable work has been done on the development of an instrument which will serve as a mechanical observer to record the sum of the forces to which occupants of a vehicle are subjected. This instrument records by means of an electrolytic cell the total time (that is, the sum of all the short-time intervals) during which the vertical forces due to vehicle motion are of sufficient magnitude to produce discomfort.

Automotive Headlighting.—Changes in the design of automobiles and in traffic conditions on the highways have rendered existing standards of headlighting much less satisfactory. The bureau has undertaken a comprehensive series of experiments to collect data for the revision of these standards.

Two cars are fitted with sets of four special head lamps which are capable of adjustment to produce any desired field of illumination. One of the cars has the experimental lamps mounted on the

rear. This car is fitted with a visibility target and various signal lamps. Measurements are made of the distance at which the test target is visible both without and with the rear head lamps lighted, under all kinds of road conditions and with a wide variety of light distributions on both cars. In this way statistical data are being assembled which it is believed will make possible radical improvement in accepted standards of headlighting.

BUILDING AND HOUSING

The work on building and housing is designed to promote a wider application of the best standards for building materials and design to the $6,000,000,000 to $7,000,000,000 of new construction which is being carried out each year. In this way it helps to widen the practical usefulness of the laboratory and field research work of the Bureau of Standards and other scientific bodies, and to secure a more general adherence to approved specifications, and simplified practice programs.

The division of building and housing coordinates its work closely with that of the division of simplified practice in its extensive program covering more than 40 different building materials. It has cooperated with groups interested in standardizing nomenclature and units used in the sale of building materials; more uniform State mechanics' lien legislation; and adherence to high standards for practice in the field of home financing.

In the field of city planning and zoning, the adoption by State governments of legislation based on standard laws drafted by an advisory committee connected with the division is leading to considerable standardization in procedure and methods in the enactment of zoning and city planning ordinances, and private groups have adopted recommended principles regarding the layout of streets and lots in new real estate subdivisions.

Building Code Committee.—The advisory building code committee, made up of nationally prominent engineers and architects, appointed by the Secretary of Commerce in 1921, has been most active and influential in the development of standards for building regulation. More than $3,000,000,000 worth of construction work is carried out each year under the conditions prescribed by local building codes. The committee's six reports give concise recommendations suitable for inclusion in such codes, and each has been formulated with the cooperation of scores or hundreds of trade associations, professional societies, and municipal officials and individuals who have submitted their views, and commented on preliminary drafts sent out for criticism. Already more than 115 municipalities have made use of the reports, and 7 States have used recommendations of the subcommittee on plumbing for state-wide codes, which indicates that the

adoption as well as formulation of standards in this field is making substantial progress. Each of the committee's reports contains an appendix which explains the recommendations and offers much additional information of value to designers and builders.

In addition to disseminating directly knowledge as to good standards of building practice, the committee's reports have also had a wide indirect influence in connection with the work of several different trade associations and other groups which have undertaken campaigns to promote better building. Among these other groups, the National Committee on Wood Utilization, whose headquarters are located in the Department of Commerce, deserves special mention.

Relationship of Building Codes to Commercial Standardization.—To understand the relationship of building codes to standardization in general 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. It is not enough that the adoption of a given size or grade of material shall confer an economic benefit, desirable though that may be. The choice must be due primarily to a proper exercise of the police power, which concerns itself with the protection of the public in matters of safety, health, or morals. Moreover, 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 broader.

Spontaneous movements looking toward uniform building code requirements have sprung up in a number of localities. Prominent among these during the past year have been the activities of the Pacific Coast Building Officials' Conference and the Florida Building Officials' Conference. The former has brought to fruition, after several years' work, a recommended uniform code for Pacific coast cities. At its annual meeting in October final action was taken upon the proposed code and indications are that it will be widely used throughout the territory mentioned. It employs the recommendations of the Building Code Committee and of Bureau of Standards experts to a large extent, and applies the principle of the "performance basis" which has been mentioned. The Building Officials' Conference, whose membership covers the eastern United States and some representatives from farther west, has under consideration a similar plan for preparing a recommended uniform code covering an even wider area. The Florida Building Officials' Conference has held several

meetings for the purpose of drawing up recommended requirements, and considerable progress has been made. 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 regarding 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.

City Planning and Zoning.—The rapid development of city zoning, which means the dividing of cities into classes of districts in which the height of buildings, the area of the lot which they may cover, and the uses to which they may be put are regulated, bears a vital relation to the welfare of home owners, land owners, commercial and industrial interests, and civic welfare throughout the country.

The standard State zoning enabling act, drafted by the advisory committee on city planning and zoning, appointed by the Secretary of Commerce, has been used wholly or in large part in at least 28 States. It has had considerable influence in guiding the zoning 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 division it is believed that a tremendous amount of litigation has been avoided, and zoning has been strongly influenced to follow sound and reasonable lines. The constitutionality of zoning has been upheld recently in four cases by the United States Supreme Court, and has also been sustained in the highest courts of at least 22 States. More than 575 municipalities, comprising more than half the total urban population of the country, have adopted zoning ordinances, more than 500 having done so since January 1, 1922.

The increasing need for control of street layout in the growing sections of cities and for more wisely planned expenditure of public funds for highways, public works of all types, and public buildings, and the desirability of better consideration by private owners of the probable course of city development have led to a much wider demand for soundly guided city planning. The advisory committee on city planning and zoning accordingly drafted a standard city-planning enabling act, which was issued in March, 1927, and within three months was used in legislation enacted in California, Maryland, and Pennsylvania. A part of it has also been used in an ordinance of Cincinnati, Ohio. The act when adopted by a State legislature

enables cities to organize planning commissions along lines which have worked well in practice, and to control private developers of land in the laying out of new subdivisions. It represents some distinct advances in methods for controlling the small minority of such developers who are not willing to work in friendly cooperation with planning authorities, and also lays the groundwork for the development of regional planning.

The standards for State legislation on city planning and zoning are not derived from physical constants and test data, but in some respects are subject to the same type of approach as building codes. The elucidation of certain legal and practical fundamentals, based on study of conditions in many States and cities, is of great help to individuals who are trying to solve local problems. A joint committee of the National Conference on City Planning and the National Association of Real Estate Boards made recommendations which were adopted by the two bodies in 1927, indorsing the underlying principles of the standard city planning enabling act as they apply to control of the platting of subdivisions.

Good planning and zoning make for stability in the suitable use of urban land, and thereby help to eliminate the waste from the scrapping of structurally sound buildings which has been so prevalent in American cities, and provide a stronger incentive for sound and durable construction.

Lists of zoned municipalities and of State zoning enabling acts have been compiled from time to time, commencing in January, 1923. These lists have been reprinted widely in periodicals and the daily press, as well as in the yearly "Municiapl Index" commencing in 1924. The latest list is available in mimeographed form. The members of the advisory committee on city planning and zoning have contributed many articles to the published proceedings of the National Conference on City Planning, and the city-planning division of the American Society of Civil Engineers, and to other organizations and periodicals.

Zoning Enabling Acts.—The following 28 States have adopted "a standard State zoning enabling act," wholly or in large part:

Arizona.
Colorado.
Connecticut.
Delaware.
Florida.
Georgia.
Idaho.
Illinois.
Iowa.
Louisiana.
Mississippi.
Nevada.
New Hampshire.
New Jersey.
Nebraska.
North Carolina.
North Dakota.
Oklahoma.
Pennsylvania.
Rhode Island.
South Carolina.
South Dakota.
Tennessee.
Texas.
Utah.
Virginia.
West Virginia.
Wyoming.

Control of Fabricating and Curing Conditions for Concrete and Cement Testing.—Due to the influence of temperature and humidity during fabrication and storage on the strength of mortar and concrete test specimens it is necessary to control the fabricating and storage conditions. An automatically controlled cabinet has been built and placed in operation at the bureau for the storage at 70° F. and as high a humidity as practical, of cement and mortar test specimens for the first 24 hours after molding.

Equipment has also been installed to maintain constant temperature in the concrete-mixing laboratory and damp-storage room for curing concrete test specimens. In the future the concrete materials will be at 70° F. when used, and the specimens will be made and aged in the molds for 24 hours at this temperature. The damp storage room will also be maintained at this temperature.

Proportioning and Grading of Aggregates for Concrete.—The increase in allowable working stresses, and the rapidity of construction procedure make it important that the concrete placed in a structure be of the designed strength. It is also very desirable that the strength to be developed by a given aggregate in any proportion may be known within reasonable limits either from seven-day or shorter age tests, or simply from the grading and other characteristics of the aggregates. An extensive study has been made of the effects of different cements, different types of aggregates, proportions of materials, gradation of coarse aggregates, the ratio of fine to coarse aggregate, and the relation of the earlier strengths of concrete to the 28-day and later age strengths.

The tests indicate that the strengths of the concretes made of the several cements used at ages up to and including 28 days vary considerably, but at six months and one year (beyond which age the tests have not been carried) the strengths are more nearly equal for the several cements. The tests also indicate the desirability of using a ratio for fine to coarse aggregate between 1 to 1 and 1 to 2, in order to obtain maximum strength and workability, preferably nearer the higher ratio in the case of coarse aggregates deficient in the smaller sizes.

Workability of Cement Pastes and Concrete Mixtures.—Means of measuring the workability of cement pastes and concrete mixtures have been experimentally studied during the year. To date there has been no acceptable method of measuring the workability of a mix other than by the judgment of a skilled operator. Those hitherto employed—the slump cone, the flow table, the penetration test—are all satisfactory to a certain degree, but two mixes giving the same measurement on these machines may have very different workabilities as judged by skilled operators. A new apparatus has been

developed in conjunction with the Celite Products Co. Associateship at the bureau, consisting of a flexible hollow metal cylinder which, when filled with the concrete whose workability is to be measured, is compacted by a number of impacts on the flow table, and then compressed in the direction perpendicular to the axis. The apparatus is as yet in the experimental stage, but test results from it show less variation in measured values than with the apparatus previously used.

Standard Methods of Physical Tests for Cements.—An investigation upon the volumetric changes of Portland cement after mixing, with the object of comparing these changes with the soundness of cement has been concluded. The measured volume changes for 32 brands of cement, varied from almost no change to an expansion of 0.061 per cent, both with the correct amount of water for normal consistency as now accepted, and also with 42 per cent of water by weight of dry cement. The usual soundness test requirements were met by all of these cements. The problem of developing more satisfactory physical tests for the acceptance of Portland cement is being studied. The present tests, especially for tensile strength, do not appear to be correlated with the relative strengths that these same cements will develop in a concrete, and it is desirable to develop a simple test to obtain this correlation.

Constitution of Portland Cement.—In addition to the studies of cement conducted in cooperation with the Portland Cement Association, work has been conducted on the study of the heat of reaction of Portland cement with water, and on studies of the hydration of the aluminates of lime. Sufficient data were obtained to indicate that the interesting feature of the reaction will be in the first 12 hours, and it appears that much simpler equipment can be used and at least relative values obtained. This is now being done.

Chemical analysis and petrographic examination of the material precipitated from the metastable solutions indicated that hydrated alumina and hydrated tricalcium aluminate were precipitated as equilibrium was approached. Calculations based upon electrometric measurements indicate that the aluminate in solution is the calcium salt of monobasic aluminic acid.

It would appear that the cementing properties of the monocalcium aluminate, the 3:5 aluminate, the 5:3 aluminate, and the high-alumina cement studied were in part due to the precipitation of hydrated alumina and crystalline hydrated tricalcium aluminate from a metastable and supersaturated monocalcium aluminate solution.

Publications.—Why aging is a factor in the study and use of cement, P. H. Bates, Proc. Am. Conc. Inst.; 1927.

The present status of Portland cement and the possibilities of "super" cements, P. H. Bates, Zement, **16**, p. 753; 1927.

Long-time tests of high magnesia Portland cement, P. H. Bates, Proc. Am. Soc. Test. Mtls.; 1927.

Studies on the system $CaO=Fe_2O_3=SiO_2$, by Hansen and Bogue, J. Am. Chem. Soc., **48,** p. 1261; 1926—Paper No. 1 of the Portland Cement Association fellowship.

The determination of uncombined lime in Portland cement, by Lerch and Bogue Ind. Eng. Chem., **18,** p. 739; 1926—Paper No. 2 of the Portland Cement Association fellowship.

A digest of the literature on the constitution of Portland cement clinker, by Bogue, Concrete; July, 1926, to February, 1927—Paper No. 3 of the Portland Cement Association fellowship.

Portland cement research, by Bogue, Proc. A. S. T. M., **26,** Pt. II; 1926—Paper No. 4 of the Portland Cement Association fellowship.

The preparation and optical properties of calcium hydroxide crystals, by Ashton and Wilson, Am. J. Sci., **13,** p. 209; 1927—Paper No. 5 of the Portland Cement Association fellowship.

Studies on the system $CaO=Al_2O_3=SiO_2$. The composition $8CaO+Al_2O_3+2SiO_2$, by Hansen, Dyckerhoff, Ashton, and Bogue, J. Phys. Chem., **31,** p. 607; 1927; Zement, **16,** p. 51; 1927; Rock Products, April 16, 1927—Paper No. 6 of the Portland Cement Association fellowship.

The preparation of optically clear selenium for use in index media, by Brownmiller, Am. Mineralogist, **12,** p. 43; 1927—Paper No. 7 of the Portland Cement Association fellowship.

X-ray diffraction measurements on some of the pure compounds concerned in the study of Portland cement, by Harrington, Am. J. Sci., **13,** p. 467; 1927—Paper No. 8 of the Portland Cement Association fellowship.

Portland cement in concrete engineering, by Bogue, Proc. Am. Conc. Inst., **23,** p. 355; 1927; Concrete, **30,** p. 33; 1927—Paper No. 9 of the Portland Cement Association fellowship.

Preliminary investigation on the combination of lime in Portland cement compounds, by Hansen and Bogue, Ind. Eng. Chem., **19;** 1927—Paper No. 10 of the Portland Cement Association fellowship.

Studies on the hydrolysis of compounds which may occur in Portland cement, by Lerch and Bogue, J. Phys. Chem., **31;** 1927—Paper No. 11 of the Portland Cement Association fellowship.

Experimental Concrete Mine Stoppings.—The Bureau of Standards cooperating with the Bureau of Mines conducted an investigation of the resistance of concrete mine stoppings to suddenly formed pressures produced by explosions. Stoppings are built in mines to prevent flames and other destructive effects of explosions from spreading throughout an entire mine and for sealing abandoned galleries. Data on the effects of explosive pressures were obtained by testing 12 experimental stoppings.

An explosion chamber of concrete, heavily reinforced, was constructed as part of the test equipment. One side of this chamber was open and was fitted to receive a test stopping which could be sealed in place to form a closed chamber. In making a test a stopping was subjected first to air pressures, slowly applied, and then to a series of pressures of increasing intensity produced by the explosion of charges of black powder until failure occurred. As the pressures

were applied measurements were made of the intensity of the pressures and of the deflection of the slabs. A report on the investigation was submitted to the Bureau of Mines, and the data obtained served as a basis for recommending methods of design.

Stevenson Creek, Calif., Experimental Concrete Arch Dam.—As a part of a general investigation of arch dams to develop a sound basis for design, Engineering Foundation sponsored the erection and testing of an experimental concrete arch dam at Stevenson Creek, Calif. The Foundation financed the investigation by contributions solicited from industrial organizations, and appointed a committee of engineers to plan and supervise the project. The bureau has for the past two years assisted by placing a member of its staff in charge of the testing.

The test dam, being 60 feet in height, is of sufficient size to fairly represent commercial structures. Since it was built for testing, unusual care was taken in construction to assure that the features of the dam would correspond to the design plans. Provisions were made during construction for installing the instruments required in the tests. A means for controlling, at all times, the amount of water in the pond formed by the dam was also provided. In spite of the magnitude of the dam and the lack of temperature control, the test procedure resembled a laboratory test in the care used to obtain reliable data.

Progress reports of the tests have been published in several bulletins of the Engineering Foundation. The tests of the dam have been completed, and a preliminary report containing a summary and an analysis of the test data has been prepared for the review of the committee of the foundation on arch dams.

Publications.—Some results from the Stevenson Creek Arch Dam test, W. A. Slater, Modern Irrigation, p. 22; June, 1927.

CERTIFICATION AND LABELING

Certification Plan.—An analysis of the status of the making and the utilization of specifications reveals the fact that many excellent specifications, well recognized throughout industry, are not being widely used at the present time because of the inability on the part of most purchasers to determine whether or not commodities delivered correspond to the specification requirements. A great impetus to the popularizing of the use of specifications can be given by eliminating this disadvantage to the small-quantity purchaser.

As a solution to the problem of eliminating the above-mentioned disadvantage and thereby facilitating the use of specifications, use is being made of the so-called "certification plan."

In carrying out this plan there are compiled lists of manufacturers who have expressed their desire to supply material in accordance

with certain selected specifications and are willing to certify to the purchaser upon request that the material thus supplied is guaranteed to comply with the requirements and tests of the specifications.

The certification plan has been, or is now being, applied to 151 United States Government master specifications. Lists of manufacturers willing to certify to compliance with 146 of these specifications have already been compiled, 75 of these lists have been placed in form for distribution upon request. These are lists of firms who have expressed to the bureau their desire to have their names placed on the lists of manufacturers willing, when requested to do so, to certify to the purchasers that material supplied in accordance with the designated 75 specifications complies with the requirements of these specifications and is so guaranteed by them. Represented on these 75 lists are 684 separate individual manufacturing firms; the manufacturers average 2.35 specified commodities each. The average number of "willing-to-certify" manufacturers on each list is about 21, the aggregate number of names on the 75 lists being 1,609.

The 75 specifications referred to are as follows:

Specification No.	Commodities covered
23.	Large tungsten filament incandescent electric lamps (being revised).
36a.	Fire-extinguishing liquid (carbon tetrachloride base).
37.	Leather belting (vegetable tanned).
52a.	Wood screws.
55.	Cut-out bases.
57.	Flexible nonmetallic tubing.
58.	Dry cells (being revised).
62.	Snap switches.
65.	Rubber-covered wires and cables for ordinary purposes.
80.	Coal-tar pitch for roofing.
81.	Coal-tar saturated rag felt for roofing and waterproofing.
82.	Surfacing materials for bituminous built-up roofing.
83.	Coal-tar pitch for waterproofing and damp proofing.
84.	Asphalt for mineral surfaced roofing.
85.	Asphalt for waterproofing and damp proofing.
86.	Asphalt saturated rag felt for roofing and waterproofing.
87.	Asphalt primer for roofing and waterproofing.
88.	Asphalt for unsurfaced built-up roofing.
123.	Flat glass for glazing purposes.
124.	Hand chemical fire extinguishers (1 quart carbon tetrachloride type).
175.	Knife switches.
183.	Upholstery leather.
184.	Lace leather (vegetable tanned).
191.	Brush, blacking, and dauber.
192.	Brush, casting.
193.	Brush, clothes scrubbing.
194.	Brush, cuspidor.
195.	Brush, dauber, long paddle.
196.	Brush, deck scrubbing.
197.	Brush, hand floor scrubbing.
198.	Brush, hair, military.
199.	Brush, radiator dusting.
200.	Brush, shaving.
201.	Brush, sidewalk.
202.	Brush, tooth.
203.	Brush, window.
204.	Broom, rattan push.
205.	Broom, rattan (upright).
206.	Broom, scrubbing.
207.	Broom, wire push.
208a.	Duster, counter.
213.	Hand chemical fire extinguisher (soda and acid type).
214.	Asphalt prepared roofing.
241.	Sole leather (vegetable tanned).
242.	Wrought-iron pipe (welded) (black and galvanized).

Specification No.	Commodities covered
275.	Road oil for hot application (type OH–1–25).
276a.	Asphalt for use in road and pavement construction.
277.	Petroleum asphalt for joint filler (squeegee or pouring method) (type PAF–1–25).
279.	Tars for cold application.
280.	Refined tar for hot application (type TH–1–25).
281.	Tar for use in repair work.
282.	Refined tar for construction.
287.	Tubing, copper, seamless, and pipe, copper, seamless, standard iron-pipe size.
291.	Friction tape.
292.	Rubber insulating tape.
294.	Asphalt-saturated woven cotton fabric for waterproofing.
295.	Asphalt-saturated rag felt for flashings.
296.	Slate surfaced, asphalt prepared roofing and shingles.
297.	Wire rope.
311.	Rigid conduit, enameled.
312.	Rubber gloves for electrical workers (for use in connection with apparatus or circuits not exceeding 3,000 volts to ground).
314.	Railroad track scales.
332.	Brooms, whisk.
333.	Brooms, corn.
336.	Builders hardware.
342a.	Pipe, brass, seamless, iron-pipe size, standard and extra strong.
343.	Cast-iron soil pipe and fittings, coated and uncoated.
347.	Lap welded and seamless steel boiler tubes.
349.	Lap welded charcoal iron boiler tubes.
362.	Liquid-measuring devices, retail type.
363.	Burglar-resisting safes.
380.	Cement, asphalt plastic.
411.	Tableware, silver-plated.
423.	Roofing, prepared, asphalt and asbestos, slate-surfaced.
424.	Roof coating, asphalt fibrous.

Labeling System and Checking Agencies.—To the extent that the certification plan will result in the standardization of such commodities as can properly be standardized, its benefits will be felt by those affected by standardization, either directly or indirectly, whether or not they make use of the certification plan themselves.

In addition to the public purchasers and institutional and other large-quantity buyers who can conveniently make use of specifications in accordance with the certification plan, there are numerous small-quantity purchasers who can not be expected to buy on specifications, but who should be permitted to share to the maximum possible extent in the well-known economies incident to "mass production" of the commodities bought by them. To this great group of buyers the best safeguard so far as quality is concerned is the "label" backed by a guarantee issued by a reliable inspecting and testing agency. To the "over-the-counter" purchaser who can not make use of written contracts in obtaining commodities, and who must depend upon the local merchants to supply his needs, the use of a label backed by a guarantee that means what it says is the most valuable and immediately available of the protective plans.

The maximum of benefit to all persons concerned will be obtained when the "nationally recognized specification" for a chosen commodity has been so formulated as to cover the most satisfactory

commodity in the best possible manner, when the manufacturers place this commodity in "mass production" in accordance with this specification, when the suppliers issue their certificates guaranteeing compliance with this specification, and when "guarantee-labeling" establishments base their tests and inspections on this identical specification. The conditions here outlined are being realized with a few commodities at the present time.

In the establishment and maintenance of "acceptable lists of manufacturers" (or their equivalent), trade associations, inspection bureaus, testing establishments, and guarantee labeling organizations can render a real service to both the producers and the consumers.

There are several ways in which industry, through representative trade associations and similar organizations, can become very active in the certification plan for promoting the use of nationally recognized specifications and of the labeling system for extending its benefits to small-quantity purchasers and "over-the-counter" buyers.

(*a*) First of all is publicity, by means of which the industry will be made acquainted with the real significance of the undertaking and shown the benefits to be derived from the plan.

(*b*) Second, but of no less importance than the first, is thorough cooperation in the preparation of specifications that can most properly be referred to as nationally recognized.

(*c*) Next is cooperation in the plan by inducing all of the members of the association to have their names included in the list of manufacturers willing to certify to the purchaser that the commodities supplied by them under nationally recognized specifications have been tested and found to comply with these specifications.

(*d*) Trade associations, representing either dealers or manufacturers who reach consumers through retailers, can be of much help in showing the dealers and retailers how they (as both purchasers and sellers) will benefit from the plan, especially when accompanied by an effective labeling system.

(*e*) A final step for the trade association to take, when the time seems ripe for it to do so, is to make sure that its members are keeping faith so far as the certification and labeling are concerned.

CHEMISTRY

Standard Samples for Analysis.—In many industries the purchase of materials, process of manufacture, and sale of the manufactured product are controlled by analysis and by the use of instruments, such as pyrometers and saccharimeters. Oftentimes the analysis is difficult because of the chemical complexity of the substance under test, and but little time is available for checking all steps of the method that is used. If an instrument of uncertain performance is used, defective products may result and thousands of dollars may be lost.

In such cases the simplest and at the same time the best safeguard lies in the use of standard samples. If, for example, a standard and a sample of the material under test are analyzed at the same time and under practically identical conditions, and results are obtained for the standard corresponding to those shown on the certificate, the presumption is strong that the figures obtained for the unknown material are equally accurate. Wide divergence from the certificate values shows at once something radically wrong, such as an improper method of analysis or faulty reagents. Thus, in the simplest possible manner and in the shortest possible time, a large number of variable factors have been simultaneously investigated with almost the same result as though each had been taken up separately.

Theoretically, there should be provided for the analyst as many standard samples as he has different kinds of material to deal with. It is obviously impossible to prepare and issue standard samples of all such materials. The Bureau of Standards has, however, endeavored to prepare samples that are representative of different groups, and such substances as are needed for the standardization of solutions and the calibration of instruments. The list now includes 77 samples of such diverse materials as limestone, feldspar, fluorspar, bauxite, and phosphate rock; ores of molybdenum, zinc, manganese and iron; glass; cast irons; plain carbon steels, such as basic and acid open-hearth, Bessemer and electric; alloy steels; ferro-alloys; brass, bronzes, and bearing metals; metals of certified melting points; cements for testing sieves; and chemicals for oxidation, reduction, acidimetric, saccharimetric, and calorimetric values. The complete list, together with analyses, prices, and other information, is given in the supplement to circular No. 25, which can be obtained free of charge upon application to the Bureau of Standards.

The principal uses of the bureau's standard samples can be summarized as follows:

1. In checking methods of analysis and in standardizing solutions that are used in controlling the manufacture of certain metallurgical and agricultural products.

2. In the settling and avoiding of disputes between buyers and sellers. Such disputes very frequently arise through the selection of inappropriate or faulty methods of analysis by one of the chemists, and the analysis of a standard sample usually brings these to light before the case comes to court.

3. In standardizing calorimeters for gas and coal tests and polarimeters for sugar tests.

4. In standardizing pyrometers for use in the annealing of steels, alloy steels, and other metallurgical products.

5. For checking the sieving value of sieves used in the cement industry.

6. In investigating improved and more rapid methods of analysis.
7. In research work in educational institutions.

Standard Methods of Analysis.—In cooperation with the American Society for Testing Materials, tests were made of the standard methods that are recommended by the society for checking the chemical requirements given in its specifications for cast iron, steels, resistance alloys, and light aluminum alloys. Standard analyzed samples of the latter are now in preparation. The bureau also cooperated with the standardization committee of the glass division of the American Ceramic Society in the development of methods for the analysis of glass sand, and has prepared standard analyzed samples of glass sand, dolomite, soda-lime glass, and lead-barium glass.

Publication.—The analysis of soda-lime glass, G. E. F. Lundell and H. B. Knowles, J. Am. Cer. Soc., **10**, p. 829; 1927.

Physical Constants of Chemical Substances.—A critical survey and analysis has been undertaken in order to improve methods for purifying chemical substances and criteria for determining their purity.

Publication.—Constancy of pressure during isothermal condensation or vaporization as a criterion for purity, E. W. Washburn, Zeitschr. f. Physikalische Chemie (Cohen-Festband); 1927.

Heat of Formation of Sulphur Dioxide.—An improved method and apparatus have been developed for determining this physical constant.

Publication.—Determination of Sulphur Trioxide in the Presence of Sulphur Dioxide, Together With Some Analyses of Commercial Liquid Sulphur Dioxide, J. R. Eckman, B. S. Sci. Paper No. 554.

Phase Equilibrium Diagram for the System SiO_2–Al_2O_3–ZnO.—A special furnace enabling the investigation of high temperature equilibria up to 2,300° C. in an oxidizing atmosphere has been devised. The diagram for the binary system SiO_2–ZnO has been largely completed.

Publication.—A Weight Burette for the Micromeasurement of Liquid Volumes, Martin Shepherd, B. S. Sci. Paper No. 555.

Specifications for Analytical Reagent Chemicals.—The bureau's activity in this field takes the form of cooperation with the American Chemical Society's committee on analytical reagents, a committee which is made up of two representatives of reagent manufacturers and one each from the United States Geological Survey, the Bureau of Chemistry and Soils, and the Bureau of Standards. The bureau's share in the work has been the critical study of many of the methods of test which are to be prescribed in the specifications. Specifications for 37 chemical reagents were published prior to 1927; 13 more appeared in the May, 1927, issue of Industrial and Engineering Chemistry; and additional specifications appeared in the December

issue. This is a continuing project and other specifications will be prepared and issued next year.

Recommended Specification for Petroleum Distillate for Use as a Dry-Cleaning Solvent.—In cooperation with the National Association of Dyers and Cleaners and with petroleum producers and refiners, a recommended specification has been formulated for a satisfactory dry-cleaning solvent of improved quality, that will reduce the fire hazards in the industry.

CLAY AND SILICATE PRODUCTS

Investigation of Feldspar and Its Effect in Pottery Bodies.—The primary object is to obtain the necessary data to make possible a better understanding of the inherent physical and chemical properties of individual feldspars in order that they may be used more intelligently by the manufacturer and also to assist him to purchase materials of desired characteristics on specification.

The determinations made during the year, together with those completed previously, seem to justify the following conclusions: (1) The residue of the commercial ground feldspars used on the No. 200 sieve varied approximately from 0 to 7 per cent; on the No. 325 sieve from 3 to 15 per cent, and by air elutriation (0.02 mm separation) from 32 to 55 per cent. (2) The variation in screen analyses made independently by various laboratories may differ sufficiently to make specifications to closer than ± 0.5 per cent of little significance. (3) That differences in chemical analyses are sufficient to justify a more extensive and cooperative investigation to determine the cause and control of present variations and the accuracy which can be expected with recognized good analytical methods. (4) Results indicate that refractoriness increases, and the softening range decreases, with increase in K_2O. (5) Softening points range from that of cone 4 for soda feldspar to that of cones 9 to 10 for potash feldspar. Average variations of one cone can be expected in the results of different laboratories, particularly when different methods are followed. (6) True specific gravity of crystalline feldspar ranges from 2.635 for a commercially pure soda feldspar, to 2.572 for a commercially pure potash feldspar. (7) The porosity of "semivitreous" bodies is highest when using feldspars of intermediate K_2O content and the volume shrinkage of vitreous bodies decreases with increase in the K_2O content of the feldspar used. (The results are somewhat erratic and, although consistent, should be checked.) (8) Feldspar has no discernible effect on the color of the body by reflected light. (9) The translucency of vitreous bodies increases (the soda spar body excepted) with increase in the K_2O content of the feldspar used. (10) Mechanical strength is affected more by the method of firing than by the feldspar. (11) The thermal expansion is increased by rapid firing and by increased Na_2O content of the feldspar.

The quantitative method of analyzing feldspar by means of the polarizing microscope has been described in detail in a paper and published.

Publications.—The quantitative microscopic analysis of commercial feldspar, Herbert Insley, J. Am. Cer. Soc., **10,** No. 9, p. 651; September, 1927.

Bureau of Standards Investigation of Feldspar, Second Progress Report, R. F. Geller, J. Am. Cer. Soc., **10,** No. 6, p. 411; June, 1927.

Problems Relating to Sagger Clays.—This problem has been divided into two parts, the first of which has been confined to a study of the characteristics of 51 clays, representing, as well as could be judged, all the important sagger clay mining districts of the country. By this study it has been possible to classify the clays into five groups, and to use only a limited number of clays representative of each group for further investigation. It was also found that according to thermal expansion behavior there existed two distinct types of clays. The work of the past year has been confined to a further intensive study of 17 clays representative of the five groups. This study embraced the modulus of elasticity, modulus of rupture, and maximum fiber elongation of the clays at several temperatures ranging up to and including 1,000° C. The results obtained may be summarized as follows: (1) The modulus of elasticity of the majority of clays was found to increase when tested at 750° C. as against values obtained at room temperature, but at 1,000° C. they were found to have a much lower modulus of elasticity. The modulus of rupture of the majority of clays was found to be greater at 1,000° C. than at lower temperatures. (2) Although the softening point, in cones, of the clays included in the present phase of the investigation ranges from 14 to over 33 (Orton pyrometric cones), all clays showed plastic deformation at 1,000° C. with a load causing a stress of approximately 30 lbs./in.^{2} applied centrally to a 1 by 1 by 12 inch specimen on a 10-inch span. (3) The chemical analyses gave only a very general indication of the elastic recovery and plastic flow properties of the burned clays at 1,000° C. (4) The results indicate that under the conditions of this test all those clays having a softening point of over cone 30 show little variation in plastic flow, while those having a softening point of cone 30 or less show a greater flow (as a group). (5) An empirical formula was developed, using data obtained at elevated temperatures (750° C. and below) which gives an indication of the relative resistance of saggers to failure due to thermal shock.

Publication.—III. Progress report on the investigation of sagger clays: Their elasticity and transverse strength at several temperatures, R. A. Heindl and W. L. Pendergast, J. Am. Cer. Soc., **10,** No. 7, p. 524; July, 1927.

Physical Properties of Clay Bodies as Affected by the Drying Treatment.—A new method has been devised which it is believed

makes possible the complete determination of the rates of water flow and of the values of the water concentration and shrinkage gradients at any points within the drying clay body at any time during the drying process. Comparisons of the drying data secured on two clays differing widely in required drying time show much steeper water concentration and shrinkage gradients occurring in the more difficult drying clay during the earlier and critical stages of the drying process, and especially in the outer 1 inch of the drying material. The data indicate that to resist injuries during the drying process the material should have a high water conductivity and hence a resultant low shrinkage gradient, and that the time required for satisfactory drying is roughly proportional to the percentage of the total water of plasticity which must be evaporated before the internal shrinkage gradient reaches its maximum value. It has also been found that, in general, fire clays require more careful treatment and a longer drying time than do shales.

COMMERCIAL STANDARDS

Although in operation only since November 1, 1927, the procedure provided to assist industry in the promulgation of nationally accepted specifications has received encouraging support as indicated by consummation of two projects and requests for several others. About 16 projects are in various stages of initiation and organization.

Concrete Reinforcement Bars.—Commercial Standard No. 1.—New Billet-Steel Concrete Reinforcement Bars recommends the adoption of the intermediate grade given in A. S. T. M. specification A15–14 as the commercial standard which will be produced and stocked regularly, and upon which consumer requirements will be concentrated as far as practicable.

Dry Cleaning Solvent.—The second commercial standard is a specification for dry-cleaning solvent sponsored by the National Association of Dyers and Cleaners to improve the quality of that commodity; to reduce the fire hazard, and permit evaluation of competitive bids. This solvent is known to the industry as "Stoddard Solvent" in honor of the man who is chiefly responsible for its development (W. J. Stoddard). A conference representing producers and organized consumers voted to have the standard used as a basis for operation of the certification plan.

CORROSION

Corrosion Testing Methods.—Accelerated corrosion tests which can be used in specifications with some assurance that the life of a metal in service will be correctly indicated by the test are much needed, but satisfactory tests are not yet available. Cooperation with the American Society for Testing Materials in its extensive

program of exposure tests on zinc-coated sheets is related chiefly to the correlation of accelerated laboratory tests with exposure results.

Even more exhaustive laboratory work has been required in the cooperative work with this society on corrosion methods for nonferrous metals, and the research program has been extended beyond that of the society to a study of electrolytic corrosion methods and to the comparative study of various test methods on a series of alloys of copper and nickel, in a variety of corrosive solutions. The results place the metals and alloys in different orders of excellence, depending upon the sort of accelerated test used. No single short-cut test can yet be adopted for specification purposes, and it is increasingly evident that the test chosen must be so conducted as to reproduce as closely as possible the variables and the conditions met in the particular type of service for which evaluation of metals and alloys is sought.

Publications.—The ferroxyl reagent in the laboratory study of corrosion, H. S. Rawdon, Min. and Met., **8**, p. 229; 1927.

The Intercrystalline Corrosion of Metals, H. S. Rawdon, Ind. and Eng. Chem., **19**, p. 613; 1927; Metal Ind. (London), **30**, p. 647; 1927.

Principles of electrolytic studies on corrosion, W. Blum and H. S. Rawdon, Preprint 48, May, 1927, meeting, Am. Electrochem. Soc.

The Effect of the Testing Method on the Determination of Corrosion-Resistance, H. S. Rawdon and E. C. Groesbeck. (B. S. Tech. paper, in press.)

DENTAL MATERIALS AND METHODS

There are few professions suffering from deficiencies of standards as seriously as is the dental profession. Textbooks and other literature are often in disagreement on important items on which there should be agreement.

In most instances dental restorations require the most exacting accuracy, the highest mechanical properties of materials, and by reason of the restricted areas available the most careful design and execution of the restoration. The dentist must be a designing and construction engineer of the highest type if he is to serve the public in an efficient manner. Despite all these requirements, there are practically no standards of quality upon which he may base his selection of material. Figures can not express the losses in health nor the distress and helplessness of many millions of our population who are suffering from defective dentistry.

The National Government has recognized the possibility of rendering efficient service in this field and is now engaged in establishing the physical properties of dental materials. Helpful cooperation has been received from a number of Government departments.

An exceptionally valuable cooperative arrangement has been in force for several years with a dental research laboratory (the Weinstein Research Laboratory, of New York City), and a similar research

in cooperation with the American Dental Association will soon be undertaken. Tests are being made to find causes of failures. It is necessary to find to what extent defective materials, improper usage, and adaptation of materials are responsible for the failures, and what can be done to improve the art of dental restoration.

A Federal specification has been adopted covering the properties required for an amalgam alloy (Federal specification No. 356) and is now in use by the Government. Dental schools are preparing to test materials according to this specification. Decided improvements have been made in amalgam alloys since the bureau published its findings in this field.

The gold-alloy restorations offer a far greater opportunity for service in standardization. Materials are now selected in this field without adequate knowledge of their properties, price and claims often being the deciding factors.

The bureau, in cooperation with departments of the Government using dental golds, has prepared a tentative specification for the gold alloys which may serve until a completed specification is available. The following table shows the more important items covered in this tentative specification. An official of one foreign Government acquainted himself with the work and has adopted a similar research in his own country.

Tentative specifications for dental casting gold alloys, lingual bars (wrought), clasp and orthodontia wires

Use	Assay		Fusion temperature (minimum)	Brinell hardness number			Proportional limit, oven cooled (minimum)	Ultimate tensile strength, oven cooled (minimum)	Elongation, 2-inch gauge length	
				Quenched		Oven cooled (minimum)			Quenched (minimum)	Oven cooled (minimum)
	Gold, silver, and platinum group (minimum)	Silver (minimum)		Minimum	Maximum					
	Total per ct.	*Per ct.*	*° C.*				*Lbs./in.²*	*Lbs./in.²*	*Per cent*	*Per cent*
Inlays (soft)	90	4	925	35	65	------	----------	----------	15	--------
¾ crowns, hard inlays, soft saddles	90	----	925	90	140	------	25,000	45,000	5	2
Cast clasps, bars	85	----	900	------	------	------	72,000	90,000	3	1
Single-piece castings, hard saddles	80	----	875	------	------	175	72,000	90,000	3	1
Single-piece castings of lower precious metal content	76	----	840	------	------	------	64,000	80,000	2	1
Clasp and orthodontia wires (wrought)	85	----	925	------	------	------	----------	120,000	9	4
									Cold bends	
Lingual bars (wrought)	75	----	875	------	------	185	----------	----------	2	1

NOTE.—In all cases the color is on sample.

Publications.—Selections of dental materials, Wilmer Souder, J. Am. Dental Assoc.; February, 1927.

Physical properties of dental materials, R. L. Coleman, Dental Cosmos; October, 1927.

Tests and properties of dental amalgams, Wilmer Souder, J. Dental Research; June, 1927.

Specifications and tests for dental gold alloys, Wilmer Souder, J. Am. Dental Assoc. (in press).

ELECTRICITY

Electrical Resistivity of Metals.—The electrical resistivity of platinum, zinc, cadmium, nickel, aluminum, thorium, and beryllium has been determined. The samples of platinum, zinc, cadmium, and nickel were of exceptionally high purity, while the samples of thorium and beryllium were of as high purity as was obtainable.

Determination of the Ampere in Terms of Mechanical Units.—The Rosa-Dorsey current balance was reassembled and a comparison of an electric current with previous values was made on the assumption that the standard resistances and standard cells have remained constant. As the result agrees within experimental error with that found 15 years ago, the assumption of the constancy of the resistances and cells is justified.

Determination of the Henry in Terms of Mechanical Units.—The absolute determination of the henry (the unit of inductance) is based on the construction of a coil whose inductance can be computed from its dimensions. The measurement of capacitance has been carefully studied and a paper published by H. L. Curtis and C. Moon on "The Absolute Measurement of Capacitance by Maxwell's Bridge." Some study has also been made of the inductance measurement. Some preliminary measurements give a result for the ratio of the c. g. s. henry to the international henry which is, within the limit of experimental error, the same as has been found at the National Physical Laboratory and the Physikalisch-Technische Reichsanstalt—viz, 1 international henry = 1.0005 c. g. s. henry.

Standardization of Magnetic Permeameters.—The standardization of magnetic permeameters offers peculiar difficulties because the absolute methods of measurement, heretofore accepted as standard, are extremely sensitive to the conditions of test and especially to the effects of nonuniformity in the specimen. For this reason particular care must be exercised in the choice of specimens and conditions of test in standardization work. This fact has long been recognized in a general way, but it is doubtful if the magnitude of the effects has been fully recognized. In the interest of uniformity in magnetic testing, both from the commercial point of view and in connection with investigations of a scientific nature, it is of considerable importance to establish the accuracy of the permeameters and testing methods used. For this reason, a comprehensive investigation has

been made of the effect of various factors affecting the accuracy of magnetic measurements with special reference to the selection and preparation of specimens to be used as magnetic standards. The results of this investigation are given in a paper on magnetic standards and the calibration of magnetic permeameters now in preparation.

Magnetic Measurements on Sheet Steel.—Sheet steel known to the trade as electrical sheet is particularly nonuniform in its magnetic properties, and the choice of a testing method which will give consistent and reproducible results on this type of material is of considerable commercial importance. The results of an investigation of this subject are given in Bureau of Standards Scientific Paper No. 545, "The Determination of the Magnetic Induction in Sheet Steel," by R. L. Sanford and J. M. Barry.

Standard Cells and the International Volt.—The preparation of pure materials including mercury, mercurous sulphate, cadmium sulphate, and the cadmium amalgam has been actively in progress. Two groups of cells, including both neutral and acid cells, have been prepared. The mean value for these cells agrees closely with the defined value of the Weston normal cell when measured in terms of the bureau's basis of reference. The preparation of new cells is an important means of checking the accuracy of our standards for electromotive force, and it is planned that similar groups shall be prepared each year.

An intercomparison of the American standards of voltage with those of England and Japan has been undertaken. The comparison with the English national laboratory has been completed and the results show an agreement to within about ten-millionths of a volt.

A new form of certificate for standard cells has been prepared and put in service. This certificate is designed to give more information relative to the proper use of standard cells than has previously been available to the public. Since the fundamental standard for the volt maintained at the bureau is made available to the power companies, manufacturers, public utility commissions, and others through the certification of the unsaturated cells, it is important that the bureau should give this information to each user as well as the voltage of his cell.

In order to check the bureau's value for the unit of electromotive force, work has been begun on a redetermination of the ampere by means of the silver voltameter. Apparatus formerly used for this work is being reconditioned for these experiments.

Standardization of Tests for Dry Cells.—On account of changes in the use of dry cells and improvement in their quality, some modifications of the tests previously employed have become necessary. The bureau made simultaneous tests using specifications previously published and new tests formulated in cooperation with the manufacturers and large users of dry cells. Data have been obtained from

which it is possible to decide the proper minimum requirements for these batteries under the new tests. The qualification testing of dry cells which is done in connection with Government purchases has been continued. One of these tests was finished during the year 1927 and two additional qualification tests begun. These tests, which are made with the cooperation of about 20 manufacturers, have proved of value both to the Government and to the manufacturers. Dry cell tests require considerable time for completion, but it is now possible for the bureau, on the basis of the qualification tests, to inform promptly any department requesting information whether any particular brand of dry cell or battery complies with the Government specifications. The interest of the manufacturers in these tests has been made evident by their repeated requests to be included in each succeeding test. Sample batteries for these tests are taken by a representative of the bureau who calls at the factory and selects the batteries from those which are being made at that time. The bureau's testing equipment has been modified to permit making tests in accordance with the revised specifications.

Standardization of Storage Batteries.—Experimental work directed toward the standardization of storage batteries of various types and the preparation of specifications for them has been carried on. Particular attention has been given to the effect of temperature of the positive and negative plates of batteries when subjected to the low temperatures encountered at high altitudes. A study of the materials used in the manufacture of storage batteries has also been undertaken, including the measurement of the physical and chemical properties of the oxides and the materials used for battery jars.

FIRE RESISTANCE

Fire Resistance of Wall Constructions.—Fire tests of brick walls and hollow tile walls were completed during the year, the final tests being of walls that had been seasoned by accelerated methods to constant weight before testing. As tested after seasoning under room conditions for 30 to 60 days, the walls contain more free water than would be present in interior party and fire walls after some years of service in heated buildings. When subjected to fire on one side, the contained moisture retards the temperature transmission through the wall. The dried walls gave fire resistance periods, based on the time required for temperatures high enough to ignite combustible materials to be reached on the unexposed side, from 15 to 35 per cent lower than for the normally seasoned walls, the difference being most marked for the heavier walls.

Pending publication of the results of the whole series of tests, general results have been made available through progress reports,[8]

[8] Summary of results of fire tests of hollow load-bearing wall tile, by H. D. Foster, Proc. Ninth Annual Meeting, Hollow Building Tile Association, 1927, pp. 112-125.

letter circulars,[9] and direct contact with States, cities, and other bodies formulating or revising building codes, and have assisted materially in securing uniformity in standards of regulation and design consistent with the performance shown in the tests.

Intensity and Duration of Building Fires.—The object of these tests is to develop information on the basis of which reliable estimates can be made of the severity of fires, interpreted in terms of the fire exposure in the standard fire test, that can arise with typical constructions and occupancies involving given amounts of combustible materials per unit of floor area. This will enable protection requirements, such as those for structural members, wall openings, and record containers, to be placed on a more definite basis than formerly has been possible. The tests completed up to this time have been of office occupancy housed in fire-resistive structures with wood or steel desks, filing cabinets, and shelving. A note describing the tests was included in the Standards Yearbook for 1927. Those conducted during the present year have been concerned with methods of reducing the severity of fire from concentrations of materials in office buildings, such as in record rooms. While the ordinary occupancy with wood desks and filing cabinets was found to give a severity equivalent to not more than the first two hours of the standard fire test, even where representative of congested conditions giving a combustible content of 20 pounds per square foot of floor area, the record room with wood shelving and combustible content of 50 to 60 pounds per square foot, gave equivalent fire durations of six to eight hours. This is somewhat beyond the fire resistance of the types of construction and protections used in office buildings. The tests with equivalent amounts of records on metal shelving open on all sides indicated a considerable decrease in severity even with poorly braced shelving that collapsed after the fire had attained a given intensity. Further tests with shelving giving metal inclosure on all sides except the front, indicated less opportunity for spread of fire from small origins, although under favorable conditions, a fire spread involving the whole room contents was obtained. However, no collapse of shelving occurred. The room has been fitted for a final test with similar shelving where the fire will be given an exposure start, to duplicate conditions obtaining in a previous test with wood shelving.

Fire Tests of Roofing Materials.—In efforts to decrease the community fire hazard most municipalities impose restrictions on the kind of roofing materials permitted within the city limits or certain portions thereof. The scope of such restrictive measures has occasioned much dispute and at the request of organizations representing producers and users of roofing materials, a comprehensive series of tests of the fire resistance of all prepared roofing materials in ordinary

[9] Letter Circulars Nos. 228 and 229 on fire resistance of clay, concrete, and sand-lime brick walls.

use was undertaken, and it has been completed during the present year. This has included tests of new and weathered wood shingles and asphalt prepared roll roofing and shingles, slate, asbestos, metal, and tile roofings. Tests have also been made of painted and chemically treated wood shingles, both new and after exposure to the weather for periods up to 12 years. Specimens of weathered wood shingle roofs covered with asphalt prepared roll roofing and shingles or with paint coatings have also been tested.

For the combustible roofings the fire resistance of the weathered roofings was generally considerably below that of the newly applied materials, although some forms of asphalt roofings showed little decrease in fire resistance after weather exposures up to 12 years. Results of the tests also emphasize the general superiority from the fire-resistance standpoint of incombustible roofing materials, such as slate, cement, asbestos, clay and concrete tile, and metal.

The results of the tests are being prepared for publication in the Bureau of Standards technologic series. Copies of a preliminary report giving the results of tests with new roofings have been supplied to the officials of a number of cities who requested them in connection with the adoption of roofing ordinances.

ELECTROLYSIS TESTING

The 1921 report of the American Committee on Electrolysis, in the preparation of which the Bureau of Standards took an active part, pointed out several lines of investigation which needed further study. The bureau has done considerable work on some of them, and as a result of this work a new method of electrolysis testing has been developed. This method consists in measuring the intensity of discharge of current from a portion of a pipe line, which factor is the one most directly related to the rate of corrosion. These measurements are made with a new instrument developed at the bureau and called the earth-current meter. Experience with the new method indicates that the older methods do not directly determine the hazard of buried structures, and that under certain conditions some of the tests lead to erroneous conclusions.

It has seemed desirable, therefore, to issue a paper in which the various electrolysis tests are discussed in the light of the most recent data concerning them, and such a paper has been published as Technologic Paper No. 355, "Electrolysis Testing," by Burton McCollum and K. H. Logan. The older methods of determining general electrolysis conditions are first discussed and then a detailed description of the new apparatus and methods for studying local conditions is given. This is followed by a description of tests for determination of track conditions and a discussion of the interpretation of electrolysis data.

A more detailed description of the earth-current meter and its use has been published as Technologic Paper No. 351, "Practical Applications of the Earth-Current Meter," by Burton McCollum and K. H. Logan. The instrument and accessories permit the determination of the resistivity and potential gradient of the soil adjacent to a pipe. A formula is developed for determining the rate of discharge of current by the pipe from these data. The formula involves a constant determined experimentally, and the method of determination of this constant is described in the paper.

Instructions are given for the several uses of the apparatus. The care of the instrument and the precautions necessary for obtaining reliable data are discussed. In the last part of the paper the interpretation of data is considered and the results of field work are quoted to show that the earth-current meter gives more reliable information regarding electrolysis conditions than can be obtained otherwise.

GAS ANALYSIS

Fuel Gases.—An extensive investigation of the behavior of water heaters was carried out in cooperation with the testing laboratory of the American Gas Association in order to establish specifications for these appliances.

Members of the bureau staff have served on four of the committees of the American Gas Association which are engaged in the drafting of specifications for various types of appliances and their installation. These committees have completed the preparation or revision of several specifications of national scope within the industry.

The various factors relative to burner design and service conditions at the burner when using different fuel gases are being investigated, a large amount of work having already been carried out with Washington City gas and with propane. It is the purpose of this work to determine the best form of construction of domestic burners for each condition of gas service, and thereby to assist the gas industry in the determination of such standards as will result in the most satisfactory gas service to each community.

A theoretical study of the characteristics of flames for the purpose of adapting the results to the investigation of gas burners and appliances has been in progress. Such knowledge becomes essential in order to anticipate the behavior of these appliances when various fuel gases are used.

A review of the entire literature relating to the economic factors involved in the production of water gas from both coke and coal has been made and should be of considerable value to public utility commissions.

A thorough investigation of primary importance has been that of the probable effects of a change in the heating value standard for gas

in a certain state, particularly with reference to the engineering results obtainable in the manufacture of the gas.

Formal testimony has been given before two State commissions having under consideration changes in their existing standards. One case has been decided in accordance with the recommendations made by the bureau. The other is still undecided. Informal discussion of service standards has been supplied on their request to several States and municipalities.

Gas Analysis.—A thermal conductivity apparatus for determining both carbon dioxide and oxygen in respired air has been developed. Because of the rapidity with which determinations can be made, this method is expected to find extensive application among physicians for the diagnosis of physiological conditions. A paper describing this work, entitled "An adaptation of the thermal conductivity method to the analysis of respiratory gases," by Paul G. Ledig, of the bureau, and Richard S. Lyman, of the school of medicine and dentistry, University of Rochester, who cooperated in the work, was published in the October, 1927, issue of the Journal of Clinical Investigation.

Studies of the separation of gas mixtures by fractional distillation at low temperatures and pressures have been productive of several new methods for the separation of natural gases with especial reference to the determination of natural gasoline fractions. A commercial apparatus was designed and has been used successfully in industrial laboratories. This work was a continuation of that undertaken for the purpose of determining the best standard method for indicating the amount of gasoline in natural gas for the purpose of establishing the value of a natural gas supply in commercial transactions, and also to establish a standard by which the efficiency of recovery of the gasoline might be judged.

A semicommercial fractionating column was designed for the critical study of the composition of petroleum oils and waxes.

Publication.—A Burette for the Accurate Measurement of Gas Volumes Without Gas Connection to a Compensator, E. R. Weaver and Martin Shepherd. B. S. Sci. Paper No. 559.

GLASS AND GLAZES

Composition and Physical Properties of Glass.—This work is being carried on with the assistance of the Navy Department to determine the conditions affecting the quality of optical glass during melting, molding, and annealing. For this purpose the bureau makes all the glass pots used from carefully selected clays, blended to give a refractory body that will best resist the corrosive action of the molten glass. The glass is made from commercial raw materials, as pure as can be obtained, which are carefully mixed before melting in the proportions required to produce a glass of the desired index of refraction and dispersion.

During the past year five different kinds of glass were made as follows: Borosilicate crown, light barium crown, barium flint, medium flint and dense flint, the indices of refraction and dispersion being respectively, 1.517–64.0, 1.574–57.7, 1.605–43.3, 1.620–36.6, and 1.650–33.0. As a result of this work approximately 22,500 optical blanks of various shapes and sizes, weighing about 2,600 pounds, have been delivered to the Naval Optical Shop to be used as replacements and in the construction of new optical instruments.

The annealing of glass for ordinary optical purposes does not present great difficulties, but for instruments of the highest precision exceedingly great care must be taken to eliminate temperature gradients in the annealing furnace. This conclusion is based on index of refraction measurements of six "fine-annealed" blanks, obtained for making the objectives of a high precision spectrometer. These measurements showed deviations from the average as large as $37 \times (10)^{-6}$. Before reannealing the glass to reduce this variation if possible and at the same time to maintain the same average index of refraction, it was necessary to determine the temperature at which it had been previously annealed. This was accomplished by heat absorption and index measurements on a piece of one of the blanks which indicated that the glass had been annealed at approximately 485° C. After reannealing at this temperature with some precautions to eliminate temperature gradients, the deviation from the mean was reduced to $12 \times (10)^{-6}$, with but slight change from the original average index of refraction, and this was further reduced to $3 \times (10)^{-6}$, or one-twelfth the original deviation in the second reannealing when very great care was taken to reduce temperature gradients to a minimum.

Study of Glazes.—This investigation is a study of certain properties of glazes, particularly modulus of elasticity, tensile strength, coefficient of expansion, and the so-called "after working" of glass, to determine the relationships between these physical properties and the chemical composition of the glazes. The properties referred to are thought to be an index of conditions in a glaze which lead to crazing, shivering, etc.—defects which are of paramount importance.

In beginning the work, considerable experimenting was necessary to get the glazes into such shape that these properties could be determined. The method finally adopted was to fuse the glaze batch completely and then draw it out into rods. This gives a glaze thickness of uniform composition while the same glaze adhering to a body doubtless differs somewhat from body to face. Various representative glazes are being studied and the effect of various oxides entering into the batch evaluated and factors worked out enabling the calculation of certain of the properties.

A part of the investigation incidental to the other work led to an examination of glazes attached to bodies for type of strain. While the examination has been quite limited in extent, results so far show that a glaze which has crazed is under tension while one free from the defect is under compression. Some glazes which have run and streaked show a variation in the type and amount of strain.

Resistance of Ceramic Glazes to Abrasion.—Glazes on whiteware often become scratched, abraded, and otherwise disfigured while the ware is still mechanically serviceable. The problem was investigated by the bureau and the principal features of the investigation were: (1) The development of a suitable method for determining glaze hardness. (2) The determination and comparison of the hardness of commercial brands of chinaware. (3) The study of the effect on glaze hardness of variations in composition, thickness, firing temperature, and body used. A description of the apparatus used and the results obtained has been published.

The following conclusions were reached as a result of the study: (1) The glarimeter method gives results, sufficiently consistent to be used for research and other work which requires a high degree of accuracy in the measurement of surface abrasion. (2) An "alternate method" described for determining glaze resistance is sufficiently accurate, simple, and rapid for plant control. (3) The average resistance of the foreign ware was higher than that of the domestic, and the variation from the average was, in general, less. (4) The data are insufficient to justify definite conclusions regarding the effect of varying SiO_2 and Al_2O_3 content. (5) The resistance of well-matured glazes is inversely proportional to the thickness. (6) The resistance decreases as the tendency to matt increases. (7) For the two temperatures used, the resistance is markedly increased by the higher glost fire. (8) Glaze composition and temperature of glost fire affect resistance more than does the type of body used.

Publications.—A preliminary study of the resistance to abrasion of ceramic glazes, its control and methods of determination, A. C. Harrison, J. Am. Cer. Soc., **10,** No. 2, p. 77; February, 1927.

Effects of Typical Enamels on Colors Obtained With Various Stains.—The demand for colored vitreous enamaled ware is growing rapidly, as evidenced by the increasing number of advertising signs, restaurant fixtures, stove parts, and other articles enameled in color. The literature is meager in references on this subject, and the bureau undertook a study of some of the compositions and processes involved in the production of colored enamels by grinding stains with the enamel frit.

The following is a brief summary of the findings: The best results were obtained when the stains were ground to pass a No. 200 sieve after calcination. Removal of soluble matter from the calcined

stains, through washing by decantation with hot water, tended to prevent a spotty appearance of the fired enamels. The time and temperature of calcination of the stains, and furnace atmosphere as affected by adjustment of the gas flame, had to be duplicated in order to duplicate the shade of color obtained with a given batch composition. Substitutions of silica and feldspar in the batch, one for the other, produced little effect on the resulting shades except that (*a*) in the presence of zinc oxide an increase in silica at the expense of feldspar resulted in a darker shade, and (*b*) the tendency of sodium antimonate to produce a dark shade was accentuated by the substitution of silica for feldspar. Lead oxide in the frit had a distinct tendency to darken the shade obtained with a given stain, an effect which was most noticeable with selenium-red stains. These red stains were also more sensitive to other factors than the remainder of the stains studied.

Publications.—A preliminary study of ceramic colors and their use in vitreous enamels, W. N. Harrison and T. D. Hartshorn, J. Am. Cer. Soc., **10,** No. 10, p. 747; October, 1927.

Effects of Composition on the Properties of Ground Coat Enamels for Sheet Steel.—The relative narrowness of the range of compositions, which includes most commercial enamels, led to an investigation to determine the effects of greater changes in composition than have heretofore been attempted. One phase of this study was confined to finish coats, but the phase reported here concerns ground-coat enamels. A series of ground-coat enamels was developed about each of three refractory bases, one of which consisted of flint plus feldspar, another of feldspar only, and a third of flint only. The variable portion in each series was made up of equal parts of 3 constituents commonly used in enameling, chosen from a total of 6 in such a way that every possible combination was used, making a total of 20 enamels in each series. All were tested for resistance to mechanical and thermal shock, and the various ingredients compared by analysis of the results of these tests. In general, the ingredients which received the best ratings were flint in the refractory portion, and sodium oxide in the variable portion, constituted of fluxes. Also, boric oxide favorably influenced resistance to mechanical shock in the series containing both flint and feldspar. Resistance to mechanical and thermal shock was considerably less affected by variations in thermal expansivity of the enamels than is the case in cover coats, the influence of that factor appearing to be partially obscured by other factors.

Publications.—Effects of composition on the properties of ground-coat enamels for sheet steel, W. N. Harrison and H. G. Wolfram, J. Am. Cer. Soc., **10**, No. 3, p. 163; March, 1927.

Physicochemical Factors Affecting the Consistency of Enamel Slips.—Since the last report of this investigation field studies have

been made, experimental work on the consistency of enamel slips being carried on in two factories. The simplest possible apparatus and method of expressing consistency was developed for factory use.

Upon correlation of the results of the factory work it was concluded that: (1) The weight of enamel slip retained on a unit surface of metal when applied and allowed to drain is primarily a function of yield value, and secondarily a function of set. (2) A slip of high mobility drains quickly and one of low mobility drains slowly. (3) Although mobility is affected by other things besides percentage of water, that factor is so important that by means of it mobility can be controlled. (4) By means of water and salt additions the mobility of a slip can be changed without affecting the resultant yield value, and the yield value can be changed without affecting mobility. (5) Enamel slips when classified according to consistency fall into groups, the particular group into which any slip falls depending upon the type of work for which it is intended.

Publications.—Controlling the Consistency of Enamel Slips, W. N. Harrison, B. S. Tech. Paper No. 356.

Vitreous enamel slips and their control, W. N. Harrison, J. Am. Cer. Soc. **10,** 1927.

GRAVITATIONAL CONSTANT

The accepted value of the constant of gravitation for the past 30 years has rested upon the independent work of Boys and of Braun. These two experimenters obtained mean results agreeing to four significant figures (6.658×10^{-8} cm^3 g^{-1} $sec.^{-2}$), but because their separate values varied in the third figure (by as much as 4 units in Braun's work, and by 2 units in that of Boys) Poynting, in his discussion of the subject, assigns the value 6.66×10^{-8}, with a possible uncertainty of 1 unit in the third figure.

Thirty years having elapsed since the work of Boys and Braun, it was felt that it might now be possible to push the precision of this determination one decimal place farther.

The apparatus employed was the torsion balance, used in one form or another by half a dozen experimenters in this subject since the days of Cavendish. The general dimensions of Braun's apparatus were followed, except that the large masses were greatly increased in size. The torsion pendulum was operated in a vacuum. In this method the time of swing of the pendulum is measured in two positions, which may be called "near" and "far." Braun, working with large masses of about 9 kg each and small masses of 54 g each, with a radius of revolution of about 10 cm obtained a difference in the two times of swing of about 46 seconds. In the present work the large masses weighed about 66 kg each, the other quantities being nearly the same as those employed by Braun. In consequence of the greater mass, the times of swing differed by about 330 seconds.

The large masses were of steel, cylindrical in shape. This form was adopted because of practical difficulties in shaping spheres of the weight employed (66 kg each). The cylinders were turned from ingots which had been forged down from 12 to 9 inches in diameter to close up blowholes, and as finished were about 28.5 cm long and 19.5 cm in diameter. The small masses used in 1926 were of platinum, weighing about 50 g each, fused in a vacuum furnace to insure absence of cavities. They were spherical in form.

The work was done in the constant temperature room of the Bureau of Standards located about 35 feet below ground.

The observations during 1926 gave five values of the constant of gravitation as follows:

	6. 661
	6. 661
	6. 667
	6. 667
	6. 664
Mean	6.664×10^{-8}
Average departure from mean	.002

No previous investigator has obtained results agreeing to more than two significant figures.

It is planned to carry out an additional series of observations during 1928, by which it is hoped to obtain six or seven more values of this important constant. Publication of the complete results will be made eventually as a Bureau of Standards Scientific Paper.

HEAT

Effect of Impurities on the Platinum Resistance Thermometer at Low Temperatures.—The platinum resistance thermometer, as explained under "Standard scale of temperature," serves as the standard instrument from −183 to +650° C. In the range −183 to 0° C. there remains some uncertainty as to the effect on the scale of minor impurities in the platinum. Special resistance thermometers and comparison baths have been prepared for making a precise analysis of the relative indication of thermometers made from platinum of different degrees of purity.

Thermal Conductivity of Commercial Insulating Materials Used at Low or Ordinary Temperature.—A series of tests on nearly all commercial materials of this class used for cold storage or house insulation was completed during the year. The tests consisted of measurements of thermal conductivity, apparent density, and commercial thickness. A number of samples of each material were tested in order to get a representative average in each case. Measurements of conductivity were made at two mean temperatures, 32 and 60° C. Certain easily compressible materials were measured at various densities of packing.

A paper on the subject was prepared and has been accepted for presentation at the Fourth International Congress of Refrigeration to be held in Rome in April, 1928. A circular letter was prepared giving the results as well as other information of interest to prospective builders of insulated houses. This pamphlet has had an extremely wide circulation.

Thermal Conductivity of Insulating Materials at High Temperatures.—This investigation, started in the previous year in cooperation with an outside concern, was continued. A number of different high-temperature insulators were tested at various temperatures up to 600° C. The work necessitated the test of a large number of different individual specimens. The most striking feature of the results thus far obtained is the rapid increase of conductivity of powdered or loose materials with increasing temperature. The temperature coefficient of conductivity of all the loose materials tested has been found to be materially greater than that of air.

Heat Transfer Through Building Construction.—A large number of tests were made on the insulating value of various external constructions used on the outside of the studding in frame buildings. The test panels consisted of ordinary wood sheathing, 2 feet square, on which were placed various combinations of external coverings, such as metal lath and stucco; furring strips, metal lath and stucco; building paper and shingles; siding, and other combinations of these materials. These tests are less difficult to make than tests on a complete frame wall, and furnish equivalent information, since it is possible to calculate the insulating value of the complete wall from the test results on a single type of complete frame wall.

Properties of Steam and Carbon Dioxide.—The American Society of Mechanical Engineers is sponsor for an extensive project designed to provide new data on the properties of water and steam. The experimental work was divided between Harvard University, the Massachusetts Institute of Technology, and the Bureau of Standards, the last named undertaking the calorimetric measurements. During the past year the determinations of the specific heat of water, in the temperature range 0 to 200° C. were completed. Measurements of specific heat at higher temperatures and of latent heat of vaporization remain to be completed.

The first definite result of these measurements is a determination of the mean calorie in international joules, and thus in terms of ergs. The result formed is that the amount of heat required to raise the temperature of 1 g of water from 0° to 100° at atmospheric pressure is 418.8×10^7 ergs. Another definition of the mean calorie, namely, 1/100 of the difference between the enthalpy or heat content of

water at 100 and at 0°, at saturation pressure in each case, has been recommended as better adapted for use in steam tables, and with this definition the result becomes

$$1 \text{ mean calorie} = 4.189 \times 10^7 \text{ ergs.}$$

The data obtained in these investigations will serve after formulation into suitable tables as a national and probably to a large extent as an international standard of reference on the properties of steam, just as the previous work on properties of ammonia has been so generally accepted as to become a standard by common consent, or as the determination of the heat of combustion of benzoic acid, published in 1914, has become an international standard in thermochemistry by virtue of formal action of the Union International de la Chimie Pure et Appliquée at Lyons in 1922. The apparatus now being used to determine the properties of water and steam is to be used in similar measurements of the properties of CO_2, and these results, together with those of supplementary investigations already completed or in progress, will serve as the basis for standard tables of the properties of CO_2.

Thermochemical Standards.—The standard samples of naphthalene, benzoic acid, and sucrose, with certified heats of combustion, have found wide use. During the year a complete redeterimination of the heats of combustion of these materials was made. The new determination is completely independent of the old, having been obtained by different observers, with a new calorimeter, which was calibrated by the fundamental electric method. The new results are in good agreement with the older ones.

Heat Losses from a 75-Ton Hot-Metal Car.—For many years it has been the practice in the iron and steel industries to transport molten metal from one furnace to another in open ladles. More recently a closed type of ladle has been introduced which has about the shape of a submarine and is mounted on trucks similar to those of a railway car. The only opening in this ladle is at the top and is only about 3 feet in diameter, so that the heat loss is much less than from the open ladle. These closed ladles are made with capacities up to 150 tons of metal. It is important to know how long the metal in such a ladle will remain hot enough to be used. Accordingly, the Bureau of Standards recently conducted a test to determine the rate of cooling and the heat losses from a 75-ton closed-car ladle. It was found that the molten iron in such a ladle cooled only about 11° F. per hour, and with this rate of cooling it would be possible to hold a ladle of molten iron for 40 hours before it became too cold to be poured out. The heat loss from this ladle was found to be 35 kilocalories per second, which is equivalent to about 140 kilowatts. The results of this test will be of material assistance to industries

using these ladles and those designing heating devices to be applied to these ladles for the purpose of holding the temperature essentially constant.

This work is reported in a paper entitled "Heat losses from a 75-ton hot metal car," by William F. Roeser in the Journal of the American Foundrymen's Association. (In press.)

Pyrometry of Iron and Steel.—An investigation is being made of the corrections to be applied to the readings of an optical pyrometer when sighted on molten cast iron in the open, either on streams or on the surface of quiet ladles. Optical pyrometers are calibrated to read correctly when sighted into closed furnaces and always read low when sighted on metal in the open. The amount by which the readings are low depends on the radiating characteristics of the surface, and these are being determined for cast iron under various conditions to aid industrial plants in obtaining reliable temperature measurements.

LEATHER

Sulphite Cellulose Extract.—Research on this subject was completed during the year and the results published as Technologic Paper No. 339, entitled "The Use of Sulphite Cellulose Extract as a Tanning Material," by R. C. Bowker and E. L. Wallace. It was shown that these materials possessed definite tanning properties, and actual tanning experiments demonstrated that they could be satisfactorily blended with the ordinary vegetable tanning materials. The leather produced compared favorably with that made with the usual vegetable materials as regards both physical and chemical properties. The application of the results of this research will lower tanning costs, cause the tanning industry to be less dependent upon imported materials, and tend to compensate for the loss of domestic chestnut wood through blight, by utilizing a product now largely wasted.

This research, together with previous work described in Technologic Paper No. 215, entitled "The Durability of Sole Leather Filled with Sulphite Cellulose Extract," by R. C. Bowker, shows conclusively that leather containing these materials is in no way impaired as to quality and utility. This definite conclusion resulted in the elimination from many Government specifications of a clause which prohibited the use of sulphite cellulose extracts.

Investigation of Acid in Leather.—An investigation was started during the year to determine the effects of different acids upon the life and properties of leather and how these effects are influenced by the tanning process and the finishing materials used. This investigation was initiated largely because the usual quality standards for leather limit closely the maximum amount of free mineral acid permissible in leather, since experience has shown that strong

acids are detrimental to leather. Methods of determining the acid are inadequate, the amount of acid which may be present without causing serious deterioration is not definitely known, the effect of other acids than mineral has not been thoroughly studied, and the influence of the various materials used in making leather upon the action of the acid merits consideration. Information on these points will have its effect on leather-making methods and will allow intelligent quality standards to be drafted.

Standard leather samples have been prepared in the experimental tannery using different tanning materials. Samples of each leather have been treated so as to contain sulphuric acid in the following amounts: 0, ¼, ½, ¾, 1, 1¼, 1½, 1¾, 2, 2½, 3, 3½, and 4 per cent. After determining the original strength and stretch of these samples two samples of each acid treatment will be stored for the following aging periods: 2, 4, 6, 9, 12, and 24 months, after which periods the strength and stretch will be again determined as an indication of the deterioration effect of the acid with time.

Physical and chemical tests will be made on the aged leather during the coming year, and additional leather will be prepared for similar studies on some of the points mentioned. Close contact with the industry is being maintained in this work through an advisory committee.

Properties of Leather.—Sole Leather.—Investigation of the comparative durability of vegetable-tanned sole leather and chrome sole leather retanned with vegetable materials was started during the year. The cooperation of five leading tanners was secured who furnished the leather. Results of 300 out of 500 actual service tests indicate that chrome leather lightly retanned with vegetable materials will wear about 75 per cent longer than vegetable leather. The thoroughly retanned leather appears to wear about 33 per cent longer than the vegetable leather. This comparison of wear standards will be completed during the next year.

Strength and Stretch.—Arrangements were made to secure steerhide leather, calf leather, and sheep leather tanned by both the vegetable and chrome processes in order that a study might be made of the effect of the tannage on the strength and stretch of leather.

Cleaning of Furs and Leathers.—The use of fur and leather in garments has increased during the last few years. A study was made to determine the proper method of handling these materials in the dry-cleaning establishments. The kinds and amounts of fatty content in different types of fur were determined and various methods of cleaning studied.

The method developed consists of adding small percentages of paraffin to the cleaning solvent. This method was tried successfully

in various cleaning plants. A bureau publication giving the results of this study is now being prepared.

This work was supported by the National Association of Dyers and Cleaners through their research associateship.

LIME AND GYPSUM

Fineness of Slaked Chemical Quicklime.—A determination of the "fineness" of slaked chemical quicklimes has been made during the year. Many of the chemical industries using lime find it advantageous to use quicklime in order to utilize the heat of hydration. This principle is used, for example, in the liberation of NH_3 from the ammonical liquors produced in the by-product coke industry. In those industries in which quicklime is used as a reagent, it is desirable that during the process of hydration the disintegration of the quicklime should be as complete as possible. A fine state of subdivision increases the rate of solubility and the speed of reaction. Coarse material not only decreases the solubility and efficiency of the lime, but also has a deleterious effect on processing machinery. Following substantially the practice recommended by the American Society for Testing Materials for determining the fineness of masons' hydrated lime, the following results were obtained: It was found that from 69.3 to 94.8 per cent passed a No. 200 sieve and from 0.9 to 22.5 per cent was retained on a No. 30 sieve.

Sample No.	Retained on No. 30 sieve	Passing No. 30 sieve, retained on No. 50 sieve	Passing No. 50 sieve, retained on No. 100 sieve	Passing No. 100 sieve, retained on No. 200 sieve	Passing No. 200 sieve
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
11	0.9	0.8	2.6	0.9	94.8
21	2.2	1.7	.7	2.2	93.2
24	3.1	2.3	1.3	3.7	89.6
28	10.3	2.2	2.1	2.2	83.2
35	3.1	7.4	6.9	5.6	77.0
17	2.6	2.5	3.6	3.8	87.5
8	1.6	.7	1.6	1.3	94.8
38	22.5	3.1	3.1	2.0	69.3
19	4.8	3.7	2.0	2.9	86.6

Manufacture of Lime.—Changes occurring in the lime industry since the issue of Technologic Paper No. 16, "The Manufacture of Lime," in 1913, made necessary a revision of this publication. To obtain the information desired, 12 lime plants, one ready-mixed mortar plant, and one limestone crushing plant were recently visited. Many innovations in the lime industry were observed. The data collected included information upon the following: (1) The production of chemical lime. (2) The latest type of gas-fired kilns. (3) New processes of hydration. (4) Burning of lime in rotary kilns. (5) Automatic stokers as applied to shaft kilns. (6) The mining of limestone.

Furthermore, the inquiry was conducted with a view of obtaining complete information about the process of lime manufacture; of noting the methods of quarrying or mining and crushing; of selecting representative samples of limestone which were forwarded to the laboratory for analysis and study; of observing the methods of burning, temperature, and duration of burning and sampling the resulting lime; and of following this through the process of hydration and of sampling the resulting product.

Publications.—The Manufacture of Lime, Bureau of Standards Circular No. 337.

Analysis of hydrated lime by a thermochemical method, D. F. Richardson, Ind. and Eng. Chem., **19**, No. 5, p. 625; May, 1927.

Expansion of Calcined Gypsum on Setting.—The expansion which occurs when calcined gypsum sets is one of its important properties. This property makes gypsum an excellent material for casting purposes as it enables the material to give true reproductions of the mold. In some other uses this expansion is undesirable and is to be avoided if possible. An investigation was conducted to determine whether it would be possible by simple methods to control this expansion. It was found that the expansion might be controlled within certain limits by control of the ingredients of plasters and of the conditions under which they are used.

Publications.—The expansion of a calcined gypsum on setting, by J. A. Murray, Rock Products; 1927.

Some advances in gypsum technology, J. M. Porter, Chem. and Met. Eng., **33**, No. 9, p. 549; September, 1926.

An Acoustical Gypsum Plaster.—A plaster which will absorb 10 to 15 per cent of the sound striking it will remedy the conditions of most of the auditoriums, theaters, churches, etc., having acoustical defects. An investigation has been conducted during the year having as its object the development of such a plaster.

To absorb any appreciable amount of sound energy a plaster must possess a porous surface of such a nature that the sound will penetrate into the plaster and be changed to some other form of energy. A hard, nonporous surface, such as is possessed by the ordinary sanded plasters or by the lime-gypsum white finish coat, does not have this porosity, hence practically all sound striking such a plaster is reflected back into the room. This condition gives rise to the objectionable echoes and reverberations which are so often found in public buildings.

By adding small amounts of alum or aluminum sulphate and a carbonate ($CaCO_3$, for example) to a calcined gypsum-sand dry mix it has been found that a plaster may be prepared which possesses the desired characteristic of surface porosity and which may be easily worked and applied. When this plaster is wetted the alum and

carbonate react to form carbon dioxide (CO_2) which is entrapped in the body of the plaster in the form of countless minute bubbles of gas. When the plaster is applied to a water absorptive backing, such as an ordinary scratch or brown coat of plaster, the excess water in the wet acoustical plaster is partially removed by the absorptive effect of the backing and the water films surrounding the gas bubbles are broken, leaving a large number of communicating small pores throughout the plaster. These small gas bubbles also serve another purpose in increasing the workability of the plaster and thus making it easier to apply.

Many different types of aggregate have been experimented with in an effort to find the most satisfactory one for use. Among those investigated may be mentioned sand, pumice, raw and calcined diatomaceous earth, cinders, ground cork, asbestos, tufa stone (a volcanic ash), and several others. Of these the pumice, calcined diatomaceous earth, and tufa stone produced the most satisfactory plasters. A plaster containing 2 parts granulated tufa (graded to pass a No. 14 and be retained on a No. 40 sieve), 1 part sand (graded from sieve No. 10 to sieve No. 30), and 1 part of calcined gypsum, to which was added a small amount of a calcium carbonate-potassium alum mixture and a retarder, had approximately the sound-absorbing properties desired. It is possible to increase the percentage sound absorption by increasing the tufa-calcined gypsum ratio, increasing the tufa-sand ratio, or increasing the particle size of the aggregate.

LUBRICANTS AND LIQUID FUELS

Methods for Testing Petroleum Products.—The standardization of methods for testing petroleum products has been continued in cooperation with Committee D–2 on petroleum products and lubricants of the American Society for Testing Materials.

As a result of work on petrolatum the "grease penetration test," with slight modifications, was adopted as the standard method for measuring the consistency of petrolatum. The development of a standard method for measuring the melting point of petrolatum is still under investigation.

The "burette consistometer," referred to in the 1927 Yearbook, although rapid and accurate, has a more restricted field of application than the "Herschel consistometer," designed at the Bureau of Standards, and described in Oil and Gas Journal, December 2, 1926. A new instrument has now been very nearly completed which will combine the advantages of both the Herschel consistometer and the burette.

Selecting Motor Oils.—In purchasing lubricants and liquid fuels on Government specifications (Technical Paper No. 323) the question has at times been raised in regard to the selection of the most

suitable oil for a specific purpose, particularly in connection with automotive lubrication. Instructions have, therefore, been prepared for selecting the proper grade or viscosity of motor oil for any given make of automobile. These have been adopted and issued as Bulletin No. 24, Supplement No. 5, by the Office of the Chief Coordinator, September 7, 1927, and include both winter and summer recommendations for trucks, tractors, and passenger cars.

Properties of Petroleum.—The available data on properties of petroleum and its products are not such as to make possible the compilation of standard tables of properties, with, perhaps, the single exception of thermal expansion, which is given in Bureau of Standards Circular No. 154. Experiments to establish data to serve as a basis for standard tables have been begun, with the cooperation of the American Petroleum Institute. As it will take several years before the desired data can be had, the information now available on such properties as specific heat, latent heat of vaporization, heat of combustion, etc., has been assembled and analyzed and the results published in provisional form as a Letter Circular No. 231.

MECHANICS

Structural materials are bought and sold largely on the basis of specifications, which is the only satisfactory procedure from the standpoint of both producer and consumer. These specifications state the physical properties of the material, such as tensile strength, yield point, elongation, hardness, etc. Tests are, therefore, necessary to determine whether the material complies with the minimum requirements of the specification. If the testing machines of the producer and consumer are not properly calibrated, discrepancy results which leads to needless confusion, delay, and discussion. Manufacturers and consumers alike have urgently requested the bureau to establish a service for calibrating testing machines in the shops and factories of the country.

The first step in supplying this service has been taken by installing a dead-weight testing machine of 100,000 pounds capacity. Loads can be applied by this machine in increments of 10,000 pounds. Since the load consists of carefully calibrated weights without the use of multiplying levers of any kind, the accuracy of the deadweight machine as a primary source of calibration is not open to question.

The second step is the development of a satisfactory proving ring which, after calibration in the deadweight machine, may be used in turn to calibrate the testing machines in factories and other laboratories with the required precision. This work is now actively under way.

Masonry Walls.—For several years the Bureau of Standards has been cooperating with manufacturers of masonry building units in determining the most economical and safe processes and designs to be

used in constructing masonry walls. For the past three years the Common Brick Manufacturers' Association, the Hollow Building Tile Association, the National Terra Cotta Society, and the Research Service (Inc.), have maintained research associates at the bureau (some continuously and some from time to time) engaged in testing various types of brick walls, hollow tile walls, and terra-cotta faced walls. The tests are still continuing, results of some tests are now being prepared for publication, and during the past year a number of publications have been issued:

Comparative tests on brick masonry, J. W. McBurney, The Bricklayer, Mason, and Plasterer, **29,** No. 10, p. 225; October, 1926.

Common brick tests at Washington. J. W. McBurney, Proc. of Ninth Annual Convention of Common Brick Manufacturers' Association, held in Chicago, February 21–26, p. 46; 1927.

New construction data on brick walls. A. H. Stang, The American Contractor, **8,** No. 31, p. 5; July 30, 1927.

Effect of workmanship on the strength of brick masonry. J. W. McBurney The American Architect, **132,** No. 2532, p. 613, pt. 1; November 5, 1927.

These deal with various phases of the investigations.

More comprehensive papers dealing more fully with larger series of tests are being prepared. A paper on "Transverse and compressive strength of walls built of an interlocking hollow building tile" will appear shortly.

So great is the demand for the information furnished by these tests that results not yet published are frequently called for by public officials to furnish the basis for city building codes and other codes of standard building practice.

A necessary part of the study of these walls is a study of the strength of the units of which they are composed. Extensive series of tests are still in progress to determine what mechanical and other properties of these materials are of importance in determining the strength and durability of the walls. These tests sometimes lead to the design of new apparatus to facilitate the tests. A Portable Apparatus for Transverse Tests of Brick, by A. H. Stang, (B. S. Tech. Paper No. 341), describes one such apparatus.

Research on Indentation Testing.—Indentation tests commonly called "hardness" tests, are every year more widely used as inspection tests to control the uniformity and suitability of metal parts. The desire to increase the cheapness, reliability, and speed of these tests has led to the manufacture of many different machines for making indentation tests. As the two most widely used are the Rockwell and the Brinell machines, it was of importance to study the relation between these. Technologic Paper No. 334, "Relationships Between the Rockwell and Brinell Numbers," by S. N. Petrenko, reports an extensive series of tests on a wide range of materials. From these tests conversion formulas were derived and the limitations on the

comparability of the two tests determined. It was found that where agreement closer than 10 per cent was not of importance conversion formulas could be used.

Autogenous Welding.—During the last few years the use of autogenous welding, including oxyacetylene, electric arc, hydrogen arc, and atomic hydrogen welding, has grown enormously in many different industries. The cheapness with which complicated shapes can be fabricated by the welding processes has led to the most varied applications and brought out many varied problems for testing laboratories. What pressures are safe to use on tanks of a given design welded in different ways and by different processes? What is the best way to weld street railway rails to insure the longest life? What types of welds should be used in structural framework and what loads can they safely carry? How should an airplane fuselage be welded to insure greatest safety with minimum weight? All these problems and many others have been brought to the Bureau of Standards by the Army, the Navy, the American Bureau of Welding, the American Electric Railway Association, and other groups of manufacturers and users of welded structures. The problems are not simple, but one by one various phases of them are being investigated by the engineering mechanics section and from time to time as the results obtained warrant it publications are issued covering different phases of the subjects.

During the past year the larger number of these have appeared in the Journal of the American Welding Society, and discuss such varied matters as—

Test of an arc-welded plate girder, H. L. Whittemore, J. Am. Weld. Soc., **6,** No. 1, p. 42; January, 1927.

Suggested program for the investigation of the fatigue resistance of welds, H. L. Whittemore, J. Am. Weld. Soc., **6,** No. 1, p. 21; January, 1927.

Testing gas welds, H. L. Whittemore, Power, **65,** No. 6, p. 211; February 8, 1927.

Comments on shear test results, H. L. Whittemore, Fifth Progress Report, J. Am. Weld. Soc., **6,** No. 3, p. 56; March, 1927.

Suggested program for strain-gauge measurements of welded rail joints, H. L. Whittemore, Fifth Progress Report, J. Am. Weld. Soc., **6,** No. 3, p. 68; March, 1927.

Incidental to these tests many different problems arise concerned with stresses to which the structures are to be subjected in service and the effect of design on their strength and safety. Stresses in a rail due to a falling weight, A. H. Stang, Fifth Progress Report, J. Am. Weld Soc., **6,** No. 3, p. 64; March, 1927; and a discussion of a paper on The design of dished heads of pressure vessels, H. L. Whittemore, Mech. Eng., **49,** No. 5, p. 470; May, 1927, are two papers growing out of these welding investigations. So far only a small beginning has been made and work is already outlined for the bureau's testing laboratories which will take several years to complete.

Determination of Gases in Metals.—The effect of gases in metals is too obscure for the determination of gas content to appear in commercial specifications as yet. Some few manufacturers are, however, setting their own limits for allowable gas content and analyzing their steels for gases, by the methods worked out at the bureau apparently with useful results. The General Electric Co. recently sent a guest worker to the bureau to get in touch with methods for nitrogen analysis which might be applied to transformer steel.

Beside the constant study of analytical methods for determination of gases in metals, work is in hand from the synthetic point of view on the solubility of gases in metals.

Publication.—Gases in Metals III. The Determination of Nitrogen in Metals by Fusion in Vacuum, L. Jordan and J. R. Eckman, B. S. Sci. Paper No. 563.

Special Alloy.—In the hope of extending the range of accuracy of the Brinell hardness test, so widely used in specifications, a special alloy of iron-carbon and vanadium, which, when work hardened, produced a Brinell ball with less permanent distortion in service than the steels previously used, was tried out, but it was found that the real cause of the lack of accuracy of Brinell testing of very hard steels lies more in the elastic distortion of the ball than in the plastic deformation.

Publication.—An iron-carbon-vanadium alloy for Brinell balls, G. W. Quick and L. Jordan, Trans. Am. Soc. Steel Treating, **12**, p. 3; 1927.

United States Patent 1638855, L. Jordan and G. W. Quick. Assigned to Secretary of Commerce.

Methods of Testing Molding Sands.—The use of standard testing methods for evaluation of molding and core sand is growing rapidly. The bureau continues to cooperate with the American Foundrymen's Association and the Washington Navy Yard on this problem.

Publication.—Work included in report of subcommittee on tests, Joint Committee on Molding Sand Research, American Foundrymen's Association, meeting, June, 1927.

Letter Circular No. 230, Glycerine or ethylene glycol in foundry sand mold facing mixtures.

Joint Committee on Investigation of the Effect of Phosphorus and Sulphur in Steel.—The work of this committee, on which a number of technical societies are represented, and of which the Director of the Bureau of Standards is chairman, has been active.

The object of the work is to secure data by which specifications may be drawn for the permissible amount of phosphorus and sulphur in different grades of steel with certainty as to the effects produced by those elements. The steels are produced commercially under the observation of a subcommittee on manufacture, and from that point on are handled entirely by Government laboratories, the Bureau of

Standards taking care of heat treatment and the Watertown Arsenal and the Naval Experiment Station doing the physical testing.

A second series of forging steels of varying sulphur content was prepared at the plant of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa., and a series of steel castings of varying phosphorus content at the plant of the Atlantic Steel Castings Co., Chester, Pa.

Wear of Metals.—The resistance of metals to wear is one of the most important properties under modern conditions, but data are lacking not only on the actual resistance to wear, but also on suitable methods for determining wear resistance. The president of the American Society for Testing Materials stated in June, 1927, that "wear losses in practically all lines of industry represent possibly the greatest form of economic waste in materials."

Before specifications can be drawn for metals to resist wear, reliable methods of testing for wear resistance must be evolved. The work of the bureau so far has been chiefly related to the problem of wear of plug gauges in cooperation with the Gauge Steel Committee and to the wear of railroad bearing bronzes in cooperation with a research associate from the Chicago Bearing Metal Co. and the Magnus Metal Co. Methods of test were developed which showed the superior wear resistance of chromium plated gauges and of those with a nitride coating, while in the railroad bronze it appeared that a rather wide variation in lead content had relatively little effect on wear resistance. Many other properties of the bearing metals are being determined in an effort to find out why railroad specifications for similar bearings show wide variations and inconsistencies. Further work on the bearing metal problem, especially on wear, is planned in cooperation with a research associate from the Bunting Brass & Bronze Co., and the general wear problem is being attacked along still other lines.

Publication.—Wear testing of metals, H. J. French, preprint for June, 1927, meeting, Am. Soc. Test. Matls.

Wear of steels with particular reference to plug gauges, H. J. French and H. K. Herschman, Trans. Am. Soc. Steel Treat., **10,** p. 683; 1926.

Recent experiments relating to the wear of plug gauges, H. J. French and H. K. Herschman, preprint for September, 1927, meeting, Am. Soc. Steel Treat.

Metallurgical Circulars.—A revision of the circular on aluminum and its alloys giving a great amount of standard data has been completed and extended to cover magnesium with some data on silicon and beryllium. The properties of, and specifications for, the light metals and alloys are given in detail. Producers of light alloys cooperated in the revision. A similar circular on zinc and cadmium is in preparation, in which the cooperation of the American Zinc Institute is promised.

Publication.—Light Metals and Alloys, Aluminum, Magnesium, B. S. Circular o. 346.

Quality of Steel for Carburizing.—While the carburizing (McQuaid-Ehn) test for "abnormality" of steel to be used for carburizing does not appear in the specifications of any of the national specification-making bodies, individual users of steel, especially automotive manufacturers, often incorporate this test. Users and producers of steel are not in complete agreement as to what the test means, or even as to the existence of "abnormal" steel. Study of this problem has been under way for several years. The most probable explanation for the cause of "abnormality" lies in the production, during the steel-making process, of submicroscopic inclusions which act as obstructions to grain growth. An "abnormal" steel is not necessarily inferior, its inferiority or superiority depending on the use to which it is to be put.

Publication.—Progress in study of normal and abnormal steel, S. Epstein and H. S. Rawdon, Trans. Am. Soc. Steel Treat., **12**, p. 337; 1927.

Strength of Materials at High Temperatures.—In connection with fire tests of building constructions it is often important to know the strength and elastic properties of the constituent materials at corresponding temperatures. An equipment with which good temperature uniformity and control is obtainable has been in use during the past three years. Tests with structural steel and cast iron have been completed. A paper[10] giving results with structural shapes has been published. In addition, a series of tests has been made to obtain information on effect of length, specimens having slenderness ratios from 10 to 140 1/r being included.

With the strength, deformation, and temperature relations well defined it is possible with proper precautions to express one in terms of the others. This was recently done in the case of specifications for the fire protection of structural steel [11] where temperature measurements on a protected structural steel member exposed to a test fire were substituted for load application with consequent simplification of testing procedure.

Properties of Steel at Elevated Temperatures.—Although some tentative standards for steel products for high temperature service have recently been issued by the American Society for Testing Materials, such specifications can hardly be said to rest as yet on as secure a basis of definite facts secured by well-tried methods of testing, as do most specifications for metals. The work of the bureau, cooperative with and oriented to supplement the work of the Joint Committee on Properties of Metals at High Temperatures of the American Society of Mechanical Engineers and the American Society for Testing Materials, is aimed to bring out whatever correla-

[10] Compressive strength and deformation of structural steel and cast-iron shapes at temperatures up to 950° C., by S. H. Ingberg and P. D. Sale, Proc. Am. Soc. for Testing Mat., **26**, Pt. II, pp. 33–51; 1926.

[11] Fireproofing Specification, issued October, 1927, by the Am. Inst. of Steel Construction.

tion may exist between accurately made short-time tests and the tedious long-time, or "creep" tests, and thus make possible the accumulation of more complete and more dependable data to serve as a basis for specifications.

Publication.—Creep in Five Steels at Different Temperatures, H. J. French, H. C. Cross, and A. A. Peterson, B. S. Tech. Paper No. 362.

Machinability of Steel and Cutting Properties of Tool Steels.—Existing specifications for high-speed tool steels do not include tests directly evaluating the ability of the steels to cut, nor do those for steels to be cut include any direct test for the ease with which they may be cut.

Tests on rough turning carried out at the bureau, made after the manner of those performed by Taylor in his classic work leading to the development of modern high-speed steels, show that Taylor's methods of test are applicable to modern steels, both those to be cut and those used as tools in rough turning. The relative machinability of alloy steels varies with the heat treatment; one steel may be cut more readily than another in the soft state, but when heat-treated to develop high tensile strengths their machinability may be reversed. Variations in the quality of the high-speed tool steel may affect cutting speed more than variations in the composition of the steel cut. The work is now being extended to finish cuts, and the effect of impurities in high-speed steels is being studied.

Publication.—Rough turning with particular reference to the steel cut, H. J. French and T. G. Digges, Proc. Am. Soc. Mech. Eng., 1926, p. 533, No. 2018

Density of Pure Iron and Carbon Steels.—The densities of pure iron and of various carbon steels have been determined. The average density of pure iron is 7.864 grams per cubic centimeter. Carbon steels as hot-rolled show a gradual decrease in density with increasing carbon content up to about 1.3 per cent and lie on or close to the straight line

$$\text{Density} = 7.855 - 0.032\ C$$

where C is the percentage of carbon. This equation applies for carbon content 0.09 to 1.29 per cent.

Carbon steels as annealed show a gradual decrease in density with increasing carbon content up to about 1.4 per cent, and the values lie on or close to the straight line

$$\text{Density} = 7.860 - 0.04\ C$$

where C is the percentage of carbon. This equation applies for carbon content 0.09 to 1.37 per cent.

The density of carbon steels containing up to about 1.3 per cent carbon decreases upon quenching, due to the formation of martensite.

The magnitude of this decrease rises with increasing carbon content reaching a maximum at about 1 per cent carbon and then falls off slightly. Upon tempering the quenched steels they gradually increase in density. A decrease in density was noted in the hypereutectoid steels, when tempered at 225° C., due to the tempering of retained austenite. Upon tempering about 225° C. the density of all samples increased, ultimately approaching the density of the annealed material when tempered at 600° C. The greatest rate of increase of density was noted upon tempering at 300° C., the rate then gradually falling off practically to zero at 600° C.

Publication.—Density of Hot-Rolled and Heat-Treated Carbon Steels, H. C. Cross and E. E. Hill, B. S. Sci. Paper No. 562.

Investigations have also been carried out on the density of sheet copper, aluminum, beryllium, aluminum-beryllium alloys, cadmium, zinc, and nickel.

OPTICS

Standard Wave Lengths in the Solar Spectrum.—The wave lengths corresponding to absorption lines in the sun's atmosphere have served as standards in spectroscopic and astrophysical investigations for many years. The classical work of Professor Rowland nearly 40 years ago resulted in a table of solar spectrum wave lengths which has not been superseded or materially improved, although it has been recognized for 20 years that it contained irregular errors. For purposes of laboratory spectroscopy a new system of standard wave lengths derived from the iron arc has been internationally adopted, but some astronomers still continue to use the Rowland scale. In order that all might be persuaded to use a single universal scale of wave lengths it appeared advisable to remeasure standards in the solar spectrum. A redetermination of these standards was also desirable on account of the fact that interferometer methods of comparing wave lengths can now be applied with the prospect of obtaining higher precision than Rowland did with his concave diffraction gratings. Incidentally, it was of interest also to compare solar and laboratory values of wave lengths obtained by the more accurate methods and thus test the prediction of the theory of relativity that the wave lengths are 2 parts in 1,000,000 longer in the sun than in the laboratory.

Accordingly the spectroscopic laboratory of this bureau and the Allegheny Observatory began in 1923, a cooperative program of standard wave-length work which has now been completed for one octave of the solar spectrum. The results have appeared in the publications of the Allegheny Observatory from time to time as different spectral regions were completed. Final results for about 700 lines ranging in wave length from 3,592.027 Ångstroms in the ultraviolet to 7,148.159 Angstroms in the red have thus been announced.

Each value is the mean of 3 to 30 direct comparisons with international standards in the neon spectrum, and the errors in these final values are probably less than one part in several millions. These observations have made it possible to deduce a correction curve by means of which Rowlands values can be accurately transformed to the international scale. Comparison of the solar values with those obtained for the same lines emitted in the laboratory by vacuum arcs shows that the weak solar lines have the same wave lengths as the terrestrial sources, but stronger lines are displaced redwards. The amount of this displacement appears to be a function of the line intensity and of the spectral region; its explanation is still in doubt, and until this phenomenon is accounted for, it is impossible to determine if there is a general shift due to solar gravity.

In connection with the wave-length comparisons and identifications of lines of the chemical elements in the solar spectrum, it has been necessary to describe some of the laboratory spectra more accurately, and to analyze the structures of these spectra. During the past year descriptions of the standard arc spectra of zirconium and scandium have been completed. Accurate measurements of 350 lines in the vacuum arc spectrum of titanium and lanthanum were completed, and the complete arc and spark spectra of yttrium were remeasured.

Publications.—Solar spectrum wave lengths, by Keivin Burns and C. C. Kiess, Allegheny Observatory, **6**, p. 125; 1927.

Solar spectrum wave lengths, by Keivin Burns, Allegheny Observatory, **6**, p. 141; 1927.

Wave-length Measurements in the Arc and Spark Spectra of Zirconium, by C. C. Kiess, B. S. Sci. Paper No. 548; April 28, 1927.

Wave-length Measurements in the Arc Spectrum of Scandium, by William F. Meggers, B. S. Sci. Paper No. 549; May 4, 1927.

An Analysis of the Arc and Spark Spectra of Scandium (Sc I and Sc II), by Henry Norris Russell and William F. Meggers, B. S. Sci. Paper No. 558; August 12, 1927.

Standardization of Lovibond Glasses Extensively Used in the Color Grading of Cottonseed Oil.—The value of cottonseed oil produced in the United States, in 1926, about $230,000,000 wholesale, is largely determined by its color—very small differences from the specified color amounting to several hundreds of thousands or even millions of dollars in the value of the year's production.

In trade, the color is specified by comparison with red and yellow "Lovibond" glasses, thousands of which are in use in the oil industry. Experience has shown that these working standards may vary from their nominal value by several times the least difference which is considered in determining the market price of the oil.

The Bureau of Standards has recently completed the establishment of a fundamental standard scale in terms of which the glasses in

actual use may be calibrated, thus reducing them all to a common fundamental standard.

In cooperation with the Oil Chemists Association, the glasses used in their various laboratories are now being reduced to a common standard, and should result in a large reduction in disputes between buyer and seller and a consequent saving in this industry. The program is now well under way with over 100 glasses standardized during the latter half of 1927. It is estimated that the completed work will cover 2,000 to 3,000 glasses.

Publication.—The Lovibond Color System. I. A Spectrophotometric Analysis of the Lovibond Glasses, by K. S. Gibson and F. K. Harris, B. S. Sci. Paper No. 547, 1927.

Standardizing the red and yellow Lovibond glasses, by Irwin G. Priest and K. S. Gibson, abstract given at twelfth annual meeting of the Optical Society of America, Schenectady, N. Y., October 20–22, 1927. Published in the minutes of the meeting.

An Interference Method for Aberration Determinations.—In specifying the characteristics of an optical design or the performance of an optical instrument there is a rapidly growing tendency to abandon the "circular disk of confusion" of geometric optics and to express the aberration directly in terms of wave lengths of phase retardation. Over the geometric method this has the advantage of accuracy of statement and convenience for comparison with the Rayleigh tolerance. In accordance with this tendency the bureau has developed a new interference method especially adapted for the measurement of phase retardation by a modification of the older Hartmann geometric method. This new method is particularly suited for application to astronomical objectives and other optical systems of large linear aperture as the use of accurate auxilliary reflecting surfaces of the same diameter as the objective may be entirely dispensed with if desired, although, for convenience, an optical flat may be advantageously employed in laboratory work.

This method of testing has been applied to two 6-inch astronomical objectives and will be applied to the 12-inch astronomical objective constructed some time ago from bureau glass. The results of the tests are embodied in contours which show the deviation of the actual wave front from a spherical wave front with center at the assumed focus. From these results one is able to draw precise conclusions concerning the variation in the definition at different points in the neighborhood of the focus, the determination of definition at points off the axis, the effects of striæ or other heterogeneities in the lens and finally it will be possible to specify the standard of performance which characterizes lenses of this type.

Standardization of Components of Optical Systems.—As a result of investigations and experiments concerning variations in the index

of refraction of certain optical glasses of first quality it has been found that lack of homogeneity is almost entirely a matter of inadequate processing rather than of varying chemical composition, and that uniformity to within a few units of the sixth decimal place of index is producible by sufficiently thorough and uniform heat treatments. Should this high degree of optical homogeneity prove to be attainable in all types of properly made glass it will greatly facilitate the manufacture of optical instruments of the highest precision in which relatively long glass paths are employed, and it may also extend the previously existing limits of accuracy in many instances.

The real importance of a high degree of homogeneity lies, however, in the resultant possibility of standardization in the manufacture of high precision optical systems, such as those used in the best binoculars, in stereoscopic measuring systems, and in cameras for airplane mapping; also in objectives for the rapidly increasing and diverse types of measuring instruments which involve a fixed magnification. But in effecting any considerable degree of standardization of this nature it will first be necessary to place the reproductibility of glass melts on a secure basis, and it is in part for this reason that extensive experiments are being conducted to establish the exact relationships between the optical properties of glass and the treating temperatures used in its annealing. From the work in progress on several types of glass it appears that the annealing equilibrium coefficients of index of refraction which are being determined will permit the outlining of annealing procedures which will reduce intermelt index deviations to within the required limits, provided a few standard indices are established for each type of glass, and provided further that sufficiently accurate furnace temperature control can be achieved.

Filters for the Reproduction of Sunlight and the Determination of Color Temperature. (Proposed Working Standards for Sensitometry, Colorimetry, and Photometry.)—In photographic and colorimetric research the need has been acute for a definite reproducible working standard of radiation, particularly as regards spectral distribution. It is well known that the colors of objects vary with the spectral distribution of the illuminating source. Likewise, with commercial photographic emulsions, which differ enormously in spectral sensitiveness, the relative speeds depend largely on the spectral distribution of the source of light.

Direct sunlight and so-called daylight are universal illuminants, and their reproduction in the laboratory is of considerable importance in colorimetry and photography. None of the artificial lights available, however, have the color or spectral distribution of sunlight or daylight, and many attempts have been made to devise filters which would absorb the excess red and yellow of incandescent lights to produce such a quality.

Recently the Sixth International Congress of Photography tentatively adopted two standards of radiation for the sensitometry of emulsions, 2,360 and 5,000° K., the latter, representing sunlight, to be obtained by means of a specified working filter and a 2,360° K. source of light as recommended by the American committee.

In an attempt to obtain a more exact reproduction of sunlight for sensitometry a series of filters has been devised at the bureau for converting light of any color temperature between 2,300 and 4,000° K. to noon sunlight, giving not only a perfect color match but also a close spectral energy match with the adopted values.

In addition to their importance in photographic sensitometry this series of filters makes possible the calibration of incandescent lamps, both in terms of color temperature and intensity and always under conditions of exact color match. These filters should thus be of considerable value in the photometry of incandescent lights of different colors.

Another group of filters, designed primarily for colorimetry, converts a color temperature of 2,848° K. to any color temperature between the limits of 3,500 and 10,000° K., a range of colors including various phases of sunlight and daylight and those that may be classed as white (neutral). This second group of filters is likewise designed by computation to give a perfect color match with the specified complete radiator.

The filters are composed of the following ingredients in various concentrations:

(*a*) Copper sulphate, mannite, and pyridine in distilled water.

(*b*) Cobalt ammonium sulphate, copper sulphate, and a small quantity of sulphuric acid in distilled water.

One centimeter layer of each of the (*a*) and (*b*) solutions are contained in a double cell with three plates of borosilicate crown glass, each 2.5 millimeters thick. These filters are precisely reproducible and should prove eminently satisfactory for photographic sensitometry, colorimetry, and heterochromatic photometry.

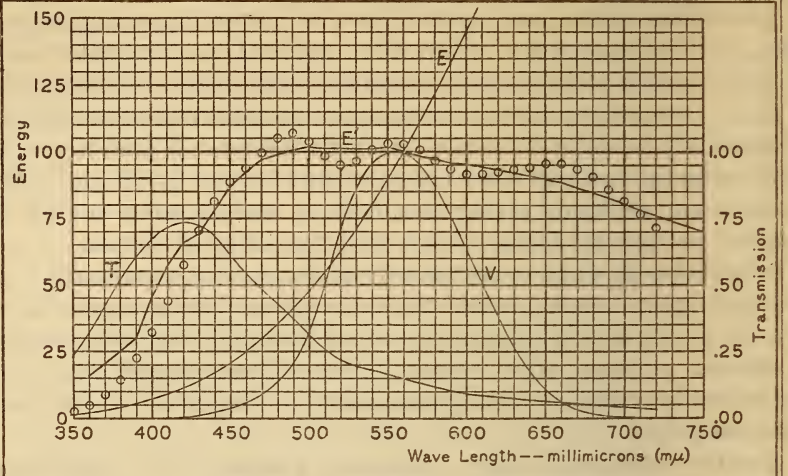
In figures 1 and 2 are shown the specifications of two of the large variety of filters, viz, 2,360° K. to mean sun and 2,848° K. to mean sun. Abstracts describing the work have been published as follows:

Reproducible liquid filters for the production of "white light," Raymond Davis and K. S. Gibson, J. Opt. Soc. Am. and Rev. Sci. Inst., **14**, p. 135; 1927.

Reproducible liquid filters for the determination of the color temperatures of incandescent lamps, Raymond Davis and K. S. Gibson, Phys. Rev. (2), **29**, p. 916; 1927.

The Ultra-Violet Transmission of Various New Glasses and Window Glass Substitutes as Compared With That of Common Window Glass.—Since ordinary window glass shuts out the ultra-violet rays below about 310 μ, much attention has been given of late to the

2360°K TO MEAN SUNLIGHT AT WASHINGTON. FILTER $\frac{\text{Mean Sun}}{2360}$



λ (mμ)	T	E"*	E"/E'
350	0.230	2.5	—
60	.321	4.9	.304
70	.420	8.7	.426
80	.518	14.5	.579
90	.608	22.5	.749
400	.671	32.2	.712
10	.714	44.0	.767
20	.737	57.4	.871
30	.725	70.3	1.016
40	.682	81.2	1.044
450	.612	88.6	1.021
60	.540	93.9	1.018
70	.483	99.9	1.031
80	.431	105.0	1.060
90	.376	107.1	1.065
500	.315	103.9	1.021
10	.259	98.3	.972
20	.219	95.0	.939
30	.197	96.8	.957
40	.182	100.6	.997
550	.167	103.2	1.014
60	.1495	103.1	1.031
70	.1316	100.4	1.021
80	.1151	96.9	.997
90	.1013	93.4	.977
600	.0907	91.3	.959
10	.0834	91.3	.968
20	.0778	92.3	.991
30	.0730	93.3	1.013
40	.0684	94.0	1.032
650	.0646	95.1	1.060
60	.0605	95.1	1.074
70	.0558	93.4	1.081
80	.0510	90.5	1.069
90	.0457	85.8	1.038
700	.0409	81.2	1.008
10	.0366	76.4	.979
20	.0326	71.6	.940

Bureau of Standards. Davis-Gibson Filters

T—Spectral Transmission of Filter at 25°C
V—Relative Visibility Function
E—Relative Energy of 2360°K
E'—Relative Energy of Mean Sunlight at Washington
E" (=T×E)*——o o o o——Relative Energy of 2360°K and Filter Combination

Light Transmission of Filter for 2360°K = 0.1352 **

FILTER FORMULA

A

Copper Sulphate ($CuSO_4 \cdot 5H_2O$)	3.707	grams
Mannite ($C_6H_8(OH)_6$)	3.707	grams
Pyridine (C_5H_5N)	30.0	cc
Water (distilled) to make	1000.	cc

B

Cobalt Ammonium Sulphate ($CoSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$)	26.827	grams
Copper Sulphate ($CuSO_4 \cdot 5H_2O$)	27.180	grams
Sulphuric Acid (sp. gr. 1.835)	10.0	cc
Water (distilled) to make	1000.	cc

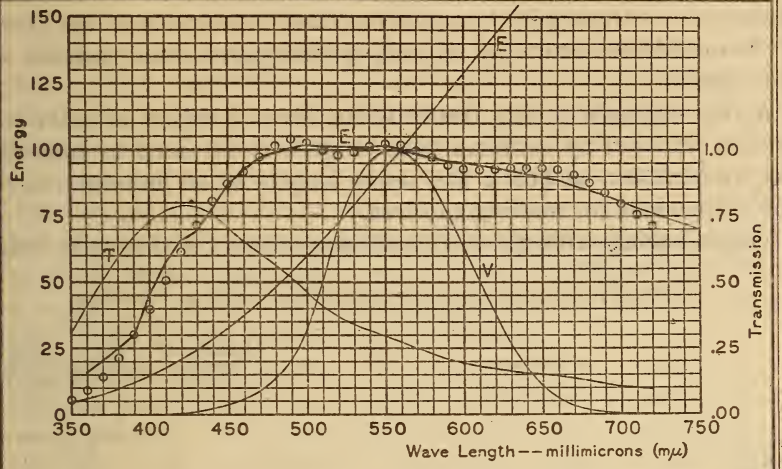
These data are for a one centimeter layer each of solutions A and B in a double cell with three plates of borosilicate crown glass (refractive index, D line, = 1.51), each 2.5 mm thick.

* Adjusted to make sum of E" - E' from 400 to 720 mμ equal practically to zero

** Factor to be used to multiply the candle-power of the light source to obtain the candle-power of the source-and-filter combination

FIG. 1

2848°K TO MEAN SUNLIGHT AT WASHINGTON. FILTER Mean Sun / 2848



λ (mμ)	T	E"*	E"/E'
350	0.309	5.5	———
60	.404	9.2	.579
70	.500	14.5	.710
80	.591	21.5	.858
90	.671	30.1	1.002
400	.728	39.8	.881
10	.768	50.4	.880
20	.788	61.5	.934
30	.783	71.8	1.037
40	.755	80.6	1.036
450	.707	87.0	1.001
60	.654	91.9	.996
70	.609	97.1	1.001
80	.567	101.6	1.026
90	.519	104.0	1.034
500	.463	102.9	1.011
10	.407	100.0	.988
20	.364	98.1	.970
30	.337	99.2	.982
40	.317	101.3	1.004
550	.297	102.5	1.008
60	.274	101.8	1.018
70	.250	99.8	1.014
80	.228	97.1	.999
90	.209	94.6	.989
600	.194	92.9	.976
10	.183	92.6	.982
20	.174	92.9	.997
30	.166	93.1	1.011
40	.158	93.0	1.022
650	.152	93.2	1.039
60	.1446	92.5	1.045
70	.1362	90.5	1.048
80	.1274	87.8	1.037
90	.1175	83.9	1.015
700	.1084	79.9	.991
10	.0998	75.8	.972
20	.0915	71.5	.940

Bureau of Standards. Davis-Gibson Filters

T -- Spectral Transmission of Filter at 25°C
V -- Relative Visibility Function
E -- Relative Energy of 2848°K
E' -- Relative Energy of Mean Sunlight at Washington
E" (=T x E)* -- o o o o -- Relative Energy of 2848°K and Filter Combination

Light Transmission of Filter ** for 2848°K = 0.2615

FILTER FORMULA

A

Copper Sulphate ($CuSO_4 \cdot 5H_2O$)	2.445	grams
Mannite ($C_6H_8(OH)_6$)	2.445	grams
Pyridine (C_5H_5N)	30.0	cc
Water (distilled) to make	1000.	cc

B

Cobalt Ammonium Sulphate ($CoSO_4 \cdot (NH_4)_2 SO_4 \cdot 6H_2O$)	16.520	grams
Copper Sulphate ($CuSO_4 \cdot 5H_2O$)	19.020	grams
Sulphuric Acid (sp. gr. 1.835)	10.0	cc
Water (distilled) to make	1000.	cc

These data are for a one centimeter layer each of solutions A and B in a double cell with three plates of borosilicate crown glass (refractive index, D line, = 1.51), each 2.5 mm thick.

* Adjusted to make sum of E" + E' from 400 to 720 mμ equal practically to zero

** Factor to be used to multiply the candle-power of the light source to obtain the candle-power of the source-and-filter combination

FIG. 2

production of special glasses, transparent to the shortest wave lengths which the atmosphere permits the sun to furnish us. Measurements of ultra-violet transmission have been made at the Bureau of Standards on a number of such special glasses and common window glass.

A fair estimate of the transmission for the region of solar wave lengths shut out by common window glass is obtained by measuring the transmission at 302 μ the wave length of an intense mercury line convenient for making the test.

The following table gives transmission values for this wave length.

Percentage transmission of various glasses at 302 μ, when new

Trade name	Number of samples tested	Average thickness	Average transmission at 3.02 μ
		mm	*Per cent*
Fused quartz	1	4.7	92
Corex	4	2.8	89
Helioglass	15	2.3	56
Vitaglass	15	2.5	44
Cel-o-glass	5	[1].1	30
Quartz-lite	16	1.9	.5
Common window glass	14	3.3	0

[1] Approximately.

Solarization.—Helioglass, vitaglass, and cel-o-glass have been found to decrease in transmission at 302 μ and neighboring wave lengths (295 to 310 μ) by exposure to ultra-violet radiation from the sun, quartz mercury arc, and carbon arc. The rate of change is much more rapid with the arc than with the sun, and varies also with the different glasses. When this solarization is complete helioglass appears to have a transmission of about 30 per cent at 302 μ and vitaglass a transmission of about 25 per cent.

Corex seems to undergo no appreciable change in transmission by exposure to sunlight, though exposure to the quartz mercury arc causes a marked decrease.

PAPER

TECHNICAL STANDARDIZATION

Measurement of Degree of Sizing.—Since the first description of the curl sizing tester developed by the bureau was published (Paper Trade J., **79**, No. 10, pp. 48–50; September 4, 1924) additional study of this instrument has led to several modifications which have improved its performance considerably. The curl tester makes use of the rate of curling of the paper, which in turn depends upon the rate of wetting of the paper, to measure the degree of sizing. A description of the perfected instrument and the principle upon which it depends, together with some of its more important applications, was published in Paper Industry **9**, No. 2, pages 259–260; May, 1927 (the curl sizing tester, F. T. Carson).

Wet-Rub Tester.—A description of the instrument developed for determining the resistance of currency paper to surface abrasion was published in Paper Trade J., **84,** No. 2, pages 45–46; January 13, 1927 (a wet-rub tester for paper, F. T. Carson and F. V. Worthington). The apparatus consists of (*a*) a means of clamping the specimen over a hard, smooth surface; (*b*) a power driven rubber friction surface or mechanical finger maintained under constant pressure; (*c*) a means of keeping the surface of the paper wet while being tested; (*d*) an automatic counter to record the number of "double rubs" required to wear a hole through the paper; (*e*) an electric contact device which stops the tester as soon as a hole is worn through the paper. A test of this nature is of value for most surface sized papers, such as blue print, map, and ledger.

Copper Number of Paper.—The copper number is a determination applied to paper to find its probable resistance to deterioration, and to control manufacturing processes so as to obtain satisfactory permanency. It is a measure of the amount of impure forms of cellulose which tend to weaken the paper and induce deterioration of the paper fiber.

Determination of the copper number of high-grade rag-fiber bond papers is difficult owing to the resistance these hard, tough papers offer to the usual procedure employed for this determination. A modified method is described in a bureau publication (B. S. Tech. Paper No. 354, A Modified Method for the Determination of the Copper Number of Paper, B. W. Scribner and W. R. Brode), by which greater accuracy in testing such papers was obtained, and which is recommended in part at least for general usage in testing paper or pulp.

Fiber Determination of Roofing Felts.—Because saturating felts are usually made of such a variety of kinds and sizes of fibers, it is difficult to make an accurate determination of the fiber composition. In connection with research being carried on at the Bureau of Standards on the life and serviceability of saturating felts, an opportunity was afforded for studying this problem. The study was made on six felts of varying fiber composition made in the bureau's paper mill. The fibrous materials used included cotton rags, gunny bagging, old mixed papers, and sawdust. In making the fiber analyses, the official method of the Technical Association of the Pulp and Paper Industry was followed as closely as it was practical to do so. Fiber determinations were made by the "dot-count" method, which was suggested to the Bureau of Standards three or four years ago. This method appears to minimize the errors due to estimating the lengths and sizes of the fibers. The results of different analysts agreed very closely, and indicate that a comparatively inexperienced analyst can by use of the dot-count method arrive at as nearly correct determina-

tion of the fiber composition as could be arrived at by calculations based upon the mill weights of the different constituents (Determination of the fiber composition of roofing felts, R. E. Lofton, Paper Trade J. 84, No. 18, pp. 57–58; April 7, 1927). As the results obtained by the bureau were corroborated in an investigation made by the American Society for Testing Materials, they have adopted the dot method as a tentative standard procedure for analysis of roofing felts.

Official Paper Testing Methods of the Technical Association.—The Technical Association of the Pulp and Paper Industry is actively continuing its formulation and adoption of official association paper testing methods. This work continues under the direction of a member of the Bureau of Standards staff who acts as chairman of the formulating body, the association's paper testing committee. The following additional 15 methods have been officially adopted by the association during the past year: Machine direction, ream weight, thickness, tearing strength, folding endurance, quantitative determination of active sulphur, moisture, ash, starch; qualitative determination of casein, rosin, nitrogenous matter, starch; analysis of mineral coating; and analysis of mineral filler.

Additional work of the committee still in progress is the revision of the association publication, Paper Testing Methods. A new edition was necessitated by exhaustion of the present edition, there being considerable demand for this handbook of paper testing technic. A thorough revision was necessitated by the many new developments in testing practice since the last edition was printed.

Fiber Wall Board.—The research in cooperation with fiber wall board manufacturers, made for the purpose of developing a Federal specification for this material, was completed and a proposed specification formulated. This covers both types of boards—the laminated and the homogeneous. The chief information developed is that the immersion water absorption test commonly made to determine the probable degree of resistance of the board to expansion is not adequate.

Classification of Paper Freight-Container Bags.—The improvement in the quality of paper bags and the development of the multiple-wall type have led during recent years to a continually increasing use of such containers for shipping powdered materials by freight. This has directed considerable attention to the requirements for them contained in the Consolidated Freight Classification. The Bureau of Standards, at the request of a paper-bag manufacturer and in cooperation with him, made a series of tests respecting the relative strength of single-wall and double-wall bags. This was in respect to section 10, rule 40, of the Consolidated Freight Classification, which requires that a multiple-wall bag shall contain a greater total weight of paper than a single wall bag, when the two types of

bags are used for a similar purpose. The bursting strength and weight of the paper composing the bags were determined and taken into account in comparing the results obtained. When subjected to the dropping test, which is generally considered to simulate best the service strains to which bags are subjected, the double-wall bags showed from 18 to 100 per cent greater resistance to the dropping impact than the single-wall bags. These tests show conclusively that double-wall bags are stronger than single-wall bags when the two are of the same type and contain the same weight of paper. A report giving these findings was submitted to the Official Freight Classifications relative to proposed revision of the section of the Consolidated Freight Classification mentioned. The revised section would permit equal weights of paper for single-wall and double-wall bags.

Sheathing Paper.—The bureau is making a study of sheathing paper for the purpose of assisting in the formulation of specifications of quality for this important building material. Obviously, as the function of sheathing paper is to act as a barrier to passage of air, the main requirements are high density for resistance to air, sufficient strength to withstand the handling incident to securing the paper in place, and a sufficient degree of water resistance to prevent impairment of its strength through absorption of water while being placed in position. Adequate strength and water resistance test methods are available, but determination of the most suitable method for measuring the air resistance is necessary. Various air resistance test methods are being compared experimentally by application of them to representative kinds of sheathing papers to find the method best suited to this particular purpose. This is a cooperative research with the National Lumber Manufacturers Association, it being made at their request.

Manila Rope Waste for Paper Manufacture.—Paper-making tests were made to determine the suitability of manila rope waste for paper manufacture. The waste employed in the experimental work was refuse fiber from the manufacture of manila cordage at the rope-walk of the Boston Navy Yard. At present little, if any, of the waste derived from manila hemp at cordage mills is used commercially, most of it being burned under the boilers as fuel. The experimental tests were made with a view to finding a profitable use for the refuse fiber of the cordage industry. Rope papers are characterized by great strength, toughness, and wearing qualities and are ordinarily used for shipping tags, wrappers, bagging, etc., in which strength is essential. Tests on kraft and sulphite wood pulps and on old rope stock were included for comparison. A good yield of paper-making fiber was obtained from the waste and the paper produced was of sufficient strength for a variety of uses. Measure-

ments on the finished paper indicate that manila rope waste does not compare favorably with old rope stock, but is considerably better than sulphite wood pulp.

A complete report of this work was published in Paper Trade J., **84,** No. 18, pp. 68–70, May 5, 1927, Manila rope waste for paper manufacture, by M. B. Shaw and G. W. Bicking.

Waste Mail Pouches for Paper Making.—An investigation was made to determine the paper-making value of worn mail pouches which have been declared unserviceable for postal use. Worn or damaged pouches are repaired in so far as practicable, but condemned ones and waste from the repair shop are mutilated into scrap and marketed as "junk" to the highest competitive bidder. The unavoidable treatment to which the pouches are subjected in train and station use causes them to become very dirty. Because of this condition the market price for the refuse material has been relatively low, although the cloth used in the manufacture of the pouches is a good grade of cotton duck. As a result the General Supply Committee, Treasury Department, requested the investigation with a view to securing a better price for the waste if its paper-making quality is good. The tests were made on a semicommercial scale under practical mill conditions. Clean pulp was obtained from the waste pouches and the paper produced therefrom was stronger than that made from sulphite wood stock and compared favorably with many of the high-grade bond and rag writing papers on the market. This practical demonstration of the paper-making quality of the material resulted in increased revenue from its sale to paper makers, amounting at present to around $17,000 annually. A detailed report of this work was published in Paper Trade J., **84,** No. 19, pp. 45–46, May 12, 1927, Waste mail pouches as paper-making material, M. B. Shaw and G. W. Bicking.

Use of Glue in Paper.—The following studies made in cooperation with the Glue Research Corporation, which maintained a research associate at the bureau to assist in the work, were completed and the reports of them published.

Because of the possibility of improving certain desirable qualities of papers, especially of those types made from the lower-priced fibers and containing mineral fillers, various methods of using glue in the beater sizing of paper were studied with the Glue Research Corporation. Optimum operating conditions and maximum retentions of glue, comparing favorably with those of the clay used, were obtained when the hydrogen-ion concentration was so controlled that the pH value approximated 4.5. In general, it was found that in papers sized with glue and rosin the strength is frequently, and the degree of sizing is generally, improved as compared with similar papers sized with rosin alone. These improvements were most

noticeable in papers containing clay filler. The chief influence of glue on the various types of papers seemed to be to enhance such intangible properties as firmness and handling qualities. (Glue as beater sizing, G. K. Hamill, M. B. Shaw, and G. W. Bicking, Paper Trade J., 84, No. 3, pp. 38–43, Jan. 20, 1927.)

In studying improvements in the water resistance of glue-bound papers by treatment with formaldehyde, comparisons were made of several water-resistance test methods as well as of certain empirical tests commonly applied to coated papers. The work was brought to a fitting conclusion through the preparation by the research associate, G. K. Hamill, of a manuscript for a handbook on use of glue in paper to be issued by the National Association of Glue Manufacturers. This book should be of value to both paper makers and glue concerns interested in paper-making glues, as there is very little information of this kind available in the literature.

United States Paper Currency.—The research on improving the quality of United States paper currency for the purpose of increasing its service life was actively continued. This research was made in cooperation with the Bureau of Efficiency and the Bureau of Engraving and Printing.

The work in the bureau semicommercial paper mill in the direction of developing standard currency paper manufacturing procedure, included further study of the beating procedure in dealing with the present fiber mixture; studies of the use of other combinations of these fibers; and some investigation of the use of caustic soda for cooking the fiber as compared with lime.

An important development was that the strength imparted to currency paper by the glue sizing was practically all destroyed in the process used in printing the paper; however, the basic strength of the paper, that due to the fibers alone, was not impaired by the printing. This has led the Treasury Department to adopt the type of paper developed by the bureau as the standard, for this is characterized by its high fiber strength. It has a folding endurance, unsized, of 5,000 folds.

The worn-out paper currency returned to the Treasury Department for redemption, together with a small proportion of spoiled paper and trimmings from the currency printing processes, amounts to approximately 4 tons daily. At the present time this material is macerated at the Bureau of Engraving and Printing and is sold in the form of pulp. No attempt is made to clean the pulp, the process being carried only far enough to comply with the requirements for protection against unlawful use of the waste paper. For this reason the price received is so low that the maceration of the material is costing annually from $15,000 to $18,000. It was found possible, through research in the Bureau of Standards paper mill, to com-

pletely deink and otherwise quite thoroughly clean the pulp with semicommercial machinery. The paper produced from the pulp compared quite favorably with good grades of fine writing and printing papers.

PHOTOMETRY

International Candlepower Comparisons.—Fifteen standardized lamps were supplied to the Bureau of Weights and Measures, Leningrad, U. S. S. R., and 11 lamps submitted by the Physikalisch-Technische Reichsanstalt, Berlin, Germany, were very carefully measured against the bureau's primary standards and substandards. There are certain outstanding differences between the values obtained in these measurements. At a conference of representatives of the National Physical Laboratory, the Reichsanstalt, the Laboratoire Central d'Électricité, and the Bureau of Standards held in Bellagio, Italy, September 5, 1927, a program of interlaboratory measurements on lamps and blue glasses was agreed upon. This intercomparison is expected to be complete and exhaustive, and is designed to bring the national standardizing laboratories into full agreement on candlepower measurements.

In connection with this international investigation, and partly in preparation for it, comparisons of candlepower substandards are being made by three American photometric laboratories in cooperation with the bureau. An extended series of measurements has also been made by flicker photometer methods, and repeated by other photometric methods, on several lots of colored-light filter in a cooperative investigation with five other photometric laboratories. Tables for facilitating transmission calculations have been prepared as an outcome of this work, but have not yet been published.

New Types of Lamps Certified.—The manufacturers of incandescent lamps have changed their manufacturing processes so that incandescent lamps in clear-glass bulbs are no longer generally obtainable in the commonly used sizes. Lamps of 100 watts and smaller are now made regularly only with inside-frosted glass bulbs. There has consequently been a demand for candlepower standards of the new type of bulb for use in testing and university laboratories and from the lamp manufacturers. The electrical characteristics of inside-frosted lamps have been investigated in connection with life-testing practice, and additional tests and comparison are in progress for the more definite determination of these characteristics.

PLUMBING

Porcelain Plumbing Fixtures.—Pursuant to a preliminary study of grading rules and nomenclature for porcelain plumbing fixtures undertaken at the request of the manufacturers, an advisory committee was formed under the auspices of the bureau for a further

study of the problem looking toward the establishment of a commercial standard covering nomenclature, grading rules, dimensional standards, roughing-in dimensions, and simplification of variety for porcelain stall urinals, sinks, laundry trays, lavatories, receptors, and baths. The work on nomenclature and grading rules has been completed, and a survey of dimensions and variety is now in progress. Cooperation with the Bureau of the Census has resulted in the official monthly collection and dissemination of statistics on production, new orders, shipments, and finished stock in this field.

PROTECTIVE COATINGS, METALLIC

Chromium Plating.—An extensive investigation of the solutions and methods used in chromium plating was completed and published as Technologic Paper No. 346, by H. E. Haring and W. P. Barrows. These methods have been applied at the Bureau of Engraving and Printing with the following results, as stated by the director of that bureau in his annual report of June, 1927:

> Electrolytic-printing plates are now being used in printing approximately 75 per cent of all United States currency, as compared with 50 per cent during the previous year. The cost of producing these plates is less than the cost of producing steel plates. Their extended use resulted in plates now being made to take care of the printing program 20 per cent in excess of that for 1926, with a smaller total engraving cost than the cost for 1926.

Partly as a result of these studies on chromium plating, its industrial application to dies, mandrels, gauges, printing plates, plumbing fixtures, and automobile parts is rapidly increasing.

Electrolytic Corrosion Testing.—Methods by which the tendency of metals to corrode may be accelerated electrolytically and their relative resistances to corrosion determined in a short time, were investigated, and published in a paper by W. Blum and H. S. Rawdon in volume 51 of the Transactions of the American Electrochemical Society. Further studies are in progress to show the relation of such tests to the results of other tests and of actual service.

"Spotting-Out."—Certain hardware finishes, especially those with a sulphide or so-called "oxidized" surface, show a tendency to become disfigured in storage through the appearance of small spots. A study of this subject has shown that this tendency can be overcome or at least retarded by certain simple methods. These are just being subjected to trial under commercial conditions.

Copper Electrotyping Solutions.—A study is being made of the effects and value of addition agents in such baths.

Iron Deposition.—Methods of producing thick deposits of iron for use in printing plates are being studied.

Cyanides for Electroplating.—The composition, analysis, and purification of various cyanides used in plating baths are being investigated.

Overvoltage.—Methods of measuring hydrogen overvoltage and its possible relation to electrodeposition will be exhaustively studied.

Assay of Rolled Gold Plate.—The terms "filled gold" are applied to a type of material, used chiefly in jewelry, which is made up of a core of base metal or base-metal alloy, covered either on one surface or entirely with a relatively thin layer of gold alloy. There is a growing tendency toward a better definition of such articles either by agreement among manufacturers to conform to certain definite standards, or by stamping the article with marks indicating the fineness of the gold alloy used and the proportion of gold alloy in the whole article.

When a gold-filled article is to be tested it is usually necessary to determine the fineness of the alloy and its total weight or its thickness. This involves a separation of the two layers by means of chemicals which dissolve away the base metal and leave the gold alloy. No information has been available on the effect of this procedure on the accuracy of the assay of the gold alloy. It was found desirable to do some experimental work in this field both for the bureau's guidance in the tests which it is required to make for governmental agencies and for the guidance of the trade which is interested in this type of material. The work was published in Industrial and Engineering Chemistry, volume 19, page 827 (1927), under the title "Data on the assay of rolled gold plate," by Raleigh Gilchrist. The paper gives the effects of the use of different stripping solutions on the accuracy of the assay of the gold alloy. Methods of measuring the thickness of the alloy are discussed briefly.

Graphite for Electrotyping.—A study of the graphite used in electrotyping was conducted in the laboratory and in several commercial plants. Tentative specifications have been prepared, based upon the purity, fineness, and rate of covering with nickel. These specifications and the results of the tests have been published in a paper by J. H. Winkler and W. Blum, printed and distributed by the International Association of Electrotypers.

PROTECTIVE COATINGS, NONMETALLIC

Commercial Flat Wall Paints (Lithopone Type).—To obtain data for a revision and improvement of Federal Specifications Board specification 21 (B. S. Circular No. 111), a detailed study of the characteristics of a large number of lithopone paints was made by E. F. Hickson and published in Circular 305 of the American Paint and Varnish Manufacturers' Association. (March, 1927.)

Research in Connection with Standards of Paint and Varnish Materials.—Penetration Tests of Paste Paints.—The term "consistency" as commonly applied to paste paints is generally expressed in such indefinite terms as "stiff," "medium stiff," "soft," "semipaste," "runny," etc. It has been found that the penetration

test for asphalt, modified by substituting a light (50 g) cone of the dimensions used in testing grease, is of considerable value in numerically rating paste paints. E. F. Hickson, in Circular 306 of the American Paint and Varnish Manufacturers' Association (January, 1927), has described the necessary apparatus and method of making this test.

Measurement of Gloss of Paints by the Ingersoll Glarimeter.—The glarimeter when properly used gives readings that can generally be checked within a few tenths of a degree by different operators. In the case of white paints, when the total reflection remains about constant, the only variable being the finish, gloss readings are in the proper direction as seen by the eye. The same would hold true in the case of grays or colors, if the total reflection were kept constant. When the total reflection is changed the glarimeter does not take this reflection change into account and, therefore, the readings do not compare with what the eye sees. On very glossy enamels the glarimeter does not pick out the fine distinctions of gloss visible to the unaided eye. See E. F. Hickson in Circular 307 of the American Paint and Varnish Manufacturers' Association.

Accelerated Testing of Paint and Varnish.—Considerable progress has been made in developing methods for the accelerated testing of paint materials using light, water, refrigeration, and ozonized air. A method for the quantitative determination of the time of failure depending upon measuring the permeability of films supported on fine wire gauze is being investigated. This work is described in a paper by P. H. Walker entitled "Some methods of testing paint and varnish materials," and was presented at the September, 1927, International Congress for Testing Materials, at Amsterdam, and will be published in the proceedings of that congress.

RADIO

Receiving Sets.—The bureau participated actively in the work of the subcommittee on receiving sets, committee on standardization, Institute of Radio Engineers. A member of the bureau is chairman of this subcommittee. The bureau's work has included the technical study of methods of testing and of expressing the performance of receiving sets. The results of part of the subcommittee's activities were included in a publication of the Institute of Radio Engineers entitled "Committee on standardization, preliminary drafts of reports of subcommittees," dated May 20, 1927.

Vacuum Tubes.—The bureau was active in the standardization of vacuum tubes through cooperation with the American Engineering Standards Committee, the Federal Specifications Board, and the International Electrotechnical Commission. A member of the

bureau is chairman of the Technical Committee on Vacuum Tubes of the A. E. S. C. sectional committee on radio. That committee has adopted a standard terminology for vacuum tubes, and has standardized upon an American standard four-pin vacuum-tube base. The bureau was instrumental in having the same tube base adopted as one of two international standards for tube bases by the International Electrotechnical Commission at its meeting in Italy in September. The bureau conducted experiments and played a leading part in agreements leading to the adoption of tentative specifications for a 50-watt power tube for use by the Government departments; this work was done under the auspices of the Federal Specifications Board, but the specifications have not received action by the board because of the likelihood of early change due to the rapid technical advances in vacuum tubes.

Radio Parts.—The bureau was represented, and took an active part, in the work of the technical committee on component parts and wiring, A. E. S. C. sectional committee on radio. This work is newly organized, and so far has been devoted particularly to condensers and vacuum-tube sockets.

Broadcasting.—The bureau participated, with other agencies, in a careful study of the engineering basis of the system of broadcasting in this country. A report on this subject was formulated and was presented by the committee on radio broadcasting, American Engineering Council, to the Federal Radio Commission. It is dated March 30, 1927, and entitled "A statement on engineering principles prepared for presentation to the Federal Radio Commission."

Government Radio Regulation.—The bureau cooperated in the assignment of frequencies to the several radio services of the Government through the activities of the interdepartment radio advisory committee. The bureau also aided the Federal Radio Commission similarly in connection with its regulation of non-Government radio services. One form of this aid was the study of technical questions, such as the choice of specific frequencies for the broadcast channels and the proper mode of power rating of transmitting stations. Another was the preparation of specifications for apparatus and procedure to be used in broadcast stations to maintain frequencies constant. In connection with this, four letter circulars were issued entitled:

Methods and apparatus for measurement of the frequencies of distant radio transmitting stations.

Specifications for portable piezooscillator, Bureau of Standards type N.

Requirements of constant frequency stations.

Use of the piezooscillator in radio broadcasting stations.

International Radio Conference.—The bureau participated in the preparations for, and conduct of, the International Radio Conference which met in Washington from October 4 to November 25.

Studies of frequency allocations, aeronautic radio problems, and many varieties of technical problems were included in the work handled by the bureau's representatives who served in the capacity of technical advisers.

Standards of Radio-Frequency.—Standards of radio-frequency are based directly on standards of time, and the values are incorporated in specially designed frequency meters and piezooscillators. In the enforcement of radio laws and regulations a very accurate frequency standard is required in order to obtain full use of the limited frequency spectrum. The great development of commercial radio communication, particularly broadcasting, requires that all available communication channels be used efficiently. There appeared to be in the frequency standards used by various Government and commercial laboratories slight discrepancies from the standards at the bureau which had been progressively improved by research work extending over several years. These discrepancies, while quite small, threatened to be serious. A conference of representatives of all the interested laboratories was held to agree upon a method of establishing one fundamental working standard for the United States based on the unit of time. This conference was made up of representatives of the Bureau of Standards, Bell Telephone Laboratories, American Telephone & Telegraph Co., Westinghouse Electric & Manufacturing Co., General Radio Co., Radio Corporation of America, General Electric Co., United States Navy, and the United States Army, who are all interested in having accurate standards. It was agreed that the several organizations join in a cooperative endeavor, centered at the Bureau of Standards, to develop a standard, in terms of which radio-frequencies could be measured to an absolute accuracy not less than 1 part in 100,000. This conference laid the plans for establishing a concrete standard based on a mean value obtained from several carefully controlled piezooscillators. This will give a standard which is readily available and which can be used as a basis by all interested laboratories. Piezooscillators are to be circulated at intervals to the various laboratories for intercomparison of standards. This program has been started and considerable progress made.

It is necessary not only to have a national standard of radio-frequency, but also to have agreement in the national standards of the various nations. Radio waves do not respect national borders, and the maximum use of the frequency spectrum requires that national standards in different countries agree very closely. To bring about such agreement, several years ago the bureau started a program of intercomparison of the frequency standards of the principal nations. During the past year a carefully measured piezooscillator was taken to the national laboratories of England, France, Germany, and

Italy for measurement against their standards. The measurements made in these laboratories showed an agreement of all national standards approaching that which the United States has set up as the aim for the United States standard.

The work done has shown that the development of frequency standards is abreast of the scientific progress of the art and of sufficient accuracy to meet all the commercial requirements for some time.

RAILROAD TRACK SCALES

During the period from July 1, 1926, to July 1, 1927, the track-scale testing equipments operated on 73 railroad systems and made tests in 35 States and the District of Columbia, on 840 track scales.

The general test data are recorded in the accompanying table. Classification of the tested scales is on the basis of ownership and geographical location. The tolerance adopted by the Bureau of Standards for grading track-scale weighing performance requires that the mean maximum error for any two positions on the scale likely to be assumed by the trucks of a commercial freight car shall not exceed two-tenths of 1 per cent, 0.20 per cent of the applied test loads. Test loads used by the bureau are not less than 40,000 pounds.

Results of track scale tests, fiscal year 1927

District and scale ownership	Number of scales tested	Number passed	Total	Number failed	Total	Mean numerical error, per cent of applied load	Analysis of error of incorrect scales					
							Errors in excess			Errors in deficiency		
							Number of scales	Per cent of incorrect scales	Mean error	Number of scales	Per cent of incorrect scales	Mean error
			Per cent		*Per cent*							
Eastern:												
Railroad	77	58	75.3	19	24.7	0.16	12	63.2	0.31	7	36.8	0.37
Industrial	63	48	76.2	15	23.8	.16	12	80.0	.36	3	20.0	.42
Government	1	1	100.0			.08						
State or municipality	1			1	100.0	.36				1	100.0	.36
Total	142	107	75.4	35	24.6	.16	24	68.6	.33	11	31.4	.38
Southern:												
Railroad	159	99	62.3	60	37.7	.24	36	60.0	.37	24	40.0	.53
Industrial	128	79	61.7	49	38.3	.29	16	32.7	.32	33	67.3	.66
Government	3	3	100.0			.09						
State or municipality	1	1	100.0			.20						
Total	291	182	62.6	109	37.4	.26	52	47.7	.35	57	52.3	.60
Western:												
Railroad	229	178	77.8	51	22.2	.18	28	54.9	.33	23	45.1	.62
Industrial	173	121	69.9	52	30.1	.20	20	38.5	.32	32	61.5	.42
Government	2			2	100.0	.22	1	50.0		1	50.0	.44
State or municipality	3	1	33.3	2	66.7	.40				2	100.0	.57
Total	407	300	73.7	107	26.3	.19	49	45.8	.32	58	54.2	.51
All districts:												
Railroad	465	335	72.0	130	28.0	.20	76	58.5	.34	54	41.5	.55
Industrial	364	248	68.1	116	31.9	.22	48	41.4	.33	66	58.6	.53
Government	6	4	66.7	2	33.3	.13	1	50.0	.25	1	50.0	.44
State or municipality	5	2	40.0	3	60.0	.35				3	100.0	.50
Grand total	840	589	70.1	251	29.9	.21	125	49.8	.34	126	50.2	.54
1926	980	641	65.4	339	34.6	{.29 .25}	155	45.8	.42	184	54.2	{.74 .54}
1925	898	586	65.2	312	34.8	.27	166	53.2	.45	146	46.8	.70

Track Scales in Grain Weighing Service.—Of the 364 track scales classed as "industry owned," 67 were used for weighing grain at receiving mills and elevators where the sale transaction was based upon the destination weights. Twenty-six scales, or 38.2 per cent, were correct within the special tolerance adopted for grain-weighing track scales. Twenty-two scales were adjusted to improve weighing results.

It appears that 79.4 per cent of the track scales in grain-weighing service would have passed the regular track-scale tolerance. Vigilant maintenance must be credited for this, but maintenance measures alone are powerless to sustain antiquated types of track scales within the tolerance fixed for grain scales. More durable and more precise types of track scales should replace many of the old scales still used at grain markets.

Master Track Scales.—Regular tests were made on 14 master track scales in the past year and all were found to be correct within the tolerances applied to these precision scales. Lack of operating funds prevented completion of the master-scale calibration schedules and five remained uncalibrated at the close of the fiscal year.

Test-Car Calibration.—In connection with the track scale testing schedules 32 test cars were calibrated in districts where master-scale facilities were lacking. Only nominal deviations from standard weight were discovered. A trend toward use of heavier test units has been observed.

Bureau Master Scale and Test Car Depot.—Construction of the bureau's master-scale house and test-car depot at Chicago is practically completed, and installation of equipment is now under way and installation of the master scale will commence shortly. Completion of this long-standing project will serve two important ends. The many railroads serving the Chicago district will be provided with a convenient means of periodically standardizing testing equipment and the bureau will have a centrally located depot where testing equipment may be calibrated, overhauled, and repaired.

Specifications for Two-Section Scales.—Specifications for the manu facture and installation of two-section, knife-edge type scales have been developed, approved, and made available to the public as Bureau of Standards Circular No. 333. Judging from the test records of the few scales in service, it may be predicted that this type of scale will find ready acceptance, particularly at weighing points where speed of weighing is a desirable consideration.

RAIL STEELS

Rail Failures and Endurance.—All railroads have exact specifications for the purchase of rails, but the specifications seem to have little or no bearing on the freedom of the rail from transverse fissures in service, whether transverse fissure failures are due to preexisting

nuclei in the rail or to its inability to withstand modern traffic conditions. Cooperation with a research associate from the Gathmann Engineering Co. on soundness of rails from ingots cast big end up provided material of known history and properties for a study of the endurance properties of rail steel, in which the American Railway Engineering Association and the Manufacturers Rail Steel Committee, and the American Society of Civil Engineers, Track Stress Committee, have cooperated. Further cooperation in the procurement of used rails of known history for more work along this line is promised by the Baltimore & Ohio Railroad. New 100-pound rails which passed the A. R. E. A. specifications give specimens whose endurance limits range from 41,000 to 59,000 lbs./in.^{2}. Various gaps in information on endurance testing which must be filled before the endurance of rail steel can be adequately examined are being studied in cooperation with the Engineering Mechanics Section.

Publication.—The Endurance and Other Properties of Rail Steels, John R. Freeman, jr., R. L. Dowdell, and Wm. J. Berry, B. S. Tech. Paper No. 363.

RUBBER

Standardization of Rubber.—The bureau has taken an active part in the standardization work of technical societies. A very close contact is maintained with The Rubber Association of America in promoting standards of quality and performance.

The rubber section of the American Chemical Society has established a research fellowship at the bureau to investigate those problems which are of the greatest importance in the standardization of test procedure. A program has been prepared and is being carried out under the direction of a committee. The first phase of the work is an investigation of the effects of temperature and humidity on the physical properties of rubber.

The Celite Products Co., of Los Angeles, Calif., established a fellowship at the bureau to investigate the properties which the various grades of Celite impart to vulcanized compounded rubber.

Cooperative work with the Continental-Mexican Rubber Co., of New York, in a study of the properties of guayule rubber has resulted in the publication of test results as Technologic Paper No. 353, Some Vulcanization Tests of Guayule Rubber. It was shown that improved processes in the extraction of this material from the shrub produce a rubber that compares favorably with plantation Hevea rubber. A standard high quality of this native rubber if produced in sufficiently large quantity would serve a very useful purpose in the United States rubber industry.

Properties of Rubber.—Density and electrical properties of compounds of rubber and sulphur were measured for the range of composition from 0 to 32 per cent of sulphur, or from crude rubber to

hard rubber, and were published in Scientific Paper No. 560, by H. L. Curtis, A. T. McPherson, and A. H. Scott. Important changes in the properties with the proportion of sulphur were noted. These changes show definite regularities and occur at compositions which may be represented by simple empirical formulas; they are, therefore, believed to indicate the existence of definite compounds of rubber and sulphur.

At the composition 19 per cent of sulphur, which corresponds to $(C_5H_8)_2S$, all the properties which have been studied undergo significant changes. At this composition the curve relating density to percentage of sulphur shows a change in slope, and the curve relating thermal expansivity to percentage of sulphur shows a distinct inflection. Both the dielectric constant and the power factor curves pass through a minimum at 19 per cent of sulphur, while the resistivity curve takes a decided upward trend.

The composition 10.5 per cent of sulphur, which corresponds to the formula $(C_5H_8)_4S$, is marked by a maximum value of the dielectric constant. The power factor shows a maximum at 13.5 per cent, which may represent $(C_5H_8)_3S$, or else an equimolecular mixture of $(C_5H_8)_2S$ and $(C_5H_8)_4S$. The maximum of the resistivity occurs at about 26 per cent of sulphur, which corresponds to $(C_5H_8)_4S_3$. Other properties show changes of a less marked nature at these compositions.

No extensive study was made of the effect of free sulphur on the electrical properties of rubber, but data were obtained which indicate that it is small relative to the effect of combined sulphur.

Use and Care of Tires.—Circular No. 341, "The Use and Care of Tires," presents useful information relative to tires in general, and points out certain precautions, the observation of which is essential to their proper use and care. The various standards which are recommended for the most efficient operation of tires are given in detail. These include recommended loads for solid rubber tires and the relation which should be maintained between the air pressure and loads in various types of pneumatic tires.

Balloon Tire Tests.—An investigation of the performance of balloon tires under carefully controlled conditions simulating those of severe road service has furnished the data necessary for establishing standard test requirements. Circular No. 115 has been revised to include specification requirements for balloon tires and tubes as promulgated by the Federal Specifications Board. Annual Federal purchases of tire equipment now approximate $1,500,000.

Rubber Floor Tile.—The rapidly increasing use of rubber floor tile in Government hospitals has emphasized the desirability of establishing standards of quality for this material. Requests for information regarding rubber tile have been received by the bureau from

Government departments, and numerous laboratory tests have been conducted. The bureau is cooperating with the Rubber Association of America in a comprehensive investigation designed to develop standards of quality for rubber floor tile.

Garden Hose.—An investigation was conducted to determine the discharge capacity of ½, ⅝, and ¾ inch garden hose when connected in the manner which is common in residences. The results of this investigation, together with a description of different types of hose, is published in circular No. 327. The advantages of standardizing on ⅝-inch hose for this use are pointed out.

Investigations on Rubber and Packings.—A mineral-oil solvent for vulcanized rubber developed at the bureau has been applied to the analyses of mechanical packings with success. Such packings are marketed as woven, braided, twisted, or compressed mixtures in which asbestos, rubber, cotton, metals, graphite, and liquid lubricants may be present. They are used as gaskets or are coiled in stuffing boxes or placed in other moving parts of machinery where continuous performance, safety, and reliability depend to a large extent on the correct composition of the material. It is now possible to determine the components in packing and to isolate the asbestos as available fiber. Specifications have been prepared based on composition. The conformance of materials to the requirements of specifications may be determined with an accuracy at least equal to the reproducibility of manufacturing operations.

Further research is necessary to provide a basis for revising the present specifications for different grades of rubber insulation. Technologic Paper 342, Aging of Soft Rubber Goods, by R. F. Tener, W. H. Smith, and W. L. Holt, has a direct bearing upon one phase of the work on insulation.

SAFETY CODES

National Electrical Safety Code.—The fourth edition of the National Electrical Safety Code was issued in 1927. It had been revised by a sectional committee functioning under the procedure of the American Engineering Standards Committee. It is designated as Handbook No. 3. A discussion of this code is designated as Handbook No. 4. The various parts of the code have been issued separately as Handbooks Nos. 6, 7, 8, 9, and 10.

The code consists of five parts, as follows:

1. Rules for installation and maintenance of machinery, switchboards, and wiring in generating stations and substations.

2. Rules for the construction and maintenance of overhead and underground supply and communication lines.

3. Rules for the installation and maintenance of electrical apparatus and wiring in factories, residences, and wherever electricity is utilized for light, heat, or power.

4. Rules to be observed by operators in working on or near electrical machinery or lines.

5. Rules for radio installations.

In addition, there are two sections containing definitions and rules for the protective grounding of circuits and equipment.

Protection Against Lightning.—A code has been about completed, in which are formulated the accepted standards for protection against lightning. The field covered includes the specifications for lightning rods for buildings and other structures, the protection of persons and livestock, the protection of oil tanks and other structures containing inflammable gases and liquids, and the protection of electrical apparatus and supply and communication lines. This work has been carried out under the auspices of the American Engineering Standards Committee, the Bureau of Standards and the American Institute of Electrical Engineers being joint sponsors for this project.

Industrial Safety Standards.—In addition to the electrical codes mentioned above, the bureau is sponsor for the following safety codes:

Gas Safety Code (joint sponsorship with the American Gas Association).

Code for the Protection of Heads and Eyes of Industrial Workers.

Safety Code for Logging and Sawmill Operations.

Saftety Code for Aeronautics (joint sponsorship with the Society of Automotive Engineers).

Safety Code for Elevators, Dumbwaiters, and Escalators (joint sponsorship with the American Institute of Architects, and the American Society of Mechanical Engineers).

Code of Colors and Form for Traffic Signals for Highways and Vehicles (joint sponsorship with the American Association of State Highway Officials and the National Safety Council).

Codes on all of these subjects have been completed and approved by the American Engineering Standards Committee. The Head and and Eye Code, the Logging Code, and the Code of Traffic Signals are publications of the bureau, while the others have been published by the joint sponsors.

SIMPLIFIED PRACTICE

During the year 1927, 23 new Simplified Practice Recommendations were completed, bringing the total number of completed recommendations to 79.

Surveys of the various industries to determine the degree of adherence to previously adopted Simplified Practice Recommendations indicate that 79.5 per cent of the acceptors, by volume of output, were adhering to the standards outlined in the recommendations.

The success of any standard is measured by the degree or extent of its actual application or use. Moreover, products, however meritorious, do not "sell" themselves; their values must be demonstrated. It is as much a function of standardizing bodies to promote their standards as it is to produce them.

The most rapid and widespread adoption of a standard is not obtained by waiting for its superiority over former practice to become evident through "trial and error." Instead, it is essential in the interest of minimizing waste that the advantages inherent in the standard be thoroughly and persistently advertised and demonstrated. Only through actual demonstration can the values of the standard be brought home effectively. Theoretical prediction and laboratory forecasts are helpful, but usually deficient in power to convince the prospective user of the benefits likely to come to him through using the standard. If standards are not "sold"; that is, promoted, then there is little use in continuing to pile them up with the hope that eventually some one will apply them.

These indispensable factors of promotion and observance are insured through the appointment at a general conference of a standing committee truly representative of all phases of the industry, and by periodic surveys by this committee to determine the degree of adherence and to secure factual data upon which to base intelligent revision or reaffirmation as one of its most important functions.

Annual audits, or surveys, conducted by the standing committees in 18 different fields revealed that there is an average degree of adherence of 79.5 per cent to their simplification programs. This indicates that the sizes, etc., adopted and published as Simplified Practice Recommendations are being applied in the products themselves, and that the recommended standards are always abreast of the best current practices in the industries involved.

Revisions and reaffirmations for the calendar year 1927

REVISIONS AND REAFFIRMATIONS SUPPORTED BY ACTUAL FACTUAL SURVEYS

Simplified Practice Recommendation No.	Title of recommendation	Date action was taken	Degree of adherence
			Per cent
1	Paving brick	Mar. 31, 1927	[1] 65
2	Beds, springs, and mattresses	Apr. 13, 1927	[2] 61
3	Metal lath	June 17, 1927	[1] 99
5	Hotel chinaware	Dec. 15, 1927	[2] 80.6
6	Files and rasps	Oct. 19, 1927	[2] 93
8	Range boilers	May 3, 1927	[2] 99
9	Woven-wire fencing	Sept. 23, 1927	[2] 99
20	Steel barrels and drums	Dec. 7, 1927	[1] 89.04
28	Sheet steel for jobbers:		
	Sheet-steel portion	Oct. 18, 1927	[2] 85
	Roofing portion	do	[2] 52
29	Eaves trough and conductor pipe	do	[2] 92
30	Terneplate	do	[1] 100
32	Concrete building units	Feb. 22, 1927	[2] 98
33	Cafeteria and lunch room chinaware	Dec. 15, 1927	[2] 80.6
35	Steel lockers	Dec. 13, 1927	[1] 85.18
39	Dining-car chinaware	Dec. 15, 1927	[2] 80.6
40	Hospital chinaware	do	[2] 80.6
43	Paint and varnish brushes	Nov. 15, 1927	[1] 80.5
44	Boxboard	do	[2] 65
46	Tissue paper	Feb. 23, 1927 Oct. 24, 1927	[2] 56 [2] 85
51	Die head chasers	Dec. 20, 1927	[1] 80.74
55	Tinware, galvanized and japanned ware	Oct. 19, 1927	[1] 92
Average			82.56

REVISIONS AND REAFFIRMATIONS NOT SUPPORTED BY ACTUAL FACTUAL SURVEYS

Simplified Practice Recommendation No.	Title of recommendation	Date action was taken	Estimated degree of adherence
			Per cent
10	Milk bottles and caps	Feb. 8, 1927	[1] 75
12	Hollow building tile	Feb. 10, 1927	[1] 87
17	Forged tools	Apr. 5, 1927	[2]
	(Reaffirmed as to forged tool recommendation revised to include eye sizes.)	----do----	[1]
18	Builders' hardware	Apr. 29, 1927	[1] 83
22	Paper	Apr. 21, 1927	[2]
26	Steel reinforcing bars	May 21, 1927	[2] 80
27	Cotton duck	Jan. 10, 1927	[1] 90
31	Loaded paper shot shells	Dec. 7, 1927	[2]
37	Commercial purchase forms	Feb. 16, 1927	[1]
45	Grinding wheels	Jan. 6, 1927	[1]
48	Shovels, spades, and scoops	June 15, 1927	[1]
50	Bank checks	Oct. 6, 1927	[2] 70
51	Die head chasers	Apr. 8, 1927	[2]
52	Vitreous china plumbing fixtures	Sept. 28, 1927	[2]
54	Sterling silver flatware	June 22, 1927	[2]
56	Carbon brushes	Sept. 29, 1927	[1]
58	Iron and steel scrap	Jan. 18, 1927	[1]
62	Metallic cartridges	Dec. 7, 1927	[2]
Average			80

[1] Indicates revision. [2] Indicates reaffirmation.

New completed Simplified Practice Recommendations for the year 1927

[Those marked * were completed during the year and are now in the acceptance stage]

Completed recommendations	Formerly	Now	Reduction	Per cent
Solid section steel sash	42,877	2,244	40,633	95
Hospital and institutional textiles	575	26	549	95
Lumber stock for wire-bound boxes (lengths)	102	6	96	94
Plumbing fixtures, staple vitreous	441	58	383	87
Concrete reinforcement bars (grades of steel)	3	1	2	67
Razor blades (systems of packing)	2	1	1	50
Salt containers	35	19	16	46
Flash-light cases	25	14	11	44
Metallic cartridges	348	256	92	26
*Insulators, porcelain (one piece)	272	249	23	9
White glazed tile and ceramic mosaic (unglazed) [1]	----	----	----	----
*Metal spools and reels	----	6	----	----
Bolt and nut containers	----	18	----	----
*Spark plugs	----	6	----	----
*Piston ring oversizes	----	6	----	----
Brake linings	----	37	----	----
Roller bearings, taper	----	172	----	----
*Turnbuckles	248	115	113	54
Composition blackboard:				
Colors	3	1	2	66
Widths	18	8	10	55
Lengths	54	13	41	76
Ash handles (grades)	----	3	----	----
*Hickory handles (grades)	----	11	----	----
*Curbstones	----	----	----	75
*Malleable foundry refractories	----	----	----	92

[1] Indeterminate.

SPECIFICATIONS

Specifications Directory and Encyclopedia.—In 1925 the National Directory of Commodity Specifications was issued as the first of the two series of publications.

As the first of the second series of publications dealing with the standards and specifications in various industries, there has been issued a volume entitled "Standards and Specifications in the Wood-Using Industries." In this volume, an attempt has been made to include the substance of all standards and specifications in the wood-using industries formulated by the lumber manufacturers associations and other trade associations having national recognition; the national technical societies, including those dealing with lumber and manufactures thereof, paper and paper products; and other organizations which speak for industry or with the authority of the Federal Government as a whole. In it use has been made of the decimal system of classification of paper and wood employed in the National Directory of Commodity Specifications. Under the proper classification numerals have been listed certain important groups of commodities for which there might well be, but are not as yet, specifications that can be referred to as nationally recognized.

Contributions Toward Specifications.—Much of the experimental research conducted in the laboratories of the bureau results in the preparation of new, or revision of existing, specifications. In setting forth what the purchaser desires and what the manufacturer is required to supply, specifications serve as the common meeting ground of the manufacturers, dealers, and users. They insure the proper grade of materials for a given use, put bids on an easily comparable basis, and promote fairness in trade competition. The bureau contributes in no small degree to the precise defining and establishing of grades and qualities for many commodities of commerce through representation on many national specification-making bodies, and in aiding the Government departments, especially through the Federal Specifications Board in formulating standard purchase specifications. It helps to draft specifications and devises methods of test; it tests Government deliveries of supplies, and determines how to improve the materials or the standards of quality. Its researches lead to the establishment of the best magnitudes of useful properties and the deviations allowable in the interest of economy.

The bureau takes a very active part in the work of almost all of the 76 technical committees of the Federal Specifications Board, and the chairmanships of 30 of these committees are held by bureau experts. The chairman ex officio of the board is the director of the bureau, and the vice chairman and technical secretary is a member of the bureau's staff. An outline of the work of the board is given in Chapter IV.

In order to facilitate the use of nationally recognized specifications the bureau has inaugurated the so-called "certification plan," in accordance with which there are compiled lists of manufacturers who have expressed their desire to supply material in accordance with certain selected specifications and their willingness to certify to the purchaser upon request that the material thus supplied is guaranteed to comply with the requirements and tests of the specifications. An outline of this plan is given on page 148.

STONE

Limestone Research.—The results of the determination of certain of the physical properties of the principal limestones of the United States ordinarily employed for cut-stone construction have been published as Bureau of Standards Technologic Paper No. 349. This paper contains the results of tests on 134 samples of limestone from Alabama, Illinois, Indiana, Kansas, Kentucky, Minnesota, Missouri, New York, and Texas. In addition to the usual physical determinations of strength, elasticity, absorption, and porosity, this publication contains results of weathering, discoloration, fatigue, permeability, thermal expansion, and efflorescence tests. The average strength in compression perpendicular to the bedding was indicated to be 9,030 pounds per square inch with a range from 2,500 to 28,400. A comparison of the results of various tests in this series has indicated the following average ratios for limestone:

Tensile strength: compressive strength	= 0.05
Transverse strength: compressive strength	= .17
Shearing strength: compressive strength	= .20
Compressive strength wet: compressive strength dry	= .91
E in flexure : E in compression	= .75
Absorption (two weeks' immersion) : porosity	= .70

The use of elastic pointing materials in masonry construction has assumed such importance that a study of the merits of such materials has been deemed advisable. An investigation along this line has been started in connection with the cooperative work being carried out by this bureau and the Indiana Limestone Co. The main points under consideration in this connection are as follows: (1) The ability of the preparations to maintain a waterproof joint when submitted to strains similar to those caused by structural movements. (2) Effects of high and low temperatures equivalent to the usual annual temperature range. (3) Discoloration or other undesirable effects caused by the use of such materials on stone masonry.

The work on steam cleaning was completed during the year, and the results described in "The development of the steam cleaning process," by H. H. Dutton, Stone, volume 48, No. 4, page 225, April, 1927, and No. 5, page 288, May, 1927, reprinted in Building and Building Management, volume 27, No. 12, page 41, June 6, 1927.

Maintenance of Interior Marble.—The research conducted by this bureau in cooperation with the National Association of Marble Dealers was completed in March, 1927. The results of this work have been published in Bureau of Standards Technologic Paper No. 350, entitled "A Study of Problems Relating to the Maintenance of Interior Marble." An abstract of this paper has also been published by the National Association of Marble Dealers in a booklet entitled "The Maintenance of Interior Marble." These publications contain the results of investigations to determine the undesirable effects which may occur, due to the use of certain types of cleaning preparations, recommendations as to cleaning preparations, and methods for cleaning marble, injurious effects of various salt solutions which may penetrate marblework under various conditions of use, methods of removing various kinds of accidental stains from marble, and recommendations for means of installation of marble to prevent certain troubles from discoloration or disintegration.

Weathering Tests on Building Stones.—Freezing tests are in progress on samples of natural building stone from a considerable number of important deposits in this country, to determine the relative resistance to frost action. Due to the length of time required to make such tests it has not been possible to publish a complete report on this work. The results of frost-action tests on limestone so far as completed were included in Technologic Paper No. 349.

TESTS

An itemized statement of tests completed during the fiscal year is given in the following table.

Numbers of test items, determinations, and fee value for tests completed during the fiscal year ended June 30, 1927

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	1,247	497	226	1,964	3,927	$13,732.89
Electric batteries	----------	1,537	----------	1,537	2,944	9,769.50
Electric lamps and lighting equipment	201	2,691	451	[1] 3,343	3,541	[2] 17,564.12
Length-measuring devices	172	168	2	342	2,113	2,063.90
Gauges and guage steels	1,540	479	1,055	3,074	11,854	2,478.00
Miscellaneous dimensional determinations	2,118	1,361	87	3,566	14,052	6,411.90
Weights and balances	5,942	1,143	533	7,618	16,201	4,893.40
Scales	----------	979	----------	979	25,352	42,990.00
Timepieces	427	10	18	455	5,871	912.00
Volumetric apparatus	6,932	4,949	154	12,035	23,046	7,657.00
Hydrometers	627	128	5	760	2,327	1,149.45
Density determinations, etc	59	7	294	360	560	536.00
Laboratory thermometers	2,161	825	235	3,221	17,447	6,309.55
Clinical thermometers	34,950	28,819	----------	63,769	255,076	5,043.41
Pyrometers, calorimeters, etc	167	60	124	351	3,289	3,703.74
Insulating materials	32	37	16	85	141	620.00
Fire-resisting materials	17	44	----------	61	145	4,863.00
Fuels and lubricants	60	1,693	160	1,913	12,295	18,530.00
Automotive equipment, etc	175	67	24	266	903	1,136.50
Optical instruments and materials	319	506	195	1,020	2,542	5,095.60
Carbohydrates	17	1,897	----------	1,914	2,906	3,194.50
Radioactive materials	523	31	----------	554	564	3,493.00
Engineering instruments and appliances	128	640	54	822	956	10,758.50
Aeronautic instruments	21	229	14	264	750	3,686.00
Aerodynamic tests of models	12	5	10	27	96	1,452.00
Physical properties of engineering materials	373	2,292	144	2,809	5,103	15,517.17
Sound producing and measuring instruments	15	51	27	93	117	1,398.50
Making of special castings	----------	58	262	320	989	2,613.68
Fusible boiler plugs	----------	366	----------	366	731	1,827.50
Metallographic examinations	----------	381	99	480	682	2,373.36
Miscellaneous metallurgical tests	----------	377	615	992	2,823	6,460.82
Pottery and chinaware	5	212	10	227	780	1,523.00
Glass	----------	22	18	40	120	455.00
Refractories and heavy clay products	4	62	81	147	1,076	2,860.00
Cement, concreting materials, lime, etc	36	8,394	125	8,555	28,435	112,838.33
Stone and sand-lime brick	----------	48	4	52	732	369.25
Miscellaneous ceramic materials	3	1,634	87	1,724	2,159	8,254.50
Rubber	----------	1,521	376	1,897	12,160	28,218.26
Textiles	----------	6,298	211	6,509	14,182	24,362.00
Paper	47	2,036	160	2,243	6,565	16,008.00
Leather	13	218	1	232	1,028	1,627.00
Paint, varnish, and bituminous materials	----------	1,170	19	1,189	9,687	21,020.79
Chemical analysis of metals	1	465	354	820	3,526	11,982.80
Chemical tests of miscellaneous materials	----------	999	108	1,107	3,909	9,965.60
Distribution of standard samples	5,830	630	20	6,480	24	13,545.50
Total	64,174	76,036	6,372	146,582	[3] 503,726	[3] 461,265.02

[1] In addition, the bureau inspected 1,216,751 incandescent lamps at various factories for other branches of the Government.

[2] Includes fee value of $3,196.12 for lamps inspected at factories.

[3] Of these totals, 214,826 determinations were for the public, fee value, $60,228.73; 269,367 determinations were for the Government departments and State institutions, fee value, $357,874.64; 19,533 determinations were for the bureau, fee value, $43,161.65. 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.

TEXTILES

Characteristics of Mohair Fiber.—PHYSICAL CHARACTERISTICS OF MOHAIR FIBER.—Data regarding the physical characteristics of mohair fiber were obtained in order to supplement the technical and economic information regarding the mohair industry now being collated by the mohair committee of the Departments of Commerce and Agriculture. Strength and diameter measurements were made. A photomicroscopic study of the mohair fiber and mohair kemp was prepared. After much tedious effort cross sections were prepared thin enough to show the cellular structure of the mohair fiber.

The mohair bulletin for which this information was obtained is a cooperative effort of the Departments of Commerce and Agriculture in response to a request of the Angora goat and mohair industry. It will contain all the authoritative data on the Angora goat and mohair available from outside sources and developed in Government laboratories. Studies were made where necessary to complete or supplement this information.

Wearing Qualities of Textiles, Carpet Wear Test.—The wear of a textile material is very complicated, including such factors as abrasion, repeated stress, continued stress, soil effect, atmospheric effects, light, heat, and washing effects.

Several types of apparatus for surface abrasion have been built and tried. The results have been chiefly interesting from the standpoint of indicating what further work is necessary.

A machine for testing carpet wear based on the leather wear testing machine (described in Bureau of Standards Technologic Paper No. 147) was designed and is now being built in the bureau's shop.

Considerable data on carpet constructions have been obtained. An interesting phase of this work was the development of a test for measuring the tightness with which the carpet pile is bound to the backing.

Rayon.—The work on rayon (artificial silk) has been along two lines: A study of wet-tensile properties and a study of the effect of aging.

Preliminary work included accurate methods of differentiation. A positive method for distinguishing cuprammonium rayon was worked out and published. (Textile World, October 19, 1926, p. 2029.)

Fastness Measurement.—A method of expressing in numerical terms the fading which occurs when dyed textile materials are exposed to sunlight, artificial light, washing, perspiration, etc., was needed. This would supplement the work which is being done on laboratory test methods for fading.

Through an arrangement with the optics division a member of the textile section made a study of spectrophotometric measurements used in pure color determinations.

These spectrophotometric data were transformed by the usual methods of colorimetry, so that the color differences are expressed in fundamental terms with regard to both the physical properties of materials underlying color production and to the psychological facts of color perception. This method is experimentally definite and reproducible. It is somewhat involved, however, and suitable for research work rather than routine analysis.

Size Standardization.—The projects on standardization of sizes have been continued. These are undertaken in cooperation with the National Association of Hosiery and Underwear Manufacturers and the Associated Knit Underwear Manufacturers.

Hosiery size standardization projects consisted of lengths of three-fourths and seven-eighths length children's and misses ribbed hosiery.

In the underwear industry the following size standards have now been adopted:

1. Men's ribbed (1x1) cotton union suits, bleached fabric from carded yarns.
2. Men's flat knit cotton union suits.
3. Men's 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).
4. Boys' ribbed (1x1) cotton union suits.
5. Boys' flat knit cotton union suits.
6. Children's ribbed (1x1) cotton union suits.
7. Children's flat knit cotton union suits.
8. Men's ribbed (1x1) cotton two-piece underwear.
9. Men's flat knit cotton two-piece underwear.
10. Men's flat knit wool and wool-cotton two-piece underwear (for garments that are washed and fulled after seaming).
11. Boys' ribbed (1x1) cotton two-piece underwear.
12. Boys' flat knit cotton two-piece underwear.
13. Boys' flat knit wool and wool-cotton two-piece underwear.
14. Infants' bands and shirts.
15. Children's sleeping garments.
16. Men's ribbed and flat knit athletic shirts (pullover shirts).

Endurance Tests of Fiber Rope.—Rope Yarn Bending.—The apparatus previously described in a bureau technologic paper (T300) was used on a number of samples of rope yarn made specially with different grades of fiber, twists, sizes, and oil contents. An extensive study has been made including, in addition to their resistance to bending, actual test results on their physical properties.

Considerable attention has been given to the effect of changes of grades on the physical properties. Logical groupings of twist, size, etc., indicate the selectivity of the rope yarn bending test, but the overlapping results on the different grades indicate that from the standpoint of the bending fatigue there is no justification for the grade

system now in use. The results will be laid before the manufacturers technical representatives for recommendations as to further study.

Rope Bending.—Several changes, both in construction and design, were made on the large rope-bending machine as the result of the preliminary tests. Results have been obtained on 27 samples of rope made at the Boston Navy Yard with different grades and grade mixtures of abaca. The variability of other constructional features largely obscured the variability due to the grades of fiber. Tests are now in progress on ropes of different lays.

Removal of Stains from Cellulose Acetate Rayon.—One large class of rayons is made using the cellulose acetate process. This rayon, although not readily stained in service, is difficult to handle when stained, since many of the common cleaning agents will attack or destroy the fiber.

A method was developed by the research associate of the National Association of Dyers and Cleaners for "spotting" these stains in the cleaning plant. The method consists essentially of mixing the usual spotting agent with glycerin in equal parts, then proceeding in the regular manner. This method was published in a trade journal (American Dyestuff Reporter, April, 1927), and also given wide circulation by means of special wall charts issued by the National Association of Dyers and Cleaners.

Investigations on Dyes.—The increasing need for standard tests for the fastness of color of dyed textiles has led to extensive work on fastness to light tests and to some on fastness to washing, both in cooperation with the American Association of Textile Chemists and Colorists. The light tests were started in June, 1926, and discontinued in the early fall. The work was resumed in June, 1927, with the assistance of a research associate.

In order to determine how dyed fabrics fade under different conditions of sunlight and daylight exposure in the same locality, six identical sets of over 1,000 dyeings each have been exposed in glazed cabinets on the roof. Other sets have been exposed to the light of a violet carbon arc, which is one of the most promising artificial sources of light for fastness tests. Because of the large number of samples to be studied the report on this investigation may not be ready for publication until late in 1928.

A supplementary investigation on the fading caused by sunlight transmitted through corex, vita, and window glass, and through various colored glasses has been completed.

Publications.—Report on experiments with the photoelectric cell in relation to testing fastness to light of dyed materials, W. D. Appel, Am. Dyestuff Reporter; November 14, 1927.

Report of the subcommittee on light fastness. I. Light exposure, series 3, W. D. Appel and W. H. Cady, chairman of the subcommittee, Am. Assoc. of Textile Chemists and Colorists, Am. Dyestuff Reporter; November 14, 1927.

At the request of the Commission of Fine Arts and of the Committee on the Standardization of the American Flag numerous dyes were tested in order to find suitably fast red and blue, for cotton and wool, of the exact shades desired. No decision can be made until after the completion of a series of practical tests by the Navy Department.

THERAPEUTIC APPARATUS

X-ray and Radium Standardization.—In recent years many of the larger hospitals in this country and abroad have been using very penetrating X rays for therapeutic purposes. It is recognized that the successful use of this radiation depends upon accurate dosage measurement under accurately controlled conditions, but at present several different units of measurement are used under varying conditions with no reliable basis for comparing the dosage used in different hospitals.

At the urgent request of the Radiological Society of America and of the American Medical Association, the X-ray laboratory of the Bureau of Standards is now centering its efforts on the problem of dosage measurement. Various units and methods of measurement are being investigated. In June, 1928, there will be an International Congress at Stockholm at which this and similar investigations at the National Physical Laboratory, the Reichsanstalt, and many centers of medical research will be reported with the hope of adopting a single international unit to be measured under carefully specified conditions. In the future practical measuring devices will be calibrated at this bureau in terms of this standard. In the meantime performance of X-ray installations is being investigated, protective materials are being tested, and hazards to operators are being studied. A new method of measuring X rays is now being investigated.

A successful investigation of very soft X rays, by the use of a diffraction grating of the type commonly used for visible light, was recently completed. The purpose of this research was primarily theoretical, but it is also of significance from the viewpoint of standardization. It demonstrates that wave-length determinations in this inaccessible region can be obtained directly in units of length. Commonly the X-ray wave lengths are measured in terms of a theoretically derived value for the spacing of atoms in crystals.

The problem of radium standardization has for a long time been on a very satisfactory basis. This bureau keeps accurately measured standard samples of radium, and the radium content of any sample submitted can be determined by accurate comparison methods in terms of this standard. Tests of over 7.5 g of radium, worth about $500,000, were made in the past year. Many properties of radium and other radioactive materials are being investigated.

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Publications.—X-ray standardization problems, F. L. Hunt, Am. J. of Radiology; 1927.

X-ray protective plasters, F. L. Hunt, Radiology, **8**, p. 117; 1927.

Half period of radium E, L. F. Curtiss, Phys. Rev., **30**, p. 539; 1927.

X rays of long-wave length from a ruled grating, F. L. Hunt, Phys. Rev., **30**, p. 227; 1927.

THERMAL EXPANSION

Equipment for Measuring Thermal Expansion.—An extremely simple and convenient device has been constructed for the ordinary requirements of thermal expansion tests in laboratories and factories wishing to standardize materials on the basis of expansion values. A fused quartz tube closed at one end serves as the container or support for the specimen to be tested. A rod of fused quartz rests on the specimen and extends to the top of the tube. The differential motion between the tube and rod is registered by a dial indicator. The indicator reading, plus the value for fused silica (known) gives the expansion of the material. This equipment is being installed in a number of research laboratories and is giving excellent satisfaction. The low cost of the equipment and the speed with which tests may be completed are further elements of convenience and efficiency which appeal to research laboratories.

Thermal Expansion of Graphite.—Results of an investigation on the linear thermal expansion of longitudinal and transverse samples of artificial graphite (99.2 to 99.7 per cent carbon) over various temperature ranges between room temperature and 600° C. are given in Technologic Paper No. 335, Thermal Expansion of Graphite, by Peter Hidnert and W. T. Sweeney.

The coefficients of expansion of graphite are low. For example, the coefficient of expansion of ordinary steel is about six times the coefficient of longitudinal sections of graphite and about four times the value for transverse sections between 20 and 100° C. The transverse samples expand considerably more than the longitudinal samples (approximately 45 per cent). The coefficients of expansion of all samples increase with temperature. For the longitudinal and transverse samples the coefficients of expansion decrease slightly as the purity (carbon content) increases.

Résumé of average coefficients of expansion of artificial graphite

Material	Average coefficients of expansion per degree centigrade					
	20 to 100° C.	20 to 200° C.	20 to 300° C.	20 to 400° C.	20 to 500° C.	20 to 600° C.
	$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$	$\times 10^{-6}$
Longitudinal	1.9	2.0	2.2	2.4	2.5	2.7
Transverse	2.9	3.0	3.2	3.5	3.6	3.7

Thermal Expansion of Beryllium and Aluminum-Beryllium Alloys.—The investigation described in S565, Thermal Expansion of Beryllium and Aluminum-Beryllium Alloys, by Peter Hidnert and W. T. Sweeney, was undertaken because no data on this increasingly important material were available. Expansion determinations were made over various temperature ranges between −120 and +700° C. on a sample of berryllium (98.9 per cent) and between room temperature and 500° C. on aluminum-beryllium alloys containing various percentages of beryllium (4 to 33 per cent).

The coefficient of expansion of beryllium increases rapidly with temperature. The coefficients or rates of expansion at −110 and +650° C. are 5.0×10^{-6} and 20×10^{-6} per ° C., respectively. Beryllium expands considerably less than the other elements of Subgroup II B (magnesium, zinc, cadmium, and mercury).

The coefficients of expansion of the aluminum-beryllium alloys decrease with increase in the beryllium content. The relations between the coefficients of expansion and the chemical composition were compared with the equilibrium diagram obtained by Oesterheld, and were found to be in agreement with the theory for this type of diagram.

The following table gives a résumé of average coefficients of expansion derived from the data on all samples for various temperature ranges between 20 and 500° C. In most cases, each coefficient represents an average of the values obtained on two or more heatings.

Résumé of average coefficients of expansion of beryllium and aluminum-beryllium alloys

Material	Average coefficients of expansion per degree centigrade				
	20 to 100° C.	20 to 200° C.	20 to 300° C.	20 to 400° C.	20 to 500° C.
	$\times10^{-6}$	$\times10^{-6}$	$\times10^{-6}$	$\times10^{-6}$	$\times10^{-6}$
Beryllium (98.9 per cent)	12.3	13.3	14.0	14.8	15.5
Aluminum-beryllium alloy (4.2 per cent beryllium)	22.2	23.2	24.4	25.1	26.5
Aluminum-beryllium alloy (10.1 per cent beryllium)	21.4	22.5	23.3	24.1	25.4
Aluminum-beryllium alloy (18.6 per cent beryllium)	20.0	20.8	22.1	23.0	24.0
Aluminum-beryllium alloy (27.5 per cent beryllium)	18.8	19.8	21.1	22.0	23.0
Aluminum-beryllium alloy (32.7 per cent beryllium)	17.9	19.2	20.6	21.3	22.3

WEIGHTS AND MEASURES

New Calibration of the Bureau's End Standards.—Precision gauges or gauge blocks (pieces of metal, usually steel, having two opposite faces plane, parallel and a specified distance apart) are used in the shop to check micrometers and other measuring instruments and also as distance pieces or size blocks for precise mechanical work. Each year this bureau calibrates (by comparison with its end standards) large numbers of precision gauges for both makers and users. These end standards, which consist of several carefully selected and

tested sets of precision gauges, as also the commercial gauges compared with them, have been calibrated since 1918 by the interference methods described in Bureau of Standards Scientific Paper No. 436. In the selection of end standards and commercial precision gauges,

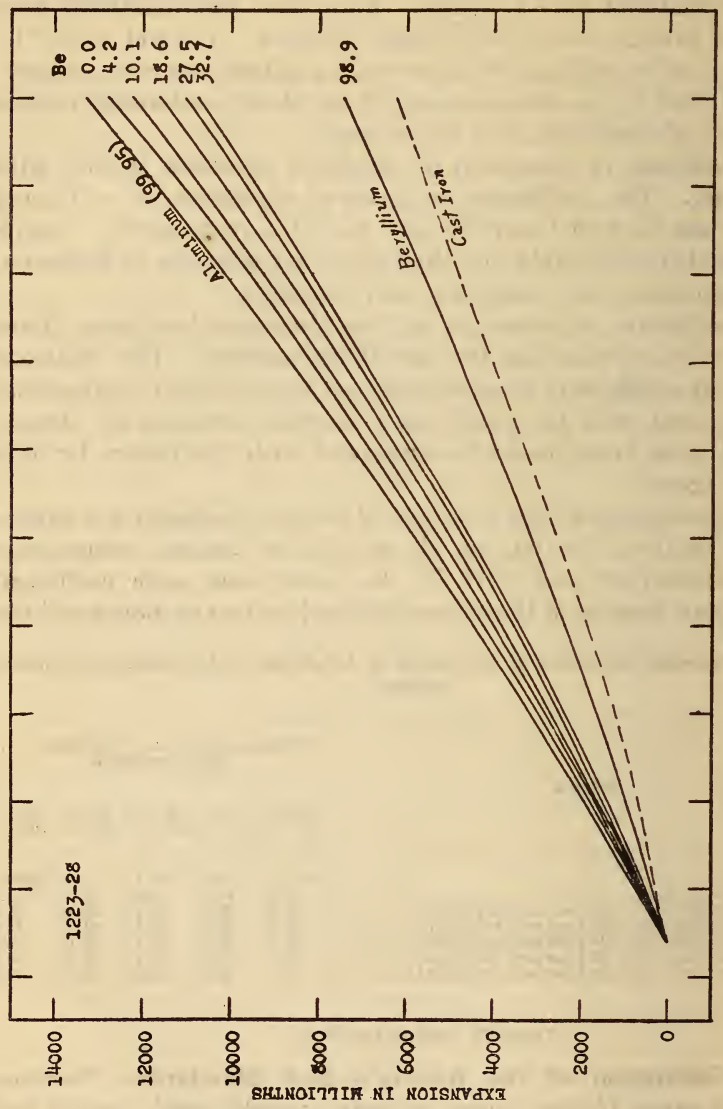

FIG. 3.—*Comparison of expansion curves of beryllium (98.9 per cent) and aluminum-beryllium alloys*
[Curve for cast iron included for comparison]

it is essential to have the surfaces accurately plane and parallel. With the interference method, above, the planeness and parallelism of the surfaces can be measured with an error less than 0.000001 inch. The nominal length of the precision gauge should be correct within the prescribed tolerance, 0.000005 to 0.000010 inch, because they are used as exact.

The end standards are calibrated relative to standard light waves and correction for the error in the nominal length applied. The error in measuring the length of the end standards relative to the light waves is about 0.000001 inch for gauges with very perfect surfaces. Since the length of steel end standards may change with time it has been necessary to make frequent intercomparisons between the several sets of standards and to recalibrate them relative to the standard light waves every two years. Up to the past year the lengths of our end standards were determined within 0.000003 inch—imperfection in the surfaces making it difficult to measure them with greater precision. During the past year, however, precision gauges have been submitted having planeness and parallelism errors not greater than 0.000001 inch and errors in the nominal length of not more than 0.000004 inch. It became necessary, therefore, to improve the calibration of our 81 end standards. For this, the standards were held within 0.01° C. of 20° C. while the measurements were being made. In these tests two hours was found necessary for gauges 1 inch long to come to equilibrium within 0.000001 inch. By taking every precaution as regards temperature control and the manipulation of the interferometer apparatus it was possible to make separate measurements on a given standard agree within 0.000001 inch. Measurements made since on two of these by the Physikalisch-Techniche Reichsanstalt gave values which agreed with ours within 0.000001 inch. These same two gauges were left at the International Bureau and two others at the National Physical Laboratory for test. When these four gauges are returned they will be remeasured here. The combined results will give an indication of the possible accuracy attainable under present conditions at the different standardizing institutions.

Weights and Measures Administration.—Acting in an advisory capacity, it is one of the functions of the Bureau of Standards to promote efficiency and uniformity among the several States in their supervision of commercial weighing and measuring apparatus. In the discharge of this function the bureau acts as a clearing house for a large variety of weights and measures information, and, upon request, advises with State and local weights and measures officials upon the many problems which arise in connection with their administration of their statutes and ordinances. At the same time the bureau is called upon for information relative to weights and measures administration in general and the organization and scope of existing departments in particular, by State and local governments at present without adequate weights and measures supervision, by manufacturers, by industry, by various organized groups, etc.

To meet, in some measure, these demands, to present the basic principles of well-organized weights and measures supervision, and to furnish in convenient form detailed information for the establish-

ment of new departments of weights and measures and the development of existing departments along uniform lines in the several States, there has been issued in handbook form a publication entitled "Weights and Measures Administration" (Handbook series No. 11). The handbook describes the functions of the weights and measures official, the present organization in each State and in typical foreign countries, and discusses various important factors connected with the organization of a department, the statutes under which it operates, its personnel, its coordination with other departments, etc.; the various phases of the mechanical, supervisional, and clerical activities of the official are treated in detail, and as appendixes are shown certain Federal laws and regulations in relation to weights and measures, the model State law on weights and measures, and a schedule of the standards and equipment considered necessary for the operation of weights and measures departments of States and cities.

There has also been published the third edition of Federal and State Laws Relating to Weights and Measures (Miscellaneous Publication No. 20). In this publication is given the full text of the weights and measures provisions of the laws of the United States and of each State, and the material is comprehensively indexed; the publication comprises 976 pages. Such a compilation is of the greatest utility in view of the divergencies which unfortunately persist in the weights and measures requirements in effect in the several States, and readily enables manufacturers and others affected by such requirements to acquaint themselves with the regulations which they must meet.

In furthering uniformity of regulations and methods among existing departments of weights and measures, the publications of the bureau have been supplemented during the year by personal conferences with officials, either as individuals or groups, in the following States: Alabama, Connecticut, Delaware, District of Columbia, Florida, Georgia, Indiana, Kansas, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, North Carolina, Oklahoma, Pennsylvania, Rhode Island, Texas, Virginia, and West Virginia.

Oil-Drilling Equipment.—The bureau has cooperated during the year with the American Petroleum Institute division of standardization and various technical committees in developing specification for rotary drilling taper joints, cold-drawn and machined-working barrels and sucker rods. The assistance rendered was chiefly with regard to product tolerance, screw-thread specification, and gauges for inspection of product. The bureau is to be the official custodian of the grand master reference gauges for the rotary tool joints. The certification of the correctness of the dimensions of A. P. I. gauges for oil-well casing, tubing, and drill pipe has been an important feature of the bureau's cooperation.

VI. MUNICIPAL, COUNTY, AND STATE AGENCIES

Although the governments of the States, counties, and municipalities purchase great quantities of materials, and a considerable amount of standardization has taken place in their purchase requirements, there is a very wide diversity in their methods of formulating specifications and placing contracts. Some information concerning these various methods is given in the present chapter.

MUNICIPAL PURCHASING AND STANDARDIZING AGENCIES

A survey of the purchasing methods of the municipal governments throughout the country indicates that, with few exceptions, in cities of over 100,000 inhabitants specifications are used in making purchases for all commodities except those bought in small quantities or having small value, usually below $500. In most cases there are consolidated purchasing or specifications making agencies representing the city as a whole. However, in Wilmington, Del., and Cambridge, Mass., the individual city departments make their own purchases, and specifications are seldom employed.

Municipalities having the city-manager form of government, of which there are now more than 360 in the country, almost irrespective of population quite generally utilize specifications in the purchase of commodities used in appreciable quantities. Some idea of the importance attached to the position of city manager in many localities can be gained from the fact that in cities in California, Connecticut, Florida, Georgia, Iowa, Kansas, Maine, Michigan, Missouri, New York, North Carolina, Ohio, Oklahoma, Tennessee, Texas, Vermont, Virginia, and Wisconsin a total of more than 50 of the city managers receive salaries at least equal to that of the governors; in several cases the salaries are twice as large, and in one case more than three times as large.

Cincinnati has the city-management form of government. The city manager, appointed by the city council, exercises control over the safety department and the service department of the city, and cooperates with the board of health, the board of park commissioners, and the rapid transit commission in the preparation of specifications. Each department of the city formulates its own specifications, which are coordinated by the city manager in consultation with other departments having similar functions. Many other municipalities having the city-management form of government operate in a somewhat similar manner.

Rochester, N. Y., which has only recently inaugurated the city-manager system, has for some time maintained its own laboratory for testing goods delivered on contracts based upon specifications.

A bureau of standards has been organized by the city of Baltimore to formulate standards and specifications and recommend, but not compel, their use by the city departments and bureaus. Standards have been set up for fuel, lubricants, paper, and soap, and numerous kinds of building materials, special effort being made to have the specifications conform to the most recent specifications of the American Society for Testing Materials and the Federal Specifications Board whenever possible.

The bureau of standards of the city of Portland is conducted under the authority of the department of public works. It cooperates with the other city bureaus in the selection and adoption of specifications and checks the delivery of materials purchased under specifications. With the bureau of buildings rests the responsibility for the enforcement of the city's "building code" issued by the department of public works.

The charter of the city of St. Louis provides for the creation of a board of standardization, consisting of the comptroller, who is elected by the people; the supply commissioner, who is appointed by the mayor; and the president of the board of public service, also appointed by the mayor. Specifications are drawn up by the board of standardization after study has been made of existing nationally recognized specifications for the commodities. Specifications have already been formulated for foodstuffs, fuel, fire hose, and paving and building materials. Contracts are let by the board of public service for street construction, buildings, etc.

Baton Rouge, La., operates under the commission form of government. Purchases are made through the city purchasing agent upon approval by the heads of the city departments. Specifications are used on all public works where the amount involved is more than $300. In 1927 Newton, Kans., adopted the commission-manager form of government, the board of commissioners employing a city manager. In this city specifications are used for all public-improvement work. The mayor and the commissioners act as a purchasing agency in Lexington, Ky., which has the commission form of government. All purchases are made according to specifications.

Among the cities operating testing laboratories are to be noted Grand Rapids and Detroit, Mich. In Detroit the street railways are operated by the municipality. Both the department of street railways and the department of purchases set up standards, the former for all materials used in railway construction and maintenance, and the latter for supplies used by the other city departments. A committee consisting of the mayor, the city controller, and the purchasing commissioner formulates the standards and adopts specifications for the purchase of materials for the city.

General purchasing agencies have been established in a number of cities. In Minneapolis each city department draws up its own

specifications for purchases to be made by the city purchasing agent, who is appointed by the civil service commission. In Jersey City the general purchasing agent, appointed by the board of city commissioners, prepares specifications and proposals for the purchase of all commodities used by the city except the specifications for fire engines, street paving, and cleaning, which are prepared by the city's engineering department. Specifications are prepared by the Dallas city purchasing agent for approval by the city commission, consisting of the mayor and four commissioners.

The chief buyer of Milwaukee purchases all materials, supplies, and equipment for the city government, upon specifications prepared by him in cooperation with the city paving chemist and city department engineers. Upon the purchasing division of the New Orleans department of public finances falls the duty of selecting specifications and making purchases for materials, supplies, and equipment for use by the city government. In Akron the purchasing agent prepares the specifications and places all contracts for materials under $1,000, and he makes recommendations for purchases exceeding this amount, the contracts for which are let by the city's board of control.

The city charter of Stockton, Calif., provides for a city purchasing agency through which all purchases not exceeding $1,500 must be made. The requirements being limited, goods are not bought in large quantities, and specifications are seldom employed.

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 last-mentioned department has authority to compile or select specifications and make purchases for all materials, supplies, equipment, etc., for use by the bureau of water works and supply and the bureau of power and light, which two bureaus comprise the department. The city purchasing agent formulates specifications and makes purchases for all departments except those earning their own revenues.

In accordance with charter provisions the city and county of San Francisco, Calif., through the board of supervisors, gives to the purchaser of supplies authority to provide for standardization of material, prepare specifications, and prescribe tests for the determination of quality.

It is estimated that specifications are employed with 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, board, or committee competitive bids must be obtained when the cost exceeds $200. Specifications for such bids are prepared by the officials in charge of the city departments.

In Providence, R. I., purchases of supplies are made by the heads of the separate city departments except when the amount involved exceeds $500, in which case the purchase is made by and through the board of contract and supply, a city ordinance requiring detailed specifications for all materials and supplies.

Supplies and equipment for city offices and public institutions in Philadelphia are purchased on specifications prepared by the director of the department of supplies, who is appointed by the mayor.

In Erie, Pa., the purchasing methods employed are based on the law of the State which requires the advertising for bids for all stationery, printing, etc. Specifications are used with all purchases and contracts for amounts exceeding $250. All contracts are approved by the city council, which reviews all bills before payment on vouchers signed by the heads of the city department, the finance director, and the city controller.

In Greensboro, N. C., the city purchasing agent uses specifications for all contract work, on all basic commodities, and for all material for which nationally recognized specifications are available. Among the other cities in North Carolina having central purchasing agencies are Asheville, Charlotte, Durham, and Winston-Salem. In Gastonia, N. C., which operates on the city manager plan, all purchases are made upon specifications.

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 for this purpose. Practically all of the work of standardization is done in the department of purchase, the head of which is appointed by the mayor. Recommendations for standards are forwarded to the board of estimate and apportionment, which consists of the mayor, the comptroller, the president of the board of aldermen, and the five borough presidents, all of whom are elected officials. Standards adopted by this board are compulsory on all city departments.

AGENCIES FOR COUNTIES AND PUBLIC SCHOOLS

In the great majority of the States little or no use is made of specifications in connection with the routine purchases for the county governments. Where employed, specifications are usually limited to materials entering into the erection of public buildings, public works, or county roads. An exception is noted in the case of California, the legislature of which has passed a bill authorizing the purchasing agents of various counties to purchase certain standard supplies for various school districts.

A survey of the specifications making and utilizing activities of the public schools throughout the country has revealed the fact that

specifications are in rather general use by the schools whenever the value of the purchases of any commodity exceed a certain definite minimum, frequently $500. In Erie and Reading, Pa., the limit is set at $300; in Cambridge and New Bedford, Mass., and in McKeesport, Pa., at $200; in Anderson, Ind., Brookline, Mass., and Kansas City, Mo., at $100; in Augusta, Ga., Revere, Mass., and Amsterdam, N. Y., at $50; and in Denver, Colo., at $25.

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 make recommendations as to the standardization of all articles in the schedules for the approval of the board's committee on housing and supplies. Approximately 85 per cent of all purchases are made on specifications. The board maintains a well-equipped commodity acceptance testing laboratory.

STATE PURCHASING AND STANDARDIZING AGENCIES

In every one of the 48 States standards for materials used in the construction and maintenance of roads and bridges have been established by the State highway commissioners. Much of the present activity in this line of standardization can be attributed to the aid given to the States by the Federal Government for the building of the main highways of the country. The specifications used by the commissions as best suited for the local climatic and traffic conditions and sources of supply of materials are in conformity with the specifications 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.

With few exceptions the State highway commissions are appointed by the governor, usually with the advice and consent of the legislature. Members of the Mississippi State highway department are elected by popular vote, and the State highway commissioner of Michigan is also elected. In Kansas, Nevada, New Mexico, North Dakota, and South Dakota the State governors serve as chairmen of the highway commissions.

A considerable number of State governments have organized centralized purchasing agencies or adopted uniform specifications, in most cases independent of the State highway commissions. Condensed outlines of the standardization activities of the agencies, with addresses of their headquarters and the names of the officers in charge, are given below.

Where symbols are used after the name and address of the agency or body they have the following significance:

(*b*) = Names and titles 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*) W. L. Waters, purchasing agent. (*c*) Appointed by the governor. (*d*) Formulate specifications and make purchases for all State departments and for the smaller State institutions.

Alabama State Highway Department, Montgomery. (*b*) Woolsey Finnell, highway director; R. S. Hale, testing engineer. (*g*) and (*h*) The aggregate to be used in State and Federal-aid projects is tested in the laboratory. Portland cement is sampled at various cement plants by the State inspector. There are State inspectors stationed on all concrete and asphalt paving jobs. Samples of sand clay, sand gravel, etc., are approved by the laboratory before being used. Check samples from each paving job are analyzed at frequent intervals. (*i*) None. (*j*) College testing laboratories have not been used to date, but plans are being made to make use of them in the near future.

Arizona Board of Directors of State Institutions, Phoenix. (*b*) C. W. Zander, secretary-purchasing agent. (*c*) The board is composed of the governor, the State treasurer, and a member appointed by the governor. (*d*) Approve specifications recommended by the State purchasing agent. All purchases for State institutions are made by this board except those for the State schools and the State highway department which do their own purchasing.

Arizona Highway Department, Phoenix. (*b*) W. C. Lefebvre, State engineer; J. W. Powers, engineer of materials. (*g*) and (*h*) The State highway commission has a very complete laboratory which is used for testing all materials entering into highway work. (*i*) Contracting firms and others are permitted to have tests made in these laboratories, a nominal charge being made for this service. (*j*) College laboratories are used only when tests can not be made in the laboratory of the highway department.

Arkansas State Purchasing Department, Little Rock. (*b*) H. A. Emerson, purchasing agent. (*c*) Governor. (*d*) Department was organized by the governor to prepare specifications, supervise erection of buildings for State institutions, and purchase supplies for the institutions.

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.

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*) Speci-

fications and standards are formulated in conjunction with the bureau of pure food and drugs and State testing laboratories and chemists as needed. (*f*) Standards and specifications are revised from time to time, and new specifications evolved as need arises. (*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 Highway Commission, Sacramento. (*b*) R. M. Morton, State highway engineer; F. T. Maddocks, testing engineer. (*g*) and (*h*) 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. On one occasion there was cooperation with a commercial research laboratory on a series of tests on the curing of concrete with calcium chloride and other methods. (*j*) None.

Colorado State Educational Institutions, Associated Purchasing Agents of, Boulder. (*b*) Henry B. Abbett, chairman. (*c*) Consists of purchasing agents of State-owned institutions. (*d*) and (*e*) Standardize on commodities that may be used in common by the State educational institutions; pool the requirements and make purchases for the institutions. (*f*) This organization has formulated standard specifications for janitor floor brushes. Its future activities will consist in making a study of all janitor supplies, painters' supplies, and laboratory (scientific) supplies, aiming at standardization. (*g*) Various commodities will be tested in the laboratories. If analyses are too difficult for the associated institutions' laboratories, the items under consideration will be tested by private or Government agencies.

Colorado State Highway Department, Denver. (*b*) L. D. Blauvelt, State highway engineer. (*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, State treasurer, State comptroller, and attorney general. (The establishment of a centralized purchasing agency for State departments is now being given consideration.)

Connecticut State Highway Department, Portland. (*b*) John A. MacDonald, commissioner; F. G. Flood, testing engineer. (*g*) and (*h*) The State highway commission maintains its own testing laboratory for making tests on all road building materials. (*i*) None. (*j*) None.

Delaware State Board of Supplies, Dover. (*b*) Charles H. Grantland, secretary of board. (*c*) Composed of governor, State treasurer, and two electors appointed by the governor with the consent of the senate. (*d*) Formulate specifications and contract for current stationery and miscellaneous supplies and printing for all State departments and institutions. (The establishment of a centralized purchasing agency for the State departments is now being given consideration.)

Delaware State Highway Department, Dover. (*b*) C. D. Buck, chief engineer; Frank S. Pritchett, testing engineer. (*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. (*i*) None. (*j*) None.

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. Department of Agriculture specifications are used for some foodstuffs. For items that are not covered by Federal specifications, advice is sought from the technical division of the District government. (*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. (*i*) None. (*j*) None.

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. (*e*) Specifications are prepared by the superintendents for approval by the board.

Florida State Roads Department. (*b*) Fons A. Hathaway, chairman, Tallahassee; J. L. Cresap, State highway engineer, Tallahassee; Harvey A. Hall, testing engineer, Gainesville. (*g*) and (*h*) The road department has maintained a testing laboratory since 1917, most of the time using space at the University of Florida. Since 1925 the laboratory has been located on department property at Gainesville. (*i*) Commercial tests are made only in special cases, not officially but as a convenience. (*j*) Cooperation with the University of Florida, but with no direct connection.

Georgia State Department of Public Printing, State capitol, Atlanta. (*b*) Josephus Camp, superintendent. (*c*) and (*d*) This department was organized by act of legislature, 1919, for the purpose of awarding contracts for all printing, binding, engraving, etc., and the purchase of all office supplies. (*e*) and (*f*) Laws and journals of house and senate, tax digests, return blanks, etc. 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. (*g*) None. (*h*) None. (*i*) None. (*j*) None.

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 which is 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. They are charged for the work, based upon the estimated cost to the highway department. (*j*) Cooperation in research work with the University of Georgia pertaining to top soil, subgrade, and asphalt problems.

Idaho Department of Public Works, Bureau of Supplies, Boise. (*b*) R. G. Archibald, State purchasing agent. (*c*) By the commissioner of public works. (*d*) Formulate and adopt specifications for all State departments and State institutions.

Idaho State Department of Public Works, Bureau of Highways, Boise. (*b*) Joe D. Wood, commissioner; R. H. Shoemaker, office engineer. (*g*) Laboratory facilities and personnel under supervision of materials engineer, who also supervises field inspection and control. (*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 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. (*i*) No. (*j*) Yes.

Illinois State Department of Public Works and Buildings, Division of Highways, Springfield. (*b*) Frank T. Sheets, chief highway engineer. (*g*) All materials used in highway construction and maintenance are tested. (*h*) A completely equipped laboratory is maintained. (*i*) None. (*j*) None.

Indiana State Joint Purchasing Committee, Indianapolis. (*b*) Daily E. McCoy, secretary. (*c*) Body selected by a majority vote of institution heads. (*d*) Has authority to make purchases for State charitable and correctional institutions. (*e*) Specifications are formulated by a subcommittee of the purchasing committee. (*f*) Chinaware, glassware, table cutlery, paints, oils, varnishes, dry goods and notions, groceries and laundry supplies, coal, gasoline, oils and greases, yeast, automobile tires and batteries, and electric light globes.

Indiana State Highway Commission, Indianapolis. (*b*) Charles W. Ziegler, chairman; John D. Williams, director; P. D. Meisenhelder, testing engineer. (*g*) Project engineers in charge of construction are supplied with equipment for making such field tests as are practical, and samples are submitted to the laboratory. (*h*) The commission maintains its own testing 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. However, no cooperative work is under way.

Iowa Board of Control of State Institutions, State capitol, Des Moines. (*b*) H. L. Shropshire, purchasing agent. (*c*) By the governor and confirmed by senate. (*d*) Formulate specifications, secure bids, and award contracts subject to the approval of the board of control. (*e*) and (*f*) Standard specifications have been prepared on a large number of items. (*g*) The State chemist makes arrangements for the testing of purchased commodities. (*j*) To some extent.

Iowa State Highway Commission, Ames. (*b*) Carl C. Riepe, chairman; R. W. Crum, engineer of materials and tests. (*g*) and (*h*) The commission maintains a completely equipped laboratory for testing all the materials used in highway construction. (*i*) For other State highway departments. (*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. (*e*) Specifications are prepared by the business manager for approval of the board of administration. (*f*) Dry goods, groceries, meats, lard and butterine, hardware, electrical supplies, stationery, drugs, queensware, flour and feed, lubricating oils, etc. (*j*) Yes.

Kansas State Highway Commission. (*b*) Gov. John W. Gardner, chairman, 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 Purchasing Commission, Frankfort. (*b*) E. E. Shannon, chairman. (*c*) Governor. The law requires that one member of the State high-

way commission and the commissioner of public institutions be members of the board. (*d*) Purchase or supervise purchase of supplies of all kinds used by the several State departments. (*e*) and (*f*) Nearly all specifications used are Government specifications, changes having been made where practicable. (*g*) and (*h*) This State has the use of the public service laboratory located at the State university. (*i*) No. (*j*) Yes.

Kentucky State Highway Department. (*b*) Ben Johnson, chairman, Frankfort; Prof. D. V. Terrell, engineer of tests, Lexington. (*g*) and (*h*) All road materials used in the State are tested at the laboratory of the University of Kentucky, which is maintained by the university and the State highway department. The highway department furnishes all necessary help and supplies, and the professor of civil engineering of the college is in charge of the laboratory. (*i*) Commercial testing is not done by the highway department. However, some commercial testing is done in this laboratory by the department of civil engineering. (*j*) There is an arrangement that when possible any work desired by the highway department is undertaken by the university. It often happens that such problems are undertaken by the civil engineering department on regular assignment, the highway department benefiting by whatever facts are discovered, and the students benefiting by the experience gained.

Louisiana State Board of Audit and Exchange, Baton Rouge. O. H. Simpson, governor; Eugene F. Lyons, State auditor; L. B. Baynard, jr., State treasurer. Board is composed of five members, three of whom are the governor, State treasurer, and State auditor.

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. (*e*) Specifications formulated by the engineering department in cooperation with the purchasing department. Use is made of specifications of the Federal Government and the American Society for Testing Materials when applicable. (*f*) Building materials, rubber goods, fuel, paint, conveyor belts, machinery, ship chandlery, conveying machinery, heavy heardware, etc. (*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 laboratories at Tulane University for testing concrete slabs and cylinders, and reinforcing steel.

Louisiana Highway Commission, Baton Rouge. (*b*) Maj. Frank T. Payne, chairman; Nicholls W. Bowden, State highway engineer; John H. Bateman, testing engineer. (*g*) and (*h*) The Louisiana 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. The employees of the laboratory, with the exception of the director, are full-time employees of the commission. 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 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.

Maine State Highway Commission. (*b*) Charles H. Murray, 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 labora-

tory 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.

Maryland State Central Purchasing Bureau, Whitaker Building, Baltimore. (*b*) Walter N. Kirkman, State purchasing agent. (*c*) Members of central purchasing bureau are heads of institutions and large departments, specified by law. (*d*) Determine and formulate standards of all materials, supplies, merchandise, and articles of every description to be purchased for the using authorities of the State. (*e*) Meetings are held from time to time to consider commodities to be standardized. (*f*) Fuels, food products, and laundry supplies.

Maryland State Roads Commission, Garrett Building, Baltimore. (*b*) John N. Mackall, chairman; F. C. Rossell, testing engineer. (*g*) and (*h*) For more than 10 years the commission has maintained laboratories for testing the materials used in road construction. (*i*) None. (*j*) It carries on research work in cooperation with the University of Maryland.

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. (*f*) Printed forms, administrative reports, foods, institution requirements, plumbing fixtures, beds, and other equipment and supplies, layout, etc. (*g*) Use Massachusetts department of public health laboratory. (*h*) No. (*i*) Occasional.

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. (*e*) When it is found that standardization is expedient, the State purchasing agent requests the heads of the departments to designate representatives to advise him in regard to standards. (*f*) Such items as groceries, fodder, cleaning materials, clothing, rubber footwear, tires, bituminous coal, electric lamps, stationery, soaps, etc. Work has just been completed on the standardization of bread for the 42 institutions of the State, and work is being undertaken on the standardization of lubricating oils for automotive and other machinery. (*g*) and (*h*) Commodities purchased on specification 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, and they devote considerable time, in addition to routine testing, to research work, such as the lubricating problem referred to above. (*i*) No. (*j*) When the need of a neutral testing agency is apparent, use is made of college laboratories and chemical research laboratories.

Massachusetts Department of Public Works, Division of Highways. (*b*) William F. Williams, commissioner of public works, Boston; A. W. Dean, chief engineer, Boston; A. V. Bratt, chemist and testing engineer, South Boston. (*g*) and (*h*) The department has maintained its own testing laboratory for several years for the testing of materials used in road construction and maintenance. (*i*) None. (*j*) A college pipe testing apparatus is the only outside apparatus used.

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. (*e*) Specifications are prepared by the director of accounting and purchasing. Uniform accounting system established and carried out under his supervision for all State departments and institutions except as above.

Michigan State Highway Department. (*b*) Frank F. Rogers, commissioner, Lansing; W. J. Emmons, director, State highway laboratory, Ann Arbor. (*g*) and (*h*) The State highway department laboratory, which is located at the University of Michigan, inspects all materials used by the department. The director is also a member of the faculty of the college, and the supervisor of the laboratory gives instruction to students in highway laboratory practice. All of the other members of the staff are employees of the highway department. Cement samplers are located at various mills, and inspectors are maintained at stone and gravel plants and at certain concrete and clay pipe plants. Commercial laboratories and other State laboratories handle a certain amount of plant inspection of materials coming from other States. Whenever a construction contract is awarded the laboratory receives a copy of the award and is held responsible for the inspection and testing of materials. Every shipment of material for either construction or maintenance is inspected. (*i*) Tests are made for counties, when desired, and plant inspection of aggregates is handled for any city which requests it, but no other commercial testing is done. (*j*) The highway department laboratory quarters include 14 laboratories and offices at the university, all of which are used by the department. Occasionally special tests are made by other departments of the university. During the winter months the laboratory staff is engaged on research work.

Minnesota State Department of Public Institutions, Bureau of Purchases, St. Paul. (*b*) C. J. Swenden, chairman; W. A. Richards, purchasing agent. (*c*) By the governor, through the board of control. (*d*) Establish specifications and make purchases for 18 State charitable and eleemosynary institutions. (*e*) Specifications prepared by the purchasing agent for the approval of the board of control. (*f*) Foodstuffs, laundry supplies, textiles, footwear, rubber hose, brushes and brooms, paints, hardware, clothing, blankets, beds, mattresses and pillows, and shade cloth and window shades.

Minnesota State Highway Department, St. Paul. (*b*) C. M. Babcock, commissioner of highways; J. T. Ellison, chief engineer; F. C. Lang, engineer of tests and inspection. (*g*) and (*h*) The Minnesota Highway Department maintains central laboratories at the University of Minnesota, Minneapolis, and at Duluth. In addition, there are small field laboratories located on constructions 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.

Mississippi Capitol Commission, Jackson. Ben S. Lowry, State treasurer. This commission makes all the purchases for the State capitol, appropriations being made by the legislature for this purpose. The purchases for the colleges are made by a purchasing agent at these points. No specifications and standards have been formulated. (The establishment of a purchasing agency for purchasing supplies for all State departments, colleges, and institutions is being given consideration.)

Mississippi State Highway Department, Jackson. (*b*) J. C. Roberts, chairman; G. A. Draper, State highway engineer. (*g*) All testing for the State high-

way 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 Purchasing Agencies, Jefferson City. (*b*) Sam A. Baker, governor. (*e*) 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.

Missouri State Highway Commission, Capitol Building, Jefferson City. (*b*) C. D. Matthews, chairman; T. H. Cutler, chief engineer; F. V. Reagel, engineer of materials. (*g*) and (*h*) The highway department maintains its own testing laboratory in Jefferson City and also plant laboratories at cement plants. Plant inspection is also made in the field in case of other road building materials wherever the volume will warrant such inspection. General inspectors are maintained at division points for handling general work. Samples which can not be tested in the field are sent to the main laboratory for tests, as are also periodical check samples from all other operations. (*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 a very limited extent. However, the Missouri School of Mines and the State university have cooperated fully when requested to do so.

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.

Montana State Highway Commission, Helena. (*b*) O. S. Warden, chairman; Ralph D. Rader, State highway engineer. (*g*) and (*h*) The commission has for several years maintained a laboratory for testing many of the materials used in road construction. (*i*) None. (*j*) Some use made of Montana Agricultural College, Bozeman.

Nebraska State Board of Control, Lincoln. (*b*) W. H. Osborne, secretary. (*c*) By the legislature. (*d*) and (*e*) Formulate specifications for supplies for all penal, charitable, and educational institutions except State university and normal school. (*f*) Flour and feed, groceries, meats and lard, laundry supplies, shoes, shoe findings, men's clothing, dry goods, drugs, dishes, paper, coal, coffee and tea, tobacco, etc. (*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. (*g*) and (*h*) The department of public works maintains a laboratory at the University of Nebraska for testing the materials used in road construction. This laboratory was established more than 25 years ago. (*i*) None. (*j*) As shown above.

Nevada State Board of Finance, Carson City. Fred B. Balzar, governor; Ed. Malley, State treasurer; Edward C. Peterson, State controller. Board is composed of six members, three of whom are the governor, controller, and treasurer.

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. State highway engineer by board of directors; testing engineer by State highway engineer. (*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 Purchasing Department, Concord. (*b*) W. A. Stone, purchasing agent. (*c*) By the governor. (*d*) Formulate specifications. (*e*) and (*f*) Specifications are formulated, or selected, by the purchasing agent from various sources. (*g*) and (*h*) State laboratory and highway testing laboratory. (*i*) Only to a small extent. (*j*) Largely for instruction.

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. (*i*) None. (*j*) None.

New Jersey State House Commission, Trenton. (*b*) A. Harry Moore, Governor of New Jersey; Edward J. Quigley, State purchasing agent. (*c*) Body consists of governor, State treasurer, and State comptroller, ex officio. (*d*) Establish standards, determine the relation thereto of articles furnished, and use State or other public or private laboratories for this purpose. (*e*) In cooperation with advisory board, composed of one representative of each State using agency, establishes standards and specifications for purchases to be made by the State purchasing agent. (*f*) Furniture, equipment, materials, supplies, printing, and stationery. (*g*) and (*h*) Use is made of the various laboratories connected with the State government, and when necessary apply to 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 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 was recently 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 Mexico State Officials, Albuquerque. R. C. Dillon, governor; Miguel A. Otero, jr., State auditor; Warren R. Graham, State treasurer; Lois Randolph, Superintendent of public instruction. (This State has no organized purchasing agency.)

New Mexico State Highway Commission. (*b*) Gov. Richard C. Dillon, chief executive, Santa Fe; Charles Springer, president, Cimarron; W. C. Davidson, State highway engineer; Santa Fe; L. C. Campbell, materials engineer, Las Cruces. (*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 York State Department of Standards and Purchases, Albany. (*b*) Frank R. Utter, superintendent of purchase and head of bureau of standards. (*c*) By the governor. (*d*) Make purchases for all State agencies. (*e*) Standards and specifications formulated by the New York State bureau of standards. (*f*) Food products, fuel, lubricants, textiles, rubber goods, paper, builders' hardware, road materials, etc. (*g*) State laboratory. (*h*) Good. (*i*) No. (*j*) Research laboratories.

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. (*i*) None. (*j*) A limited use is made of college testing laboratories.

North Carolina State Budget Bureau, Raleigh. (*b*) Gov. Angus W. McLean, director. (*c*) Ex officio. (*d*) and (*e*) Each organization or establishment purchases for its own account, a purchasing officer being designated for each. There are about 70 in the State. The purchasing is generally supervised by the director of the budget, although the purchasing officers are appointed by the head of each organization. These purchasing officers buy all supplies, materials, equipment, and commodities necessary for each organization. (*f*) No attempt has been made to formulate standards and specifications except for coal, for which a modification of the United States Navy standard has been adopted. (*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. (*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*) W. A. Donnelly, 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. (*e*) Specifications prepared by the State purchasing agent for approval by the board of administration. (*f*) All commodities. (*g*) Foodstuffs tested. (*h*) State regulatory department. (*i*) State regulatory department. (*j*) None.

North Dakota State Highway Commission, Bismarck. (*b*) Gov. Arthur G. Sorlie, chairman; H. G. Groves, engineer of tests. (*c*) Ex officio. (*g*) and (*h*) The commission maintains a laboratory in which all road materials are tested. (*i*) None. (*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. (*e*) Specifications are prepared by the superintendent of purchases and printing in conjunction with the department director and in cooperation with departmental officers. (*j*) Testing is done at the Ohio State University.

Ohio State Department of Highways and Public Works, Columbus. (*b*) George F. Schlesinger, director; A. S. Rea, engineer of tests. (*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. (*e*) Specifications are prepared by the board. (*f*) Dry goods, groceries, oil, coal, etc.

Oklahoma State Highway Commission, Oklahoma City. (*b*) H. W. Leininger, chairman; Dudley Wood, testing engineer. (*g*) and (*h*) The commission maintains its own testing laboratories, being represented by commercial laboratories only when materials come from outside of the State. (*i*) None. (*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 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. New law makes this board the purchasing department for all State activities. (*e*) Specifications prepared by the secretary for approval by the State board of control. (*f*) All commodities required by State departments and institutions. (*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.

Oregon State Highway Commission. (*b*) H. B. Van Duzer, chairman, Portland; M. M. Finkbiner, engineer of materials, Salem. (*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.

Pennsylvania State Bureau of Standards and Purchases, Harrisburg. (*b*) Walter G. Scott, director of standards and purchases. (*c*) 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 departments, boards, and commissions, and by State institutions. (*e*) A conference of representatives of the different departments, boards, and commissions, and State institutions, called periodically, is divided into committees for the purpose of establishing and accepting standards and specifications. Wherever possible the specifications as established by the Federal Specifications Board are accepted and followed by the above conference. (*f*) Textiles, groceries, dairy products, meats, general office supplies, furniture, and numerous items of equipment.

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. (*e*) Confer with users and suppliers and secure all technical data available. (*f*) Canned goods, groceries, cotton goods, etc. (*g*) and (*h*) Sent to laboratory for test when necessary, otherwise physical examination by experienced person, such as engineer or purchasing agent. (*i*) No. (*j*) Yes.

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. (*e*) No formal procedure has been adopted. (*f*) Foodstuffs, feeds, fertilizer, footwear, dry goods, and clothing.

Pennsylvania State Department of Highways, Harrisburg. (*b*) James L. Stuart, secretary of highways; Samuel Eckles, chief engineer; H. S. Mattimore, engineer of tests. (*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.

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. (*e*) Specifications prepared by the State purchasing agent for approval of the commission. (*f*) Beef, pork, lamb, mutton, provisions, butter, oleomargarine, cheese, lard, compound lard, groceries, coal, and gasoline. (*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.

Rhode Island State Board of Public Works, Providence. (*b*) Abram L. Atwood, chairman; John V. Keily, testing engineer. (*g*) and (*h*) The board maintains its own laboratory in which all road materials are tested. A new laboratory is now being constructed which will be completely equipped for testing all materials used in State road construction. At present all cement is tested at the point of manufacture. (*i*) Occasionally. (*j*) Brown University is called upon for compression tests of concrete, and the Massachusetts Institute of Technology is now making tests on rock.

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. (*g*) None. (*h*) None. (*i*) None. (*j*) None.

South Carolina State Highway Department, Columbia. (*b*) Ben M. Sawyer, chief highway commissioner; A. E. Warren, testing engineer. (*g*) and (*h*) This department maintains its own testing laboratory for testing materials for roads, etc. Each carload of road material is sampled and tested either at the source of supply or on delivery. (*i*) None. (*j*) None.

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. (*f*) Specifications for printing, stationery, office supplies, office furniture, and equipment have been completed. Work is in progress on specifications for foodstuffs, clothing and dry goods, paints, janitor and laundry supplies, and lubricating oils. (*g*) Tests are being made by the State chemist at the State university, Vermilion. (*i*) None. (*j*) As referred to above.

South Dakota State Highway Commission, Pierre. (*b*) Gov. W. J. Bulow, chairman; C. J. Loomer, engineer of tests. (*g*) and (*h*) The commission maintains its own laboratory for the testing of materials entering into road and bridge construction. (*i*) Yes, free of charge. (*j*) Occasionally.

Tennessee State Department of Highways and Public Works, Nashville. (*b*) C. N. Bass, commissioner; D. D. McGuire, engineer of tests. (*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 testing laboratory for handling all testing work. (*i*) None. (*j*) Formerly the division supported a branch laboratory at the University of Tennessee where some work was carried on cooperatively, but this arrangement is no longer necessary.

Tennessee State Department of Finance and Taxation, Division of Purchasing, Nashville. (*b*) Joel B. Fort, State purchasing agent. (*c*) By the commissioner of finance and taxation. (*d*) Select specifications and make purchases for all State departments and institutions. (*e*) Specifications are prepared by a committee on standardization composed of representatives of each State agency using supplies for approval of the commissioner of finance and taxation.

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. (*e*) Specifications are prepared by the chief of the division of purchasing for approval by the board of control.

Texas State Highway Commission, Austin. (*b*) R. S. Sterling, chairman; R. A. Thompson, 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 up-keep on machines and assistants being furnished by the department. (*i*) None. (*j*) Only as stated above.

Utah State Department of Finance and Purchase, Salt Lake City. (*b*) P. A. Thatcher, director. (*c*) By the governor. (*d*) Formulate specifications and make purchases for all State departments. (*e*) Specifications prepared by the director for approval of the department of finance and purchase.

Utah State Road Commission, Salt Lake City. (*b*) Henry H. Blood, chairman; Levi Muir, jr., materials engineer. (*g*) and (*h*) The commission maintains its own laboratory equipped for testing all materials used in road construction.

Vermont State Department of Finance, Purchasing Department, Montpelier. (*b*) Donald Tobin, State purchasing agent. (*c*) By the governor. (*d*) Formulate specifications and make purchases for all State departments and institutions except supplies for military department. (*e*) The specifications are prepared by the State purchasing agent.

Vermont State Highway Board. (*b*) George Z. Thompson, chairman, Proctor; S. B. Bates, commissioner of highways, Montpelier; R. I. Rowell, materials engineer, Montpelier. (*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 known as the Vermont State Highway 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 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. (*e*) Specifications prepared by the State purchasing agent for approval of the purchasing commission.

Virginia State Highway Commission, Richmond. (*b*) H. G. Shirley, commissioner; Shreve Clark, assistant engineer, tests. (*g*) All material entering into construction, betterment, or maintenance of all State highway roads and bridges is tested for conformity to the department's specifications either directly by the State or through its authorized representatives. Steel superstructure, reinforcing steel fabricated outside of the State, creosote, cement, etc., are tested and inspected by a commercial firm, at the sources of supply. (*h*) The State highway department maintains its own department of tests. It is equipped to make both chemical and physical tests of materials for road construction. (*i*) None. (*j*) None.

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. (*e*) Standards and specifications are formulated in the light of previous experience and in conjunction with A. S. T. M., National Bureau of Standards, and similar national bodies. (*f*) Standards and specifications formulated by division of purchasing in all instances except where engineers or other qualified persons are employed for that purpose. (*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, construction engineer. (*g*) and (*h*) Road materials are tested in the department's testing laboratory. In addition, resident engineers are supplied with equipment for making certain field tests. A small amount of material is tested by commercial laboratories. (*i*) Not for private individuals or concerns. Tests are made at cost, however, for city and county government, etc. (*j*) College laboratories have been called upon to a very limited degree.

West Virginia State Board of Control, Purchasing Department, Charleston. (*b*) C. A. Jackson, 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. (*e*) Specifications are prepared by the State purchasing agent in conjunction with board colleagues. (*f*) Food and clothing items.

West Virginia State Road Commission, Morgantown. (*b*) C. P. Fortney, chairman; R. B. Dayton, materials engineer. (*g*) and (*h*) A complete testing laboratory, maintained by the State road commission, is located in the Engineering Building of the West Virginia University. Shop work on bridges inspected by commercial laboratories. (*i*) None. (*j*) Heavy testing machinery of the university 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. (*e*) Specifications are prepared by reference to Federal standards and to other available specifications. (*f*) Groceries, meat, canned goods, blankets, flour, spices and extracts, teas and coffees, tires, etc. (*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*) J. T. Nemacheck, chairman; H. J. Kuelling, State highway engineer; C. R. Stokes, materials engineer. (*g*) and (*h*) The commission maintains its own testing laboratory. At the present time practically all types of road materials are tested there. The laboratory is so equipped that practically all work is done by the employees of

the highway commission. (*i*) A small amount of testing is done on a commercial basis, for example, physical tests of sand and gravel for parties contemplating opening up commercial deposits. (*j*) The commission laboratory is located adjacent to the Engineering Building of the University of Wisconsin. Use is often made of the larger machines of the university by the commission, and considerable research 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. Regulate purchase of supplies and salaries paid employees when not fixed by statute. (*e*) Specifications are prepared by the heads of the various departments or institutions and the board of supplies obtains bids on the specifications as submitted. (*f*) None. (*g*) None. (*h*) None. (*i*) None. (*j*) None.

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.

VII. GENERAL STANDARDIZING AGENCIES

During the year the Committee on Standardization Survey, under the chairmanship of Secretary Hoover of the United States Department of Commerce, made a comprehensive investigation of standardization activities in this country to determine the character of the work being done and the expenditures being made annually. Reports received from 243 trade associations and technical societies, from the secretaries of 29 States, and from the officers of the Federal Government showed that during the year 1926 the officers and members of these agencies expended the following amounts for standardization, including office, printing, and travel expenses:

Trade associations and technical societies	$3, 822, 516. 10
State governments	134, 240. 00
Federal Government	4, 250, 500. 00
Total	$8, 207, 256. 10

In Chapter IV have been given outlines of the standardizing agencies of the Federal Government, including the Federal Specifications Board; in Chapter V the standardization work of the National Bureau of Standards has been presented briefly, and that of the State and municipal purchasing agencies has been set forth in Chapter VI. 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 VIII.

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 Engineering Standards Committee, 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 to date and 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 Standards Yearbook, 1927.

AMERICAN ENGINEERING STANDARDS COMMITTEE

Organized in 1917 as the national clearing house for engineering and industrial standardization, the committee serves as the agency through which standardization by associations, societies, and govern-

mental agencies is passing to the stage of standardization on a broadly national scale. The committee 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.

The American Engineering Standards Committee does not concern itself with the technical details of a standard offered for approval, but considers the procedure followed in the formulation of the standard, the adequacy of the representation of the various interests concerned on the sectional committee organized by the sponsor body to formulate the standard, and the action by which the standard has been adopted by the sectional committee and approved by the sponsor. The sectional committee is made up of representatives officially designated by the various bodies interested in the particular standardization project in hand.

Work upon a standardization project is undertaken by the A. E. S. C. 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. A formal conference or a special committee of representatives of the bodies concerned with the proposed project is asked to decide (1) whether the work shall be undertaken; (2) if so, what its scope shall be; (3) how the work shall be organized; (4) how it is to be related to any other work having an important bearing on it.

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 a similar committee in the electrical field, recently organized as the result of formal proposals made by the American Institute of Electrical Engineers and the Electrical Manufacturers' Council. It is expected that a similar step will be taken for the field of the mechanical industries in the near future.

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. E. S. C., 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. E. S. C. 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. It has recently issued a printed discussion on the use of standards and specifications in advertising. This deals with the labeling of goods made under standards, with trade association activities in promotion and enforcement of standards, and with the advertising of products of standard kinds and qualities as an aid to the consumer.

Under the auspices of the A. E. S. C., 106 standardization projects have been carried forward to completion as approved standards and 134 additional projects are in various stages of progress. In the accompanying table is shown the distribution of these projects among the industrial groups.

Industrial groups	Projects	
	Total	Approved
A. Civil engineering and building trades	37	19
B. Mechanical engineering	63	21
C. Electrical engineering	40	11
D. Automotive	4	3
E. Transportation	10	9
F. Naval architecture and marine engineering	1	
G. Ferrous metallurgy	8	7
H. Nonferrous metallurgy	14	10
K. Chemical	12	10
L. Textile	3	1
M. Mining	19	6
O. Wood	5	3
P. Pulp and paper	2	1
Z. Miscellaneous	22	5
	240	106

Of these the following were approved during 1927:

Group A. Civil engineering and building trades.—Building exits code; spiral steel rods for concrete reinforcement.

Group B. Mechanical engineering.—T-Slots, their bolts, nuts, tongues and cutters; tooth form of spur gears; safety code for mechanical power transmission apparatus; cast-iron screwed fittings for maximum pressures of 125 and 250 pounds; steel flanges and flanged fittings for maximum pressures of 250, 400, 600, 900, and 1,350 pounds; code for design of transmission shafting; keys, gib head, square and flat; small rivets and special rivets; wrench head bolts and nuts and wrench openings; safety code for forging and hot-metal stamping; point of operation hazards of rubber mills and calendars.

Group C. Electrical engineering.—National Electrical Safety Code (revision); standards for hard drawn aluminum conductors.

Group D. Automotive (automobile and aircraft).—Safety code for colors for traffic signals; safety code for automobile brakes and brake testing.

Group K. Chemical industry.—Gas Safety Code.

Group M. Mining.—Safety code for coal mine drainage; mine tracks and signals; wire rope for mines.

Group O. Wood industry.—Methods for testing wood.

Group Z. Miscellaneous.—Safety codes for prevention of dust explosions.

Twenty-four of the fifty codes on the national safety code program have been approved by the A. E. S. C. The most important adopted during the past year are those for the prevention of dust explosions in a number of important industries, those for forging and hot-metal stamping, automobile brakes and brake testing, a code for rubber machinery (point of operation hazards of rubber mill and production calendars) and revisions of the gas safety code, and of the codes for punch presses and abrasive wheels. Settlement of an important issue in connection with the "National Electrical Code" has culminated in the admission, as approved material, for limited use, of nonmetallic sheathed cable.

Upon the initiative of State industrial commissions, arrangements have been made for the revision under the procedure of the American Engineering Standards Committee, of the standard plan of reporting and compiling accident statistics.

An important program of unification of conflicting standards, specifications, and practices is in the comprehensive work on standards for wrought-iron and steel pipe and tubing, that are to be developed under a representative sectional committee sponsored by the American Society for Testing Materials and the American Society of Mechanical Engineers.

Formal requests for new undertakings recently acted upon, or now under consideration by the A. E. S. C., relate to standards for plumbing equipment, screw threads for rigid electrical conduits, small hose couplings, face-to-face dimensions of ferrous flanged valves, household refrigerators, sheeting, speeds of driven machinery, development and revision of specifications and standards for electrical devices and materials with relation to fire and casualty hazards, and standards for mercury arc rectifiers.

The American Engineering Standards Committee is composed of official representatives of member bodies, of which there are now 26, comprising 34 separate national organizations, including 9 national engineering societies, 18 national industrial associations, and 7 departments of the Federal Government.

The membership of the A. E. S. C. has been augmented during recent months by the admission of the American Gear Manufacturers Association and the Portland Cement Association, both of which organizations have important interests in standardization work.

Participating in the work through some 2,000 officially accredited representatives, are 285 national organizations, technical, industrial,

and governmental. Of these nearly 200 are trade associations. Subscribing directly to its support are 320 organizations and firms interested in its work and listed as sustaining members.

AMERICAN MARINE STANDARDS COMMITTEE

This committee was organized primarily to promote simplification of practice and economy in the construction, operation, and maintenance of ships and port facilities. In actual operation the committee has been regarded as a unit of the division of simplified practice of the United States Department of Commerce, and its headquarters are maintained in the Department of Commerce Building, Washington, D. C. A. V. Bouillon is the secretary.

The technical field comprises five divisions, viz, hull details, engineering (machinery) details, ship operation details and supplies, port facilities; manufacture and construction. Only the first three divisions have so far been active. Each technical division is headed and supervised by a technical committee appointed by the executive board, which is elected annually by the membership.

One of the important functions of the American Marine Standards Committee is to review its publications from time to time with a view to their possible improvement, and users of the standards are asked to cooperate with the committee by submitting constructive suggestions. Recent rules provide that a standard once approved shall, in general, be maintained at least three years unless there arise exceptional reasons for making changes. Each existing standard is to be reviewed by the technical committee concerned after three years from the date of its adoption so as to ascertain whether changes are desirable, considering the developments of industry and the requirements of service.

Provision is made to coordinate the work with current progress in related activities through contact established with other standardizing bodies and through representatives appointed as advisory members of the executive board by the following organizations: American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, National Fire Protection Association, and the National Bureau of Standards. Moreover, the committee is officially represented on such sectional and special committees of the American Engineering Standards Committee as deal with matters in any way related to or affecting marine activities.

The American Marine Standards Committee now comprises about 330 member bodies, including shipbuilding firms, ship operators, naval architects, marine engineers, manufacturers, and, generally, educational, commercial, and Government interests related to the marine industry.

Prior to 1927 the committee's work had been of a preliminary character. Thirty-two standards had been approved, but not put in final form for convenient use. During the year 1927 most of these standards were printed and widely distributed. The total number of approved standards is now 53—21 having reached their final stages during the year, as follows:

Hull Details.—Metal rack for fire hose, saddle type; wooden rack for fire hose; pilot ladder; tubular steel cargo booms, 5, 10, 15, 20, and 30 tons capacity; lifeboat sizes and capacities, narrow and wide.

Engineering (Machinery) Details.—Flanged couplings for propeller shafts; loose couplings for inboard propeller shafts; tail shafts and stern tube bearings; propeller keys; propeller nuts; stern tube stuffing boxes; hubs for built-up propellers with recessed blades; fairwater caps for built-up propellers with recessed blades; propeller hub studs, nuts, and lock screws; packing gland for propeller hubs (optional method); fire clay refractories for marine service (specification).

Ship Operation Details.—General instructions for operation, care, and upkeep of watertube marine boilers. An important development of the standardization movement initiated by the committee in the marine field is the organization in one of the largest shipyards of a plant standardization committee made up primarily of heads of the various departments. It is expected that the work of this plant committee, in so far as it may be of general benefit to the marine industry, will become closely allied to that of the American Marine Standards Committee.

AMERICAN SOCIETY FOR TESTING MATERIALS

Organized for the purpose of promoting the knowledge of materials of engineering and the standardization of specifications and methods of testing, standardization is a most important function of the society. Practically all of the society's committees are actively engaged in the work of standardization and preparation of specifications. The headquarters of the society are at 1315 Spruce Street, Philadelphia, Pa. C. L. Warwick is the secretary-treasurer.

Standards of the society are published triennially in a book of standards (Part I on Metals and Part II on Nonmetallic Materials); and supplements to this are issued in intervening years. Tentative standards, which are offered for publication to secure criticism and comment, are published in the annual proceedings and collected each year in a book of tentative standards.

Among the current activities of the society the development of the following standards may be cited as of outstanding importance: For metals for high-temperature service; zinc coated and other metallic coated products for increased resistance to corrosion; magnetic test-

ing and analysis of metals; ferro-alloys; metallic materials for electric heating; die casting alloys; cement, concrete, and concrete products; brick, hollow tile, and other ceramic products; refractory materials; preservative coatings, including paints, varnishes, pigments, vehicles, and paint thinners; petroleum products; road and paving materials; waterproofing and roofing materials; electrical insulating materials; textile materials; slate; and naval stores.

In the following table are shown the number of standards and tentative standards adopted in the year 1927 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 1927			Total adopted to date	
	Standards	Revisions to standards	Tentative standards	Standards	Tentative standards
A. Ferrous metals	23	20	8	89	18
B. Nonferrous metals	7	11	8	50	20
C. Cement, lime, gypsum, concrete, and clay products	7	8	11	43	26
D. Miscellaneous materials	53	18	18	150	105
E. Miscellaneous subjects	5	1	0	8	6
Total	95	58	45	340	175

The following standards and tentative standards were adopted in 1927:

A. Ferrous Metals.—Standard specifications for open-hearth carbon-steel rails; manufacture of open-hearth steel girder rails of plain, grooved, and guard types; low-carbon-steel track bolts; structural silicon steel; boiler and firebox steel for stationary service; steel plates for structural quality for forge welding; steel plates of flange quality for forge welding; cold-drawn steel wire for concrete reinforcement; commercial quality hot-rolled bar steels; commercial cold-finished bar steels and cold-finished shafting; carbon-steel bars for railway springs; carbon-steel bars for railway springs with special silicon requirements; carbon-steel bars for vehicle and general purpose springs; silico-manganese-steel bars for railway springs; chrome-vanadium-steel bars for railway springs; carbon-steel and alloy-steel forgings; quenched and tempered carbon-steel axles, shafts, and other forgings for locomotives and cars; quenched and tempered alloy-steel axles, shafts, and other forgings for locomotives and cars; carbon-steel forgings for locomotives; carbon-steel car and tender axles; carbon-steel castings for railroads; lapwelded and seamless steel and lapwelded iron boiler tubes; welded and seamless steel pipe; alloy-

steel bolting material for high-temperature service; zinc-coated (galvanized) sheets; welded wrought iron pipe; lapwelded and seamless steel and lapwelded iron boiler tubes; staybolt, engine bolt, and extra refined wrought-iron bars; hollow rolled staybolt iron; common iron bars; malleable castings; tungsten powder; spiegeleisen; ferromanganese; ferrosilicon; ferrochromium; and ferrovanadium.

Standard methods of test for magnetic properties of iron and steel; verification of testing machines; Brinell hardness testing of metallic materials; sampling and chemical analysis of pig and cast iron; sampling ferro-alloys; chemical analysis of ferro-alloys.

Recommended practices for carburizing and heat treatment of carburized objects; for photography as applied to metallography and rules governing the preparation of micrographs of metals and alloys.

Standard definitions of terms relating to wrought-iron specifications.

Tentative specifications for structural steel for locomotives and cars, marine boiler steel plates, forged or rolled steel pipe flanges for high-temperature service, lapwelded and seamless steel pipe for high-temperature service, cold-rolled strip steel, alloy tool steel, zinc-coated (galvanized) iron or steel telephone and telegraph line wire, zinc-coated (galvanized) iron or steel tie wires, zinc-coated (galvanized) wire fencing, zinc-coated chain-link fence fabric galvanized after weaving, and zinc-coated chain-link fence fabric galvanized before weaving.

Tentative methods of testing zinc-coated (galvanized) iron and steel wire and wire products; test for magnetic properties of iron and steel at low inductions for audio and power frequencies; tension testing of metallic materials; compression testing of metallic materials.

Tentative definitions of terms relating to heat-treatment operations (especially as related to ferrous alloys).

B. Nonferrous Metals.—Standard specifications for lake copper wire bars, cakes, slabs, billets, ingots, and ingot bars; electrolytic copper wire bars, cakes, slabs, billets, ingots, and ingot bars; phosphor tin; phosphor copper; silicon copper; hard-drawn copper wire; medium hard-drawn copper wire; soft or annealed copper wire; soft rectangular copper wire; bare concentric-lay copper cable: Hard, medium hard, or soft; round and grooved hard-drawn copper trolley wire; manganese-bronze ingots for sand castings; manganese-bronze sand castings; Muntz metal condenser tube plates; naval brass rods for structural purposes; sheet high brass.

Standard method of chemical analysis of brass ingots and sand castings; chemical analysis of bronze bearing metal; verification of testing machines; metallographic testing of nonferrous metals and alloys; Brinell hardness testing of metallic materials.

Tentative specifications for brazing solder; bronze trolley wire; yellow brass sand castings for general purposes; bronze castings in

the rough for locomotive wearing parts; car and tender journal bearings, lined; copper tubing for refrigerators; rolled zinc; nonferrous insect screen cloth.

Tentative methods of chemical analysis of aluminum and light aluminum alloys, test for resistivity of metallic materials for electrical heating; test for change of resistance with temperature of metallic materials for electrical heating, chemical analysis of metallic materials for electrical heating, tension testing of metallic materials; compression testing of metallic materials.

C. Cement, Lime, Gypsum, Concrete, and Clay Products.—Standard specifications for quicklime for use in the manufacture of sulphite pulp, hydrated lime for the manufacture of varnish, quicklime for use in water treatment, hydrated lime for use in water treatment, gypsum plasters, gypsum partition tile or block, specifications for tests for hollow burned-clay load-bearing wall tile, and specifications and tests for hollow burned-clay floor tile.

Standard methods of sampling, inspection, packing, and marking of quicklime and lime products; testing gypsum and gypsum products; making and storing specimen of concrete in the field; making compression tests of concrete; securing specimens of hardened concrete from the structure; test for unit weight of aggregate for concrete; test for organic impurities in sands for concrete.

Standard definitions of terms relating to specific gravity.

Tentative specifications for sand for use in lime plaster; building brick (made from clay or shale); paving brick; clay fire brick for malleable furnaces with removable bungs and for annealing ovens; clay fire brick for stationary boiler service; clay fire brick for marine boiler service; required safe crushing strengths of sewer pipe to carry loads from ditch filling; and specifications and tests for hollow burned-clay fireproofing, partition, and furring tile.

Tentative methods of chemical analysis of limestone, quicklime, and hydrated lime; test for field determination of approximate apparent specific gravity of fine aggregate; test for field determination of approximate percentage of voids in fine aggregate; test for field determination of surface moisture in fine aggregate; testing brick; test for resistance of fire-clay brick to thermal spalling action; testing electrical porcelain.

Tentative definitions of terms relating to the gypsum industry, and terms relating to refractories.

D. Miscellaneous Materials.—Standard specifications for raw linseed oil; destructively distilled wood turpentine; orange shellac; mineral iron oxide; ocher; chrome yellow; pure chrome green; reduced chrome green; test for specific gravity of pigments; broken slag for bituminous macadam base; broken slag for bituminous concrete base; broken slag for bituminous concrete wearing course; broken slag for

bituminous concrete (coarse-graded aggregate type); broken slag for bituminous concrete (fine-graded aggregate type); structural wood joist, planks, beams, stringers and posts; high-carbon coal-tar pitch for use in constructing built-up roofs surfaced with slag or gravel; high-bitumen coal-tar pitch for use in constructing built-up roofs surfaced with slag or gravel; woven cotton fabrics saturated with bituminous substances for use in waterproofing; asphalt-saturated roofing felt for use in waterproofing and in constructing built-up roofs; coal-tar saturated roofing felt for use in waterproofing and in constructing built-up roofs; asphalt-saturated asbestos felt for use in constructing built-up roofs; asphalt roll roofing surfaced with powdered talc; asphalt roll roofing surfaced with granular talc; slate-surfaced asphalt roll roofing and slate-surfaced asphalt shingles; heavyweight slate-surfaced asphalt roll roofing and heavy weight slate-surfaced asphalt shingles; tolerances and test methods for electrical silk and cotton tapes; textile testing machines; tolerances and test methods for cotton yarns, single and plied; tolerances and test methods for cotton sewing threads; tolerances for numbered cotton duck; tolerances and test methods for tire fabrics, other than cord fabrics; tolerances and test methods for cord tire fabrics; tolerances and test methods for electrical silk and cotton tapes; tests for Osnaburg cement bags.

Standard methods of test for specific gravity of pigments; routine analysis of white pigments; routine analysis of dry red lead; routine analysis of yellow, orange, red, and brown pigments containing iron and manganese; routine analysis of yellow and orange pigments containing chromium compounds, blue pigments, and chrome green; routine analysis of titanium pigments; analysis of grease; test for burning quality of kerosene oils; test for burning quality of long-time burning oil for railway use; test for burning quality of mineral seal oil; test for distillation of gasoline, naphtha, kerosene, and similar petroleum products; test for distillation of natural-gas gasoline; testing electrical insulating oils; test for steam emulsion of lubricating oils; test for sulphur in petroleum oils heavier than illuminating oil; test for thermal value of fuel oil; test for water in petroleum products and other bituminous materials; mechanical analysis of sand or other fine highway material, except fine aggregates used in cement concrete; test for the determination of bitumen; test for the determination of proportion of bitumen soluble in carbon tetrachloride; test for loss in heating of oil and asphaltic compounds; float test for bituminous materials; test for specific gravity of road oils; road tars, asphalt cements, and soft tar pitches; test for specific gravity of asphalts and tar pitches sufficiently solid to be handled in fragments; laboratory sampling and analysis of coal and coke; testing small clear specimens of timber; conducting static tests of

timbers in structural sizes; sampling and analysis of creosote oil; test for coke residue of creosote oil; chemical analysis of zinc chloride; testing bituminous mastics, grouts, and like mixtures; testing felted and woven fabrics saturated with bituminous substances for use in waterproofing and roofing; testing asphalt roll roofing surfaced with fine or granular talc, slate-surfaced asphalt roll roofing and slate-surfaced asphalt shingles; testing molded insulating materials; testing electrical insulating oils; testing woven textile fabrics.

Standard definitions of terms relating to specific gravity; terms relating to coal and coke; the term slate; terms relating to textile materials.

Tentative specifications for boiled linseed oil; Prussian blue; ultramarine blue; chrome oxide green; commercial para red; titanium barium pigment; aluminum powder for paints; gold bronze powder; high-carbon tar for surface treatment, cold application; low-carbon tar for surface treatment, cold application); 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); high-carbon tar for surface treatment, hot application; low-carbon tar for surface treatment, hot application; high-carbon tar cement; low-carbon tar cement coal-tar pitch for stone block filler; asphalt filler for brick pavements (blown type); mineral filler for sheet asphalt and bituminous concrete pavements; rubber insulating tape; insulated wire and cable; 30 per cent Hevea rubber; rubber insulating tape; tolerances and test methods for rayon; tolerances and test methods for certain light and medium cotton fabrics; specifications and tests for Cuban (jute) raw sugar bags.

Tentative methods of testing shellac varnish; test for determination of wax in shellac ("machine-made" and dry-bleached refined shellac); sampling and testing lacquer solvents and diluents; routine analysis of white linseed oil paints; test for determination of toluol insoluble matter in rosin (chiefly sand, chips, dirt, and bark); sampling petroleum and petroleum products; test for carbon residue of petroleum products (Conradson carbon residue); test for cloud and pour points of petroleum products; test for detection of free sulphur and corrosive sulphur compounds in gasoline; test for neutralization number of petroleum products and lubricants; test for penetration of greases and petroleum; test for distillation of bituminous materials suitable for road treatment; determination of sulphur in coal and coke by the bomb-washing and sodium-peroxide-fusion methods; test for distillation of creosote oil; analysis of roofing felt for fiber composition; test for water absorption of slate; flexure testing of slate; test for determining the insulating qualities of slate; testing electrical porcelain; testing sheet and tape insulating materials for dielectric strength; testing electrical insulating materials for power

factor and dielectric constant at frequencies of 100 to 1,500 kilocycles; testing untreated insulating materials; identification of textile fibers and their quantitative determination in mixed goods.

Tentative definitions of terms relating to coal and coke; terms relating to textile materials.

E. Miscellaneous Subjects.—Standard methods of metallographic testing of nonferrous metals and alloys, verification of testing machines, Brinell hardness testing of metallic materials.

Standard definitions relating to metallography; terms relating to specific gravity.

Standard rules governing the preparation of micrographs of metals and alloys, including recommended practice for photography as applied to metallography.

Tentative methods of tension testing of metallic materials; compression testing of metallic materials.

As one of the five technical societies which united in the founding of the American Engineering Standards Committee, the A. S. T. M. has been especially active in the work of the A. E. S. C., to which it has submitted many of its standards for approval. It is sponsor or joint sponsor for 55 standardization projects or sectional committees functioning under A. E. S. C. procedure, as follows:

	Projects
A. Ferrous metals	11
B. Nonferrous metals	18
C. Cement, lime, gypsum, and clay products	6
D. Miscellaneous materials	20

CENTRAL COMMITTEE ON LUMBER STANDARDS

This organization, made up of 11 representatives of lumber manufacturers, wholesalers, retailers, and consumers, was created to act as an executive steering organization in drafting recommendations for the simplification of sizes, nomenclature, grades, and trade practices in the softwood and hardwood industries in cooperation with the United States Department of Commerce and the United States Department of Agriculture. Its headquarters are in the Transportation Building, Washington, D. C. Arthur T. Upson is the secretary.

Members of the central committee are appointed by their representative groups. The committee has no judicial authority in the industry, but serves as a central clearing house between the industry and the Government in encouraging the putting into practice of those recommendations which have been indorsed by general conferences representing all branches of the trade and the public.

The central committee is served by two advisory committees, namely, the consulting committee on lumber standards and the hardwood consulting committee, composed of about 30 members each.

Recommendations approved by general conferences of all interested lumber manufacturers, wholesalers, retailers, and consumers are recognized as American lumber standards and published by the division of simplified practice for the benefit of the trade and the public. The recommendations thus far published include lumber classifications, nomenclature of commercial softwoods, shipping practices, basic provisions for structural material, softwood factory and shop lumber, lumber inspection provisions, lumber abbreviations, American standard moldings, and standards for red cedar shingles. Simplification of sizes, nomenclature, grades, and trade practices has been accomplished in the softwood industry.

In 1926 the central committee completed work on standards for softwood factory and shop lumber, the determination of single-standard thicknesses for finished lumber based on the thicknesses of standard unfinished lumber with allowance for shrinkage and planing, and the establishment of marketing practice covering short lengths of lumber.

Basic grading provisions for hardwood lumber, formulated after years of study 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, were completed in 1927. These provisions had been approved by the hardwood consulting committee on June 2, 1926, subject to further development which was done by the above-mentioned groups in the industry, and were approved June 16, 1927, by unanimous vote of the central committee on lumber standards, as American standards, subject to annual revision, under the auspices of the Department of Commerce, and recommended to become effective forthwith. The central committee also approved American standards of nomenclature for commercial domestic hardwoods.

The central committee is now engaged on the following projects: Uniform patterns for worked lumber, shipping weights and dryness of lumber, structural timbers, supply and demand survey of American standard lumber, and further attention to hardwood standardization.

VIII. 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 organizations, particular attention has been paid to the present status of these activities, accomplishments to date and programs for future work, 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 Yearbook, 1927.

ALPHABETICAL LIST OF SOCIETIES AND ASSOCIATIONS

American Association for the Advancement of Science, 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 rules of procedure of the American Engineering Standards Committee.

American Association of Cereal Chemists, R. K. Durham, secretary-treasurer, Huntzinger Building, Kansas City, Mo. 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 for the good of the cereal industries. The committee on methods of analysis has prepared a book of standard methods for cereal chemists. Another committee is studying various methods now in use for standardizing 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. This association has been especially active in the promotion of the use of standardized specifications for materials used in constructing highways

and for the design and construction of steel, concrete, and timber bridges. Standard methods of sampling and testing highway materials have been adopted by the association and these specifications, together with all others so far issued through the association, have been approved by the United States Secretary of Agriculture for use in connection with Federal-aid road and bridge 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 rules of procedure of the American Engineering Standards Committee, 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). The association is officially represented on three additional sectional committees functioning under A. E. S. C. procedure.

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 and fastness to light, fastness tests to dry and wet heat, fastness to acids and alkalies, carbonizing, and sea water. The research committee is engaged in the formulation of standard methods of dye testing. This work is being performed in various laboratories, representing consumers, textile manufacturers, dyestuff manufacturers, and general testing laboratories. The results of these tests will be embodied in a report to be presented at the association's annual convention. Progress has been made in the endeavor to establish international standard methods of dye testing, and a joint committee of European and American members is being organized to study carefully the possibilities and advisability of such an undertaking. In this connection the British Society of Dyers and Colourists has expressed its desire to cooperate. 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. Recommendations of the association are submitted to the joint committee before final adoption as standards.

American Automobile Association, Ernest N. Smith, general manager, national headquarters, 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 A. E. S. C. procedure.

American Boiler Manufacturers Association, A. C. Baker, secretary, 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. In cooperation with the Stoker Manufacturers Association it has adopted boiler and stoker definitions. 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 association cooperated with the division of simplified practice of the Department of Commerce in simplifying paint and varnish brushes and has planned other activities of this kind for various additional lines of brushes.

American Bureau of Welding, William Spraragen, secretary, division of engineering, National Research Council, 33 West Thirty-ninth Street, New York. 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, 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 work on welded rail joints. Standards or specifications formulated by the committees and approved by the bureau through its executive committee are issued to the welding industry as publications of 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 of the Department of Commerce. In cooperation with the American Hotel Association it inaugurated the movement which resulted in the simplified practice recommendation relating to hotel

chinaware. It has also taken an active part in the work of the committee for simplification of paving bricks.

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). In 1925 the committee on guaranteed reagents of the society published specifications for 14 analytical reagents, and in 1926 published 23 specifications. 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 1927 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 committee 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 Concrete Institute, Harvey Whipple, secretary, 2970 West Grand Boulevard, Detroit, Mich. The institute is officially represented on the following joint committees engaged in standardizing activities: Concrete culvert pipe, concrete and reinforced con-

crete, technical problems in cement manufacture, and cement. Among its own committees carrying on standardizing work are the following: Reinforced concrete building design and specifications; fire resistance of concrete; aggregates; destructive agents and protective treatments; waterproofing; concrete floor finish; treatment of concrete surfaces; field methods; reinforced concrete chimneys; concrete bridges; standard concrete building units; concrete staves; concrete products plant operation; concrete pipe, drain tile, and conduit. The institute has formulated and published 13 standard specifications and 9 tentative specifications. Of these, the following were issued in 1927: Standard specifications for concrete building block and concrete building tile, tentative building tile regulations for the use of reinforced concrete, tentative specifications for concrete curb and concrete curb gutter, tentative specifications for concrete manhole and catch basin block. Committees of the association are working in cooperation with the Concrete Reinforcing Steel Institute regarding building regulations. It is expected that a revised standard for reinforced concrete building design will be presented at the next convention in 1928.

American Concrete Pipe Association, M. W. Loving, secretary, 33 West Grand Avenue, Chicago, Ill. This association cooperates to the fullest extent with the American Concrete Institute, the American Society for Municipal Improvements, the American Society for Testing Materials, and with other organizations represented on the Joint Concrete Culvert Pipe Committee in the preparation of specifications for concrete pipe, including drain tile, cement-concrete sewer pipe, reinforced concrete sewer pipe, and reinforced concrete culvert pipe.

The American Construction Council, Dwight L. Hoopingarner, executive, 28 West Forty-fourth Street, New York, N. Y. Organized to deal with the fundamental relations of the construction industry to the public, the council pays particular attention to such subjects as sound methods of building financing, the permanency of building construction in relation to hazards of life and investment, community building standards, and methods of securing quality building materials. It advocates the use of materials nationally recognized as standard and standard sizes and weights of materials, in order to keep the costs at the minimum consistent with good construction. It also deals with such subjects as making more uniform the use of arbitration of commercial disputes, and the promotion of better standards for all-year-round construction.

American Corn Millers Federation, Reynier Van Evera, secretary, 6 West Tenth Street, Kansas City, Mo. Under authority conferred upon him at a meeting of the federation, the president appointed a standardizing committee to formulate standards and specifications

for cream meal. These have been adopted by the federation. The federation has also adopted a symbol to be licensed by the federation to all millers who will agree to conform to the specifications.

American Cotton Manufacturers' Association, William McLaurine, secretary, Charlotte, N. C. (*See* National Council of American Cotton Manufacturers.)

American Dental Trade Association, John M. Clauser, chairman, simplification committee, 315 North Tenth Street, St. Louis, Mo. The members of this association's committees are appointed by the president. The chairmen of the various manufacturers' sections of the association are members of the simplification committee, the functions of which are to bring about simplifications desired by manufacturers and dealers through correspondence and committee meetings. The following standards have been adopted: Two standard finishes for dental equipment, or furniture; standard one-fourth inch holes for lathe grinding wheels with a limit on the number of sizes (round edge discontinued); a limit of six shades of powders for crown and bridge cement; a limit of five classes of plaster and four of investment containers; three standard lengths of gold shells; a standard end for lathe shaft to take all mandrels and chucks. Attempts are being made to simplify shades of vulcanite rubber, mouth mirrors, gold and vulcanite files, brush wheels, and many other devices and materials used in the dental trade.

American Drop Forging Institute, Donald McKaig, secretary, Union Bank Building, Pittsburgh, Pa. The institute 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 A. E. S. C. procedure.

American Drug Manufacturers Association, Carson P. Frailey, secretary, Albee Building, Washington, D. C. In addition to its activities relating to the development and standardization of methods for testing antiseptics and various other drugs, the association has organized a number of committees to establish standards under the auspices of its scientific section. Among these are committees dealing with alkaloid and drug standards, analytical assay methods, and chemical tests and standards. It has also organized a committee on standardization of glass containers, and a committee on catalogue simplification to unify and standardize that part of pharmaceutical catalogues which cover standard preparations.

American Electric Railway Association, J. W. Welsh, executive 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 electric 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. Much work during the past year has been done by the committees in preparation for the current editions of the Engineering Manual. The association is a member of the American Engineering Standards Committee, and, through it, takes active part in the consideration of all proposed standardization and code work affecting the industry, cooperating chiefly in the preparation of standards with the American Institute of Electrical Engineers, the American Railway Engineering Association, the American Society for Municipal Improvements, the American Society for Testing Materials, the American Society of Mechanical Engineers, the American Wood-Preservers' Association, and other organizations. The association is sponsor or joint sponsor for 13 sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations); specifications for tubular steel poles; recommended specifications for 600-volt direct-current overhead trolley construction; recommended designs for joint plates for 7 and 9 inch girder grooved and girder guard rails; recommended designs for 7-inch, 80, 91, and 102 pound plain girder rail for use in paved streets; specifications for use in the manufacture of materials for special track work. The association is officially represented on 29 additional sectional committees functioning under the A. E. S. C.

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 Standards 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 investigations in standardization of specifications for the electrodeposition of copper and nickel.

American Electro-Platers Society, George Gehling, secretary, 5001 Edmund Street, Philadelphia, Pa. Although this society has not formulated any standards, it maintains a research associate at the National Bureau of Standards investigating the "spotting out" of electroplated finishes.

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 main-

tains a research associate at the National Bureau of Standards, doing research work on the prevention of efflorescence on brick walls.

American Forestry Association, 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 A. E. S. C. procedure.

American Foundrymen's Association, C. E. Hoyt, executive secretary, 222 West Adams Street, Chicago, Ill.; R. E. Kennedy, technical secretary, 909 West California Street, Urbana, Ill. 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 molding sand research, which is standardizing methods of testing and grading foundry sands, and the joint committee on pattern equipment standardization, which is formulating recommended practices. This association is also joint sponsor with the American Ceramic Society for the joint committee on foundry refractories (with 10 other national organizations) 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 phosphorous and sulphur in steel (with 10 other organizations). The association is joint sponsor for two sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, 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). Its committees on metals are cooperating with similar committees of the American Society for Testing Materials. It is officially represented on five additional sectional committees functioning under A. E. S. C. procedure.

American Fruit and Vegetable Shippers Association, E. S. Briggs, manager-secretary, 1425 South Racine Avenue, Chicago, Ill. Committees are appointed by the president about the first of each year to consider such subjects as come up during the course of the year, and submit their recommendations to the secretary's office. At the annual meeting the committees meet and handle such subjects as are docketed for their consideration and render their reports to the convention as a whole. The 14 committees of the association do not formulate standards or specifications, but they serve 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.

American Gas Association (Inc.), Alexander Forward, managing director, 420 Lexington Avenue, New York, N. Y. Committees have been organized to deal with such subjects as flexible tubing, gas ranges, space heaters, water heaters, central house heating equipment, mixed gas research, gas chemistry, carbonization, distribution, and refractories. The gas association is joint sponsor for three sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Specifications for cast-iron pipe and special castings (with three other organizations), pipe thread (with the American Society of Mechanical Engineers), and gas safety code (with the National Bureau of Standards). The association is represented on 12 additional sectional committees functioning under A. E. S. C. procedure. It maintains a research associate at the National Bureau of Standards doing research work on the methods of testing gas appliances to determine their safety. In addition, arrangements are being made with the American Society of Heating and Ventilating Engineers and other allied heating professions and trades, to correlate the research work being done by the association on the subject of house heating, with the corresponding work of these organizations.

American Gear Manufacturers' Association, T. W. Owens, secretary, 2443 Prospect 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), and is officially represented on the sectional committee on shafting, functioning under A. E. S. C. procedure.

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. In cooperation with the National Hardware Association of the United States this organization 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. E. S. C. procedure.

American Hospital Association, William H. Walsh, 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, J. K. Blatchford, secretary, Auditorium Tower, Chicago, Ill. 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 simplified practice 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. The association was officially represented on the advisory board which cooperated with the Department of Commerce in the preparation of the National Directory of Commodity Specifications.

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 is represented officially on the National Committee on Metals Utilization, 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, the American Construction Council, and the Chamber of Commerce of the United States. The institute is joint sponsor for five sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, 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). The institute is officially represented on 12 additional sectional committees functioning under A. E. S. C. procedure.

American Institute of Baking, H. E. Barnard, president, 1135 Fullerton Avenue, Chicago, Ill. The institute was founded and is conducted by the American Bakers Association for scientific research and education. The manufacturer's sample is checked by duplicate tests on a sample obtained on the market. If the products comply with the claims of the manufacturer and are suitable for use in baking, a certificate of registration is issued by the institute. A contract is also made between the institute and the manufacturer governing the use of the "seal of registration." The instutite has organized an advisory board for the National Research Council.

American Institute of Chemical Engineers, H. C. Parmelee, secretary, Tenth Avenue at Thirty-sixth Street, New York, N. Y. The institute engaged in the standardization work involved in developing an evaporator test code in cooperation with the American Society of Mechanical Engineers, by which this code has been printed.

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 24 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. 5, standards for direct-current generators and motors and direct-current commutator machines in general; No. 7, standards for alternators, synchronous motors and synchronous machines in general; No. 8, standards for synchronous converters; No. 9, standards for induction motors and induction machines in general; No. 10, standards for direct-current and alternating-current fractional horsepower motors; No. 11, standards for railway motors; No. 13, standards for transformers, induction regulators and reactors; No. 14, standards for instrument transformers; No. 15, standards for industrial control apparatus; No. 16, standards for railway control and mine locomotive control apparatus; No. 19, standards for oil circuit breakers; No. 22, standards for disconnecting and horn gap switches; No. 30, standards for wires and cables; No. 33, standards for electrical measuring instruments; No. 34, standards for telegraphy and telephony; No. 36, standards for storage batteries; No. 37, standards for illumination; No. 38, standards for electric arc welding apparatus;

No. 39, standards for electric resistance welding apparatus; No. 41, standards for insulators; No. 42, standard symbols for electrical equipment of buildings; No. 45, recommended practice for electrical installations on shipboard (Marine Rules); No. 46, standards for hard-drawn aluminum conductors. Of these 24 standards, 6 have been approved as American standards under American Engineering Standards Committee procedure (Nos. 8, 14, 15, 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 Engineering Standards Committee, and is represented on the electrical advisory committee, the organization of which was recommended to the American Engineering Standards Committee by joint action of the institute and the National Electrical Manufacturers Association. The institute is sponsor or joint sponsor for 19 sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Elevators (with the American Institute of Architects and the American Society of Mechanical Engineers); rating of electrical machinery; insulated 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); electrical properties of aluminum; radio (with the Institute of Radio Engineers); industrial electrical-control apparatus (with the National Electrical Manufacturers Association); instrument transformers; 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, generators and motors; power line insulators for voltages exceeding 750 (with the National Electrical Manufacturers Association); electrical installations on shipboard; scientific and engineering symbols and abbreviations (with four other organizations); code on protection against lightning (with the National Bureau of Standards); line insulators for voltages not exceeding 750 (with National Electrical Manufacturers Association); mercury arc rectifiers; synchronous converters. The institute is represented on 27 additional sectional committees functioning under A. E. S. C. procedure. Committees of the institute are now at work on the following standardization topics: Rearrangement of rules; Spanish translation; electric arc welding apparatus; lightning arresters; telegraphy and telephony definitions; definitions and symbols; graphical symbols; measurement of test voltages in dielectric tests; storage batteries; general principles upon which temperature limits are based in the rating of electrical machin-

ery and apparatus; switchboards for power and light; definition of substation and related matters; air circuit breakers; rule for altitude correction; nomenclature. The standards committee of the institute is cooperating 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. The committee on application to marine work has recently completed an extensive revision of the A. I. E. E. marine rules now issued as a section of the standards and known as "recommended practice for electrical installations on shipboard."

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. It is officially represented on not only this committee but also on 23 sectional committees functioning under the procedure of the American Engineering Standards Committee. It is serving as sponsor for two of these sectional committees, as follows: Screening of ores; and recommended practice for rock dusting of coal mines.

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 Society of Refrigerating Engineers; American Warehousemen's Association, Cold Storage Division; Eastern Ice Association; National Association of Ice Industries; National Association of Practical Refrigerating Engineers; New York State Cold Storage Association; Pacific States Cold Storage Warehousemen's Association; Refrigerating Machinery Association; and United States Fisheries 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, Leader Building, Cleveland, Ohio. Steel specifications issued by the institute are kept in harmony with those of the American Society for Testing Materials. The institute is cooperating with the American Bureau of Welding and the American

Society of Civil Engineers in welding research activities. A committee of prominent engineers appointed by the institute completed on October 8, 1927, a standard specification for fireproofing structural steel buildings. Plans are under way for formulating drawing-room standards. The institute is officially represented on four sectional committees functioning under A. E. S. C. procedure. 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, acting 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 standards, and with the collection and classification of records relating to weights and measures.

American Medical Association, Bureau of Health and Public Instruction, J. M. Dodson, executive secretary, 535 North Dearborn Street, Chicago, Ill. Through this bureau the association seeks to promote the health education of the public through the publication of a monthly magazine, Hygeia, and a series of pamphlets on various topics; by furnishing material to assist persons in preparing addresses on health topics; by radio talks; by cooperative activity with other organizations, and by promoting special health activities.

American Medical Association, Bureau of Investigation, Arthur J. Cramp, director, 535 North Dearborn Street, Chicago, Ill. Through this bureau the association disseminates information on "patent medicines," quackery and pseudomedicine in general. The bureau publishes pamphlets, books, and educational posters on the subject; it also has lantern slides illustrating various phases of the same subjects. Most of the information in regard to this branch of the association's activities appears in the book "Nostrums and Quackery," of which there are two volumes. The bureau also answers by mail any inquiries dealing with the subjects of its investigation.

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, looks after the establishment of standards whereby the identity and purity of such products may be determined and controlled, and analyzes proprietary medicinal preparations that are offered to the medical profession and also those that are sold direct to the public. It publishes an annual report of its work. It does no commercial testing.

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 conducts a clearing house for information regarding medical col-

leges, premedical, undergraduate, and graduate medical education, licensure, hospitals, and clinical laboratories; inspects and classifies medical colleges and investigates graduate medical schools, hospitals, and clinical laboratories, and publishes annual statistics, as well as pamphlets, on these subjects, including lists of approved colleges of arts and sciences and junior colleges; medical and graduate medical schools; hospitals approved for interne training; hospitals approved for residencies in the specialties and approved clinical laboratories.

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, J. F. Callbreath, secretary, Munsey Building, Washington, D. C. The standardization activities of the organization are carried on by the division of standardization, of which there are 2 branches—coal mining, with 8 major committees; and metal mining, with 11 major committees. The following reports developed by the national standardization division have been approved by the American Engineering Standards Committee: Safety rules for installing and using electrical equipment in coal mines (underground power transmission and power equipment), wire rope for mines, coal-mine drainage, mine tracks and signals. The American Mining Congress is sponsor or joint sponsor for eight sectional committees functioning under the rules of procedure of the A. E. S. C., as follows: Underground transportation in coal mines, underground transportation in metal mines, ventilation in metal mines, outside coal-handling equipment, ladders and stairs for mines, safety code for coal-mine transportation, fire-fighting equipment in metal mines (with the National Fire Protection Association), and mechanical loading underground in metal mines. The congress is represented on 10 additional sectional committees functioning under A. E. S. C. procedure.

American Oil Burner Association, Leod D. Becker, managing director, 350 Madison Avenue, New York, N. Y. Organized in 1923 as an association of oil-burner manufacturers, the scope has been so enlarged as to include oil companies, manufacturers of accessory equipment, and dealers. Committees of the association are appointed by the president to prepare reports for approval by the whole membership. Recommendations of a committee on general trade practices have been formally adopted by the association. Committees are now engaged on the preparation of standard specifications for oil

now nearing completion and on standard installation practice which will probably be completed in 1928. Research work for the members of the association acting cooperatively is conducted under the auspices of the Oil Heating Institute, the managing director of which is also the managing director of the American Oil Burner Association.

American Oil Chemists' Society, J. C. P. Helm, secretary, 705 Tchoupitoulas Street, New Orleans, La. Although this society has issued no specifications of its own, it has cooperated actively in the standardization work of the Interstate Cotton Seed Crushers' Association. The president appoints from the membership of the society a committee of five well-known competent chemists to meet with the rules committee of the Interstate Cotton Seed Crushers' Association to formulate official methods of analysis for adoption by the association.

American Paint and Varnish Manufacturers Association (Inc.), G. B. Heckel, secretary, 509 The Bourse, Philadelphia, Pa. This association was organized in October, 1926, as 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.), which is continuing its efforts to minimize the number of varieties of paints and varnishes and sizes of containers.

American Paper and Pulp Association, Hugh P. Baker, executive secretary, 18 East Forty-first Street, New York, N. Y. This association has cooperated actively in the recommendations relating to the standardization and simplification of paper issued by the division of simplified practice. It has an advisory committee actively cooperating with the National Bureau of Standards in technical matters relating to the manufacture of pulp and paper.

American Petroleum Institute, division of standardization, C. A. Young, director, 1508 Kirby Building, Dallas, Tex. Special committees of the institute have formulated standards and specifications for belting, boilers, cable tool joints, rigs and derricks, pipe, tubular materials, rig irons, rotary drilling equipment, wire rope, manila cordage, working barrels, sucker rods, internal-combustion engines, and steel tanks. Work is now going forward on the formulation of codes on recommended field practice covering the material contained in the various standard specifications adopted to date. The institute grants to manufacturers the right to use its official monogram in the manufacturing of 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 license

to use its monogram for any reason satisfactory to the board of directors. The institute has inaugurated a very extensive gauge schedule for casing, drill pipe, line pipe, tubing threads, and taper-joint threads for rotary and cable tool drilling. A complete set of master gauges for cable-drilling tool joints, standardized at the National Bureau of Standards, has been sent to each regional district.

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 authoritative formulary, extra to the U. S. 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 the National Formulary a legal standard and placed it on a par with the U. S. Pharmacopœia in legal standing. This association has seven other committees working on standardization besides the committee on National Formulary and the committee on U. S. Pharmacopœia above mentioned. The committee on recipe book has completed the first edition of this work, which is intended to be a supplement to the Pharmacopœia and the National Formulary. The committee on pharmaceutical syllabus cooperates with a similar committee from the American Association of Colleges of Pharmacy and the National Association of Boards of Pharmacy in preparing a minimum course to be taught in the various colleges of pharmacy. The committee on horticultural nomenclature represents the association in cooperating with other scientific bodies in this important endeavor. The committee on physiological testing interests itself in the development of processes for the testing of those drugs and preparations which do not lend themselves to other methods of standardization. The committee on weights and measures has for its principal activity the extension of the use of the metric system in pharmacy. This committee also gives consideration to the general subject of weights and measures so far as they affect pharmacy. The committee on international pharmaceutical nomenclature cooperates with foreign associations in bringing about uniformity as far as possible. The committee to cooperate with committees from the American Association of Colleges of Pharmacy and the National Association Boards of Pharmacy to obtain prerequisite legislation cooperates with these associations not only to bring about prerequisite legislation, but also to standardize these requirements as far as possible. In 1926 the association organized 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 ultraviolet and infra-red regions of the spectrum. It is expected that the investigations of this 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 of water analysis, the sixth edition of which was issued in 1925. The translation of this document into French and German is now being considered by the health section of the League of Nations. The association has recently revised its standard methods of milk analysis, the fifth edition of which has just come from the press. The standardization program covers standard record forms for health departments, standard forms for the tabulation of vital statistics, and similar matters. The general direction of its activities is towards the standardization of methods rather than of materials.

American Railway Association, H. J. Forster, secretary, 30 Vesey Street, New York, N. Y. Four of the seven divisions of this association 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, mechanical, 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. This bureau is functioning to develop and prepare standard specifications for shipping containers for commodities other than explosives and dangerous articles. Twenty-one recommended standard specifications for containers have already been issued. It is expected that 15 additional recommended standard specifications for containers will soon be issued.

American Railway Association, Mechanical Division, V. R. Hawthorne, secretary, 431 South Dearborn Street, Chicago, Ill. This division is a consolidation of the former Master Car Builders' Association and the American Railway Master Mechanics Association, and it includes an equipment painting section composed of the former Master Car and Locomotive Painters' Association. Committees of the equipment painting section are at work on standards for the painting of cars and locomotives. Other committees of the division are working on specifications and tests for materials and standards for various parts of cars and locomotives. The division has issued many specifications for materials. It has 15 committees working on standardization in some form. It is represented officially

(with 10 other organizations) on the joint committee on the investigation of the effect of phosphorus and sulphur in steel. It is also represented on three sectional committees functioning under A. E. S. C. procedure.

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. The telegraph and telephone section has prepared specifications for a large number of items used by the telephone and telegraph departments of the railroads.

American Railway Association, Purchases and Stores Division, W. J. Farrell, secretary, 30 Vesey Street, New York, N. Y. Work of the division is carried on by committees dealing with subjects relating to purchasing and stores department operations. The more important recommendations 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. A committee on committees determines the scope of the activities of the various committees as occasion may require. Members of these committees are selected from the various railroad organizations and assigned to the particular subjects desired. Reports of the committees are analyzed and voted upon by the railroad representatives before they are published as specifications in the section's "Manual of Recom-

mended Practice." There are committees on mechanical interlocking, power interlocking, direct-current automatic block signaling, maintenance rules and instructions, standard designs, direct-current relays, alternating-current automatic block signaling, wires and cables, signaling practice, batteries, contracts, electrical testing, lightning protection, valuation, oils, pole lines, direct-current track circuits, electric railway track circuits, electric railway signaling, and highway crossing protection. This organization is officially represented on eight sectional committees functioning under the procedure of the American Engineering Standards Committee.

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. Sixteen standing committees are actively engaged in carrying on the work of the section. Consideration is being given to over 100 subjects, including the following important groups: Outside plant, inside plant, protection against electrolysis, electrical protection, message traffic, communication transmission development, 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 118 recommendations and specifications.

American Railway Car Institute, W. C. Tabbert, secretary, 61 Broadway, New York, N. Y. Among the objects of the association is to cooperate with railroads and other purchasers and with allied industries for the purpose of bringing about a standardization of designs and specifications and a uniformity of methods of purchasing and inspection. It has representatives on 15 standardizing committees, several of which are cooperating actively with the American Engineering Standards Committee, 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; 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 and a special committee on standardization. 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 committee 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 rules of procedure of the American Engineering Standards Committee, 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). The association and its sections are represented on 32 additional sectional committees functioning under A. E. S. C. procedure.

American Refractories Institute, Dorothy A. Texter, secretary, Oliver Building, Pittsburgh, Pa. This institute has cooperated in the final 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 Sanatorium Association, Walter L. Rathburn, secretary, Newton Memorial Hospital, Cassadaga, N. Y. The committee on standardization of this association has formulated certain sanatorium 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, 1319 F Street NW., Washington, D. C. The association has organized a purchasing department conducted under the name of the consolidated purchasing agency. Moreover, it is cooperating in the preparation of standards and specifications through official representation on two sectional committees functioning under the procedure of the American Engineering Standards Committee.

American Shovel Institute, George D. McIlvaine, secretary, Oliver Building, Pittsburgh, Pa. This institute has taken an active and leading part in the movement which resulted in the standardization of shovels, spades, and scoops set forth in Simplified Practice Recommendation No. 48 issued by the United States Department of Commerce.

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 at present in the process of 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 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 of low-pressure heating boilers at the request of the United States Bureau of Mines. Another important project is the 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 rules of procedure of the American Engineering Standards Committee, as follows: Ventilation safety code and safety code for exhaust systems. It is officially represented on six sectional committees functioning under A. E. S. C. procedure. 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 Civil Engineers, George T. Seabury, secretary, 33 West Thirty-ninth Street, New York, N. Y. Research and standardization work of the society is carried on by special committees appointed by the board of direction. Such committees have been organized to deal with the following subjects: Stresses in railroad track, bridge design and construction, standard construction contracts, electrification of steam railways, flood-protection data, hydraulics phenomena, impact in highway bridges, irrigation hydraulics, concrete and reinforced concrete arches, steel column, cement, engineering contract bonding, and arbitration. A special research committee has been appointed to study the effects of earthquakes on engineering structures, with special reference to the Japanese earthquake of September 1, 1923. 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 rules of procedure of the American Engineering Standards Committee, 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. E. S. C.), and scientific and engineering symbols and abbreviations (with four other organizations). It is officially represented on 19 additional sectional committees functioning under A. E. S. C. procedure.

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. Beginning January, 1928, each professional division will have its own quarterly publication. The technical committee activity of the society has grown very rapidly during the past nine years, until now 1,064 engineers and others are serving on the 250 committees for which the society is sponsor or joint sponsor. Under the main research committee 30 special research committees have been organized. Some of these projects have grown out of the activities of standards committees. At the present time 69 research workers are employed full or part time on the following projects: Boiler furnace refractories, fluid meters, lubrication, spark arresters, steam tables, elevators, strength of gear teeth, sub-

stitute species for domestic woods, and effect of temperature on properties of metals. New committees on fuels research, velocity measurement of fluid flow, and physical constants of several refrigerants will shortly be organized. Eleven of the research fellows are at work at the National Bureau of Standards. The dimensional standardization and safety activities of the society are carried forward under the procedure of the American Engineering Standards Committee. At the present time the society is sponsor or joint sponsor for 22 sectional committees on standards and 5 sectional committees preparing safety codes. The projects covered by the standards committee 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; 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; and motor frames. 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. The society is represented on 69 additional sectional committees functioning under A. E. S. C. procedure. Recently the following sponsorships have been accepted and sectional committees are being organized to formulate the standards and codes: Plumbing equipment, wire and sheet-metal gauges, wrought-iron and wrought-steel pipe and tubing, and dimensions for electrical motor frames. 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 15 cities in this country. These codes cover boilers of locomotives; care of steam boilers in service; heating boilers; material specifications; miniature boilers; rules for inspection, unfired pressure vessels, and welding. 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 engines; 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 14 dimensional standards; 2 safety codes, 2 research reports, and 15 power-test codes.

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, cement, concrete, stone-block, and wood-block pavements; also sidewalks and curbs. They have prepared specifications for broken stone and gravel roads, for sewers, 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 rules of procedure of the American Engineering Standards Committee. The society is officially represented on nine additional sectional committees functioning under A. E. S. C. procedure. It cooperates officially with several other societies, including National Research Council, the Illuminating Engineering Society, and the American Engineering Council.

American Society of Refrigerating Engineers, W. H. Ross, secretary, 37 West Thirty-ninth Street, New York, N. Y. The society has officially adopted a test code for steam-driven ice-manufacturing plants, a standard ton for refrigeration, specifications for synchronous motors for direct-connected ammonia compressors, and test code for refrigerating systems. The last mentioned was formulated in cooperation with the American Society of Mechanical Engineers. It is serving as sponsor for the sectional committee on safety code for mechanical refrigeration and is officially represented on seven additional sectional committees functioning under A. E. S. C. procedure.

American Society of Safety Engineers. (*See* National Safety Council.)

American Society of Sanitary Engineering, Frank L. Maar, secretary, 24 Washington Street, Poughkeepsie, N. Y. This society functions through officers and committees which are appointed at its

annual conventions. It is serving as joint sponsor with the American Society of Mechanical Engineers under A. E. S. C. procedure for a sectional committee working on the standardization of plumbing equipment.

American Society for Steel Treating, W. H. Eisenman, secretary, 4600 Prospect Avenue, Cleveland, Ohio. Technical committees of the society are now at work on the following subjects: Tool steel, measuring case depth, heat treatment of water and oil hardening gears, hardness testing of metals, mechanism of cementation, and the heat treatment of crane chains, steel castings, relation of design to heat treatment, heat treatment of spring steels, and heat treatment of spline shafts. The society is represented on the joint committee on definitions 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 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 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. All the committees of the association are appointed by its president. It has an inspection rules committee for walnut lumber which is studying the effects of a certain proposal for the grading of hardwood lumber upon the products of the members of the industry. Its veneer committee is investigating the possibilities of standardizing methods of manufacture and classification of walnut veneers.

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American Warehousemen's Association, Ralph C. Stokell, executive secretary, 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.

American Water Works Association, Council of Standardization, George W. Fuller, chairman, 170 Broadway, 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. Nine committees are now functioning in preparing material for a revised edition of the "Manual of Water Works Practice," as follows: Methods of water analysis, practicable loadings for purification processes, industrial wastes in relation to water supply, pumping station betterments, physical standards for distribution system, standard specifications for cast-iron pipe and specials, service connection practice, filter sand testing and recording, and boiler feed water studies. The council has added committees on 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 rules of procedure of the American Engineering Standards Committee, 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). It is officially represented on three additional sectional committees functioning under A. E. S. C. procedure.

American Welding Society, M. M. Kelly, secretary, 29 West Thirty-ninth Street, New York, N. Y. For the purpose of joining with other societies, associations, and Government departments in cooperative research and standardization in welding, the society has organized the American Bureau of Welding, which coordinates and controls all research and standardization in welding of the society and also acts as the welding research department of the National Research Council. (See American Bureau of Welding.)

American Wood-Preservers' Association, E. J. Stocking, secretary, 111 West Washington Street, Chicago, Ill. One of the duties assigned to the executive committee is the printing of a "Manual of Recommended Practice" in which are published the specifications and standards approved by the association, which now number 41. At

the 1928 annual meeting, 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 on the following subjects: Preservatives; preservative treatments; inspection; tie service reords; pole service records, posts, and research. The association is represented on the National Committee on Wood Utilization, on the joint committee on methods of test for petroleum oils for wood preservation (with the American Society for Testing Materials), 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). It is also represented on three sectional committees functioning under rules of procedure of the American Engineering Standards Committee.

American Zinc Institute (Inc.), 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 Engineering Standards Committee and the American Society for Testing Materials. It is joint sponsor with the A. S. T. M. for the A. E. S. C. sectional committees on zinc and zinc ores and is officially represented on the A. E. S. C. zinc coating sectional committee under A. S. T. M. sponsorship.

Arkansas Soft Pine Bureau, B. Greaves, secretary, Boyle Building, Little Rock, Ark. This association's rules for soft pine lumber conform to the American standards for yard lumber. It has adopted the wood moldings and universal sizes formulated under the auspices of the Central Committee on Lumber Standards.

Artistic Lighting Equipment Association, Granville P. Rogers, managing director, 420 Lexington Avenue, New York, N. Y. The association's standardization committee, appointed by the board of directors, is empowered to act on all questions of standardization submitted to it. It reports its findings and recommendations to the board of directors, who in turn submit the matter to the membership at a general meeting of the association. The advisability of standardizing holders for receiving the new type of inside-frosted lamps is now being given consideration.

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 (Inc.).

The Asphalt Association, J. E. Pennypacker, secretary, 441 Lexington Avenue, New York, N. Y. This association's work of standardization is carried on in cooperation with various interested organiza-

tions, such as 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. The association is conducting research which will tend toward standardization of certain details of paving mixture design, this work being done in cooperation with the Association of Asphalt Paving Technologists. 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 Association, J. S. Bryant, secretary, 285 Madison Avenue, New York, N. Y. Although the association has formulated no specifications, members of the association 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 association, by official unanimous resolution, have signified their willingness to supply asphalt and roofing materials complying with Federal Government master specifications.

The Associated Cooperage Industries of America, C. G. Hirt, secretary and manager, 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 regarding 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. Whenever called upon to do so, the executive committee investigates any complaint filed by members for violation of its code of ethics or unfair dealing and takes such action thereon as the circumstances may require. The traffic department, an important activity 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. The association also maintains an arbitration service for the purpose of rendering an impartial decision on any matters in controversy between members submitted to arbitration by them in accordance with the arbitration code.

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 rules of procedure of the American Engineering Standards Committee. This group is represented on 10 additional sectional committees functioning under A. E. S. C. procedure.

Associated General Contractors of America (Inc.), R. C. Marshall, jr., 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 Engineering Standards Committee, Federal Specifications Board, Department of Commerce, and the Joint Conference on Construction Practices. Its work of standardizing concrete mixers has been completed through agreement between the association and all mixer manufacturers of the country producing any considerable quantity of construction machines. The machines standardized 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 Department of Commerce pertaining to construction materials. In conjunction with the engineering and architectural societies, operating through what is known as the joint conference on standard construction contracts, two standard documents have been developed, one for building construction, known as the standard document of the American Institute of Architects, and one for private engineering work, which is now issued by the joint conference. Independent of this work, a standard form of municipal contract has been developed jointly with the American Society for Municipal Improve-

ments. In addition to the actual contracts themselves, a standard form of proposal has been developed for private building work. Standard methods of computing equipment rentals have been adopted, and a standard form of rental agreement used by contractors as either lessor or lessee is now in effect. The association is working in cooperation with the Bureau of Internal Revenue to establish standard methods of handling depreciation on construction equipment. Tentative recommendations have been formulated and adoption of the standards 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 standard sizes for various kinds of underwear. Work is now being done on the development of instructions for washing knit rayon underwear, and the simplification in sizes of fiber shipping containers. The association has organized a committee to cooperate with the Federal Specifications Board in the preparation of knit underwear specifications. 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 and knowingly abused. The association tentatively adopted certain symbols for designating different models of knit underwear and methods of measuring all kinds of underwear. It is making an investigation of the effect of twist in cotton yarn upon shrinkage of knitted fabrics made of this yarn, and an effort is being made to eliminate unnecessary sizes of boxes used in packing underwear.

Associated Metal Lath Manufacturers, Wharton Clay, commissioner, 123 West Madison Street, Chicago, Ill. Standardization activities of the association have been confined largely to the elimination of excess varieties and sizes of metal lath through the division of simplified practice of the United States Department of Commerce. The association is cooperating in the activities of the American Concrete Institute, American Construction Council, American Society for Testing Materials, National Federation of Construction Industries, and National Fire Protection Association. It is represented on two sectional committees functioning under the procedure of the American Engineering Standards Committee. It is also cooperating with the Department of Commerce building code committee, the Pacific Coast Building Officials Conference, and the Florida Building Officials Conference on the compilation of a uniform building code, and 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 many other 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. This association has also standardized a set of specifications for the installation of tiles which have been published under the title "Basic Specifications for Tiles and Tilework."

The 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 practical housewives. 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. The organization was officially represented on the advisory board which cooperated with the United States Department of Commerce in the preparation of the National Directory of Commodity Specifications.

Association of American Soap and Glycerine Producers (Inc.), Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. The only 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 Engineering Standards Committee, and has cooperated with these and other national standardizing bodies, including the American Railway Association and the American Society of Mechanical Engineers' boiler code committee, in promoting standard specifications. It is represented on three sectional committees functioning under A. E. S. C. procedure.

Association of American Wood Pulp Importers, Hans Lagerloef, president, 52 Vanderbilt 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 on approved pulp testing chemists for the paper industry of the United States, which has formulated rules for the weighing, sampling, and testing of wood pulp. The association is endeavoring to secure a uniform selling contract for wood pulp imported from Finland, Germany, Norway, and Sweden. A panel of six members have been picked from the association by the American Arbitration Association, to be drawn from in case of disputes.

Association of Asphalt Paving Technologists, Charles A. Mullen, secretary-treasurer, 84 Saint Antoine Street, Montreal, Canada. This organization, which is international in scope, has committees on present practice, research problems, subgrade problems, and professional practice. No final reports or recommendations for definite standards have as yet been formulated.

Association of Dairy, Food, and Drug Officials of the United States, W. G. Geagley, secretary, Lansing, Mich. This organization is referred to by the short title "The Association of Food Officials." Its membership 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. Through its officers and members, the association promotes and fosters the enactment and enforcement of uniform legislation and administrative procedure and encourages cooperation among Federal, State, county, and municipal officials. The association has made recommendations for definite standards for dairy, food, and drug products which may serve as guides for legislative action; proposals for sanitation in the production, manufacture, and distribution and sale of food and drug products.

Association of Edison Illuminating Companies, Preston S. Millar, secretary, Eightieth Street and East End Avenue, New York, N. Y. While promotion of the work of standardization is not one of the primary functions for which this association was originated, never-

theless it is joint sponsor for two sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, 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. As a member of the electric light and power group, it is sponsor for the sectional committee on miscellaneous line materials. It is represented on 20 additional sectional committees functioning under the A. E. S. C. procedure.

Association of Electragists, International, Laurence W. Davis, general manager, 15 West Thirty-seventh Street, New York, N. Y. The association has organized a committee on electragists standards for wiring installations. This committee, in conjunction with the technical staff of the association, has drawn up a complete outline for the proposed standards and has published a preliminary draft of three sections. The association 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 rules of procedure of the American Engineering Standards Committee. It is represented on three additional committees functioning under A. E. S. C. procedure.

Association of Feed Control Officials of the United States, L. E. Bopst, secretary, College Park, Md. One of the important activities of this organization is the formulation of standards and the adoption of definitions for feeding stuffs. It has formulated 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. The association is composed of the officials of the departments of labor and industry of the various States and Provinces. Its standardization activities have been confined largely to the formulation and promulgation of industrial safety codes. By formal resolution the president was authorized to appoint a committee on uniform safety laws in order to facilitate the adoption of

uniform safety codes in the States. It has organized a standing committee on uniform statistical nomenclature, 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 Engineering Standards Committee. The association is joint sponsor, with the Laundryowners National Association and the National Association of Mutual Casualty Companies, for the sectional committee on safety code for laundries functioning under A. E. S. C. procedure. It is represented on 13 additional safety-code sectional committees.

Association of Iron and Steel Electrical Engineers, John F. Kelly, business manager, Empire Building, Pittsburgh, Pa. Standardization of equipment and operating practices pertaining to the electrical operation of steel mills is the major activity of this association. It 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 general purpose 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. During the coming year an attempt will be made to standardize on antifriction bearing ratings and dimensions for large mill bearings. The safety committee of the association will develop rules for the installation and safe handling of high-tension switches and transmission lines. Another committee will investigate the requirements for sizes and grades of brushes now being furnished with electrical equipment.

Association of Manufacturers of Chilled Car Wheels, G. E. Doke, president, 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 car wheels. It furnishes standard samples of car-wheel iron for laboratory use and maintains completely equipped chemical, physical, and micro research laboratories. It has a standing committee in connection with the specifications for the foundry standard, chilled car wheel, and a committee covering chilled wheel design development.

The Association of Official Agricultural Chemists, W. W. Skinner, secretary, P. O. Box 290, Pennsylvania Avenue Station, Washington,

D. C. Representatives of this association serve with members of the American Association of Dairy, Food, and Drug Officials and of the United States Department of Agriculture on a 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 in the revision of the 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 and is officially represented on the sectional committee on electrical safety code functioning under A. E. S. C. procedure.

Better Bedding Alliance of America, S. J. Mills, secretary, 440 South Dearborn Street, Chicago, Ill. Among the stated objects of this association is the encouragement of proper labeling of bedding and the discouragement of any practice of deception. Its committee on publicity has been engaged actively in conducting educational publicity to show the public what to buy in mattresses. 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 mattresses and pillow filling materials into two groups, under the headings of "new materials" and "previously used materials."

Building Officials' Conference, H. E. Plummer, president, City Hall, Portland, Oreg.; Fred W. Lumis, secretary, Building Commission, City Hall, Springfield, Mass. The interest of this organization in standardization is in connection with materials used in building construction, devices and appliances used in connection with building operations, and matters of workmanship or manufacture, and building requirements or regulations in general. It has been active in connection with the standardization of requirements for lime, stucco, and hollow and solid building units. In 1926 reports were prepared on

wallboard and on steel joists. Plans are now being 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 standards for the industry on standard substance number bases for paper for envelopes, standard nomenclature and sizes of envelopes, and standard tolerances for overruns and underruns on customers' orders. It has organized a standing committee on standardization which is attempting to obtain greater standardization of envelope sizes and styles, reduction in number of standard sizes and styles, and simplification of nomenclature.

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. Specifications for such containers are published by the bureau in accordance with the regulations of the commission. 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.

California Redwood Association, R. F. Hammatt, secretary-manager, 24 California Street, San Francisco, Calif. Standardization 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.

Canners League of California, Preston McKinney, vice president and secretary, 112 Market Street, San Francisco, Calif. Fruit and vegetable standards formulated by committees of this organization appointed by its board of directors have been widely adopted. Its standard contract for canned goods has been formally approved by the National Wholesale Grocers Association. Working in cooperation with growers' associations and the California Development Association, the league has secured the passage of a law which requires that all canned peaches, pears, apricots, and cherries of a grade below standards be marked with the word "seconds," embossed in the top of the can. Working in conjunction with the California State Board of Health, it has secured the passage of the canned vegetable inspection act, which provides protection to the entire industry against the processing of vegetables susceptible to botulinus in a manner which is not safe. The league has adopted buying sizes for

cherries and plums. It cooperated with the California Canning Peach Growers in further improving the terms of buying contracts, both as to size of fruit and method of receiving. It has formulated specifications for canned fruits, and issued a booklet containing not alone standards, but digest of the "seconds" law, pro rata delivery rules, etc. A new edition of this booklet, now in course of preparation, will include new standards for pie fruit and fruits for salad. The preserving section of the league has adopted specifications and instructions to inspectors on strawberries; and approved standards on fresh fruit preserves and jelly. Its future work will consist of standardization of canned tomatoes, fruit in cans smaller than those designated in the specifications booklet, standardization of hydrometers used in its plants, and standardization of the nomenclature of tin cans used in the industry.

Cast Iron Pipe Research Association, A. M. Campbell, chairman, care of Glamorgan Pipe & Foundry Co., Lynchburg, Va. 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 Engineering Standards Committee; 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; the maintenance of a research associate on soil corrosion and electrolysis at the National Bureau of Standards; the dissemination of information regarding the construction of water works and promotional literature regarding the same where requested by civic bodies.

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, Department of Manufacture, E. W. McCullough, manager, Washington, D. C. During the seven 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 over 750,000 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 seven 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. It 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. Through its department of manufacture, the chamber of commerce has in many cases cooperated with the division of simplified practice in the formulation of simplified practice recommendations. It is officially represented on the planning committee acting in an advisory capacity to the division of simplified practice, and on the advisory board which cooperated with the United States Department of Commerce in the preparation of the National Directory of Commodity Specifications. The organization is officially represented on two sectional committees functioning under the rules of procedure of the American Engineering Standards Committee.

Clay Products Association, George C. D. Lenth, secretary, Chamber of Commerce Building, Chicago, Ill. This association is made up of manufacturers of vitrified salt glazed clay sewer pipe, drain tile, wall coping, segmental block, and flue lining. The association maintains a fellowship at Mellon Institute of Industrial Research, where studies are being made on the processes of the manufacturing of the above articles, as well as improvements in manufacturing. The association has several committees, among which is the committee on standardization, which 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 drain tile. The association maintains a staff of engineers for the purpose of promoting its commodities and for the education of engineers and users of their products.

Coal Mining Institute of America, H. D. Mason, jr., secretary, Edensburg, Pa. This organization takes an active part in the mining standardization work going forward under the auspices of the American Engineering Standards Committee. 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. It is officially represented on 10 sectional committees functioning, under A. E. S. C. procedure.

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 Association of Medical Museums, American Association of Pathologists and Bacteriologists, and the American Society of Zoologists. It has formulated 42 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. This association has prepared a standard section on "building code requirements for brick masonry" which has been submitted for the approval of a committee of disinterested experts, and which will, after approval, be available for use in any building code. The technical staff of the association assisted in formulating the new tentative A. S. T. M. building brick specification.

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 Engineering Standards Committee. With the American Gas Association and the International Acetylene Association it forms the gas group of the A. E. S. C. It is officially represented on the sectional committees on identification of piping systems and safety codes for gas, mechanical refrigeration, high-pressure piping, and compressed air machinery, functioning under A. E. S. C. procedure. The association also cooperates with the Bureau of Explosives in assisting the Interstate Commerce Commission in the preparation of specifications covering gas trans-

portation 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 the name of the gas contained therein.

Concrete Products Association, Austin Crabbs, secretary, Box 343, Davenport, Iowa. Although this association has not formulated any standards or specifications, it has devised ways and means for insuring that its members manufacture products to meet the requirements of certain nationally recognized specifications, such as those of the American Concrete Institute and the American Society for Testing Materials. The 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. The institute was organized to carry on research work and to standardize materials used in reinforced concrete construction. It 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 composite building code for reinforced concrete construction, and has published a handbook for architects and engineers. It has five committees on the following subjects: Grade 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, Chicago Union Station, Chicago, Ill. This committee is composed of the chairmen 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 many specifications for freight shipping containers.

Converters' Association, Samuel M. Fisher, secretary, 291 Broadway, New York, N. Y. The committees of the association are appointed by the president after authority is obtained either from the whole membership or the board of directors. 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.

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 industrial units are represented on committees of the American Society for Testing Materials and are governed by specifications adopted by that society. The association is officially represented on six sectional committees functioning under the rules of procedure of the American Engineering

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Standards Committee. It maintains two research associates at the National Bureau of Standards doing research work on the investigation of safe loading of corrugated copper roofing, etc.

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, and java ply and yarn goods. These standards are now in the process of being reviewed and expanded, the work being done with the cooperation of the division of simplified practice. A committee of the institute is working with the American Petroleum Institute in preparing standards of cordage use in oil-well production.

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.

Drill and Reamer Society, The, Herbert S. Blake, secretary, 74 Trinity Place, New York, N. Y. The standing committee on simplification and standardization is actively engaged in the task of eliminating from catalogue lists, sizes and styles of drills and reamers which the trade no longer demands, and is establishing proper standard basic mechanical sizes of these tools to be listed in revised catalogues.

Eastern Clay Products Association, Henry T. Shelley, secretary, Colonial Trust Building, Philadelphia, Pa. Among the committees appointed by the president to deal with standardization matters are: The standards committee and the Mellon Institute Committee. The association has published the following pamphlets: Standards of manufacture of salt-glazed vitrified sewer pipe and fittings, fire clay flue lining and fittings, stovepipe and fittings, and wall coping and fittings; comparative tests between salt-glazed vitrified sewer pipe and machine-made concrete pipe; handbook for plumbers on house sewers and house drains; 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.

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 conduct research involved in solving certain manufacturing problems. Although its standardization activities have been somewhat restricted, those connected with the group participate in the work of various committees doing standardization work relating to steel castings and to refractories used in steel-casting manufacture.

Elevator Manufacturers Association of the United States, John W. Ogren, commissioner, Conway Building, 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 Engineering Standards Committee, and it assists in maintaining a research associate at the National Bureau of Standards, operating for the sectional committee on elevators, functioning under A. E. S. C. procedure. It maintains a permanent committee for standardizing elevator engineering, and a permanent committee for the standardization of manufacturing procedure.

Glass Container Association, I. G. Jennings, business manager, 22 East Seventy-fifth Street, New York, N. Y. This association has a standardization committee, appointed annually, which sets up standards for the various types of caps and closures for glass containers in cooperation with the manufacturers and the users. It has adopted 23 standard specifications. Its future work will consist in cleaning up on the few remaining types of closures being manufactured and reviewing the standards that have been set up from time to time to make them conform with present-day operations. The association maintains its own research laboratories, investigating processing in glass containers and problems encountered in packing various products in glass.

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 were 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. 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 the glycerin. Specifications for

crude glycerin are to be considered later. Another committee appointed by the board of directors is the radiator glycerin merchandising committee, which, in seeking to develop the best merchandising policies and practices in the marketing of radiator glycerin by member companies, has established standard sizes of containers and standard forms of sales contracts.

Grain Dealers National Association, Charles Quinn, secretary, Toledo, Ohio. The standard grades of grain advocated by the association 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.

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 Commissions for the sectional committee on safety code for the use, care, and protection of abrasive wheels, functioning under A. E. S. C. procedure.

The Gypsum Industries, H. J. Schweim, chief engineer, 844 Rush Street, Chicago, Ill. This organization 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 C–11 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. It is represented on the A. E. S. C. sectional committee on specifications for fire tests of materials and construction, and the National Fire Protection Association committee on building construction.

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 has adopted the American standard designs and sizes of moldings prepared under the auspices of the American Institute of Architects, Central Committee on Lumber Standards, and the United States Department of Commerce.

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. 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. Three committees appointed by the president carry on the work of standardization for the association, namely, a standing committee on standardization, a special boiler output committee, and a special committee on certified heating. Through conferences with boiler manufacturers the special boiler output committee has developed a standard method for determining the output of boilers, and is engaged in compiling data to permit the selection of the proper boiler for any chosen installation. During the past year 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.

Hickory Handle Association, Guy E. Basye, secretary, care of W. E. Bruner & Sons, Heber Springs, Ark. This association has adopted grades for hickory tool handles. Its cooperative work with other organizations is carried out under the auspices of the National Association of Wood Turners (Inc.).

The Hollow Building Tile Association, J. S. Sleeper, secretary, Conway Building, Chicago, Ill. For more than eight years this association has been engaged in standardization and simplification work on hollow building tiles. In cooperation with the National Bureau of Standards it has conducted research 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 recently completed research work on the fire resistance of hollow-tile walls, acoustics of hollow-tile walls, and adhesion of plasters to hollow-tile backings. The association has arranged with testing laboratories throughout the country to make tests on hollow building tile in accordance with the standard method of testing recommended by the National Bureau of Standards. The

association 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. It is officially represented on the sectional committee on specifications for fire tests of materials and construction, functioning under the procedure of the American Engineering Standards Committee.

Hollow Metal Door and Trim Manufacturers' Association, Charles F. Burt, secretary, Union Trust Building, Cleveland, Ohio. The current activities of the association along standardization lines embrace two projects for dimensional standardization and two for standardization of procedure. Standardization of cylinder locks for hollow metal doors has been worked out 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. The association has also worked out complete standardization of the hollow metal swing door and complete specifications for all forms of hollow metal products, but these have not yet been formally approved.

Horological Institute of America (Inc.), Paul Moore, secretary, care of National Research Council, Washington, D. C. Among the stated objects of the institute, which was organized by the National Research 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. The institute maintains a research associate at the National Bureau of Standards doing research work on the certification of watchmakers.

Hydraulic Society, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. This society is a trade association representing the principal manufacturers of displacement and centrifugal pumps in the United States. It cooperates with the United States Department of Commerce, the Chamber of Commerce of the United States, the American Society of Mechanical Engineers, the American Mining Congress, the National Fire Protection Association, trade associations of other industries, and all other 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, L. H. Graves, general secretary, 29 West Thirty-ninth Street, New York, N. Y. The standardization work of the society is carried on by four committees which have been placed on a representative basis with members nominated by and officially representing various other organizations and now function as sectional committees under the rules of procedure of the American Engineering Standards Committee, 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 society is also joint sponsor (with the Association of Edison Illuminating Companies) for specifications for residence lighting luminaries. It is represented on five additional sectional committees functioning under A. E. S. C. procedure.

Institute of American Meat Packers, W. W. Woods, executive vice president, 509 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. The institute conducts a central research laboratory which is supported by the member companies. Its department of scientific research is now engaged in problems concerning, among other subjects, the curing and conservation of meats and specifica-

tions for brushes used in packing-house work. 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 as well as specifications for their purchase, including all the latest United States Government master specifications for paint and varnish materials. The institute is closely affiliated with 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. Standardization represents an important part of the activities of the institute which has formulated, adopted, and promulgated standard definitions of terms and standard graphical symbols used in radio engineering. The institute's committee on standardization is undertaking the formulation of standard methods of testing radio apparatus in order to determine the important characteristics of such devices, particularly those used in radiobroadcast 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, and is officially represented on five additional sectional committees organized according to the procedure of the American Engineering Standards Committee. 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 acetylene 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, the American Gas Association, and the Compressed Gas Manufacturers' Association form the gas group of the American Engineering Standards Committee. It is officially represented on sectional committees on identification of piping systems, rating of rivers, safety code for

mechanical refrigeration, and colors for traffic signals, functioning under A. E. S. C. procedure.

International Apple Shippers' Association, R. G. Phillips, secretary, 1108 Mercantile Building, Rochester, N. Y. This association has for many years taken a very active part in standardization matters relating to fresh fruits and vegetables. 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 New York State apple grading law enacted in 1915, and other pioneer measures relating to standaridzation of fruits and vegetables. It has given publicity in special pamphlet form to the important laws of the State and Federal Government relating to grades, marks, packing, packages, and standards of fruit and vegetables, and to the Federal food and drugs act.

International Association of Electrotypers of America, H. G. Guiteras, field secretary, Leader Building, Cleveland, Ohio. Two of the main activities of this association lead directly to standardization. One is formulating for the industry a uniform method of determining the cost of producing electrotypes, and the other is conducting research work to establish the best methods of making electrotypes. The association maintains a research associate at the National Bureau of Standards doing research work on electrotyping problems.

International Association of Industrial Accident Boards and Commissions, Ethelbert Stewart, secretary, Bureau of Labor Statistics, Washington, D. C. Standardization in the safety-code field represents an important part of the activities of this association. It is joint sponsor for five sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Safety code for the use, care, and protection of 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 of Mechanical Engineers and the National Bureau of Casualty and Surety Underwriters); safety code for rubber machinery (with the National Safety Council); safety code for woodworking 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 standardization of industrial accident statistics. It is represented on 27 additional sectional committees functioning under A. E. S. C. procedure.

International Association of Milk Dealers, R. E. Little, executive secretary, 139 North Clark 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 National 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, and is now engaged in the work of revising the simplified practice recommendation for milk and cream bottles with a view to securing a further reduction in types and looking toward a standard bottle in each of the respective heights.

Interstate Cotton Seed Crushers' Association (Inc.), George H. Bennett, secretary-treasurer, 914 Santa Fe Building, Dallas, Tex. The association has adopted definitions of grade and quality of cottonseed, cottonseed oil, peanut, soya-bean and coconut 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 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 referee chemists certified by the American Oil Chemists Society.

Laundryowners National Association of the United States and Canada, W. E. Fitch, general manager, Drawer 202, La Salle, Ill. The association has published a manual of standard practice for the power laundry washroom, the development of which is attributable

to the fellowship of three textile experts maintained by the association at the Mellon Institute for Industrial Research. There has also been published a book entitled "Textile Fabrics—The Selection and Care from the Standpoint of Use, Wear, and Launderability," which is of vital interest to the manufacturer, converter, launderer, and user of textile fabrics, and also to teachers of home economics, and women's club-study groups. In its research work the association has received the cooperation of the Converters Association of New York, the Lowell Textile School, the National Association of Dyers and Cleaners, the National Association of Finishers of Cotton Fabrics, and the National Bureau of Standards. 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. In the American Institute of Laundering (Inc.), maintained by the association at Joliet, Ill., practical applications are made of research findings developed at the Mellon Institute and by the departments of engineering and cost accounting. 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 laundries, functioning under the rules of procedure of the American Engineering Standards Committee.

Leather Belting Exchange, Louis W. Arny, secretary, 119 South Fourth Street, Philadelphia, Pa. This association 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 the exchange. It maintains a research laboratory at Cornell University to develop better methods for manufacturing leather belting.

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; standard practice of marking patterns; and a standard accounting and cost system. 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. The institute 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 production 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 requirements of 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 product has met the requirements of the specifications.

Manufacturers Standardization Society of the Valve and Fittings Industry, Albert C. Taylor, general secretary, 103 Park Avenue, New York, N. Y. This society was organized for the purpose of formulating and promulgating standards, standard practices, and specifications satisfactory to the valve and fittings industry, and to serve as the medium of contact for its members with other bodies, including Federal and municipal departments, in matters involving development of standards, specifications and simplification programs affecting the use of products of the industry. The society 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 A. E. S. C. 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, Woodward Building, Fifteenth and H Streets NW., Washington, D. C. For more than 50 years this association has been active in the movement for standardization of practice and equipment in the chemical industry. It has adopted standard tables for aqua ammonia, hydrochloric acid, nitric acid, sulphuric acid, and zinc chloride. After many years' cooperation with the Bureau of Explosives and the tank-car committee of the American Railway Association a practical working arrangement has been effected with both organizations whereby proposals for changes and improvements in shipping containers are given concurrent consideration, with the result that agreement is almost uniformly reached and united support is behind a proposal when finally submitted to the Interstate Commerce Commission. Its standing committees have

completed or are now at work on specifications for carboys, steel drums and tank cars, laboratory apparatus, 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, 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.

Mine Inspectors Institute of America, C. A. McDowell, secretary, P. O. Box 64, Pittsburgh, Pa.; William Boncer, president, mine inspector, Richmond, Va. 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. It is serving as sponsor for a sectional committee on safety code for mine explosives and is represented on 11 additional sectional committees, functioning under A. E. S. C. procedure, dealing with both coal and metal mining equipment and the safe operation thereof.

Motor Vehicle Conference Committee, Russell Huffman, secretary, 366 Madison Avenue at Forty-sixth Street, New York, N. Y. This committee was organized in 1919 and is a deliberative committee representing the following organizations nationally 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. It functions through a board composed of one representative from each member organization. The chief aim of the committee is to encourage equitable legislation pertaining to the motor vehicle and its operation, and to bring about

uniformity of such legislation in all of the States, by research, education, cooperation and the dissemination of important facts of interest to the public at large. It is cooperating 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 A. E. S. C. 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 through its representation on the central committee on lumber standards and on subcommittees appointed to consider specific matters for recommendation to the central committee.

National Association of Building Owners and Managers, Lewis B. Ermeling, executive secretary, 134 South La Salle Street, Chicago, Ill. Work of this association having a bearing on standardization is carried on by its research committee and its committee on purchasing. The chairman of each committee is appointed by the officers of the national association and each of the 37 affiliated associations appoints representatives to serve on the two committees. During the past year the research committee has made investigations of corrosion in piping systems in service, and of hot water heating costs. The committee on purchasing has made an analysis of the results obtained by the affiliated associations from collective buying of staple commodities.

National Association of Cotton Manufacturers, Russell T. Fisher, secretary, 80 Federal Street, Boston, Mass. (*See* National Council of American Cotton Manufacturers.)

National Association of Dyers and Cleaners of the United States and Canada, Ivan M. Tull, general manager, 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 will be published in January, 1928. During 1927, publication 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 sent to press in 1927. The association is maintaining a research associate at the National Bureau of Standards engaged in developing a method for the removal of tannin stains. For the expansion of its research activities it has established its own laboratories to provide

facilities for research work into the fundamental problems for the dyers and cleaners industry and to serve as a school for instruction whereby the standard practices developed by research can be taught to the trade. 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. One of the chief functions of this organization is the work of simplification and standardization of farm machinery and equipment carried on by its nine trade departments, each operating under its own by-laws and having its own officers. The plow and tillage implement division issued a book of standards in May, 1926 (with addenda showing agreed modifications since that date), summarizing the eliminations made by that branch of the industry since 1914. The committee on wood materials conservation of the farm wagon department has compiled and 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. Among the special committees of the association is an advisory council to the research department and a contact committee with the American Society of Agricultural Engineers. At the association's request, the division of simplified practice of the Department of Commerce, called a conference of manufacturers of bolts and nuts for farm equipment. The result of this conference was the adoption of a certain limited number of sizes and types of bolts and nuts which are contained in a simplified practice recommendation for plow bolts.

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 is composed of one representative from each member firm. The division 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 form 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 women's, men's, children's, infants', ¾ and ⅞ children's 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, and standard percentage of moisture and regain for combed and carded cotton yarns for hosiery and underwear. The research associate has completed over 2,500 research problems relating to the daily problems in manufacturing hosiery and underwear. The association is now inaugurating research work on standardization of lubricant for knitting and all other machinery used in the manufacture of hosiery and underwear, and standard lengths for ⅝ and children's golf hosiery.

National Association of Ice Cream Manufacturers, Fred Rasmussen, executive secretary, Telegraph Building, Harrisburg, Pa. Standardization work of this association is carried on by the committee on standardization of equipment representative of the dairy products and ice-cream industries. It is formulating standards for 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.

National Association of Manufacturers of Heating and Cooking Appliances, Allen W. Williams, secretary, Columbus, Ohio. This association is interested in standardization from the point of view of simplification and safety. It has organized 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 marble work, on a similar basis as applies to governmental work. In 1927 the association compiled standard specifications covering the erection of interior marble work. In addition to its standard specifications, the association has issued a publication entitled "Maintenance of Interior Marble."

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. Its standardiza-

tion committee has prepared symbols for use on plumbing drawings which have been adopted by the association. Steps are being taken to have these symbols recognized as American standard.

National Association of Mutual Casualty Companies, J. M. Eaton, secretary, 730 Fifth Avenue, New York, N. Y. 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 is joint sponsor for the sectional committee on safety code for laundries (with the Association of Governmental Labor Officials of the United States and Canada and the Laundry-owners National Association), and is represented on 23 additional sectional committees functioning under A. E. S. C. 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 Engineering Standards Committee, 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 office equipment cooperates with the Department of Commerce and various associations in simplifying and improving conditions surrounding the purchase of office equipment. 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 represented on the following committees of the United States Department of Commerce through which most of its work on standardization and simplification is done: The division of simplified practice planning committee, national committee on metals utilization, national committee on wood utilization, committee on simplification of desk sizes, consulting committee on lumber standards, and the committee on simplification of paint and varnish brushes. The association is represented on four sectional committees functioning under the rules of procedure of the A. E. S. C. It was officially represented on the advisory board which cooperated with the United States Department of Commerce in the preparation of the National Directory of Commodity Specifications.

The National Association of Railroad Tie Producers, E. A. Morse, secretary, 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 Engineering Standards Committee. It has authorized its president to appoint a committee to prepare and submit supplemental specifications covering crossties under 6 inches in thickness or that have been rejected because of defects described in specifications now in effect. This committee, which is now at work, will report its findings at the annual meeting in April, 1928.

National Association of Sheet and Tin Plate Manufacturers, Walter W. Lower, secretary-treasurer, Oliver Building, Pittsburgh, Pa. This organization was one of the first to formulate specifications for steel scrap. It has also prepared a list of sheet mill tolerances containing permissible variations in the furnishing of sheet steel. Valuable assistance was rendered by this association in the compilation of material for the division of simplified practice recommendation for sheet steel. Work is going forward on the standardization of depreciation for the sheet-steel industry in cooperation with the United States Treasury Department.

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. 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 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 book cases, 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, C. M. Haskins, secretary, Times Building, New York, N. Y. This association has been a pioneer in establishing 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.

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 associations, 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.

National Association of Wooden Box Manufacturers, Paul L. Grady, secretary, 844 Rush Street, Chicago, Ill. The association has compiled and issued a technical sheet which deals with the proper construction of boxes, known as the "Nailing schedule." In its book entitled "Wooden Box and Crate Construction," containing detailed information relating to the use of wood in box and crate construction, box design, crate design, box and crate testing, and structure and identification of woods, is a chapter devoted to box and crate specifications. It has cooperated with the United States Department of Commerce in publishing pamphlets on the use of wooden boxes and nailed wooden crates for the shipment of merchandise for domestic and foreign commerce. It 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. To the latter committee have been added representatives of the committee on production established immediately after a general conference of wool maufacturers held in June, 1927.

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. Recommendations of this organization are submitted to the joint committee before final adoption as the association's standards.

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 (Inc.), and the American Petroleum Institute in the development of most suitable specifications for motor fuels. It is officially represented on the sectional committees on colors for traffic signals and safety code for automobile brakes and brake testing, functioning under the rules of procedure of the American Engineering Standards Committee.

National Board of Fire Underwriters, W. E. Mallalieu, general manager, 85 John Street, New York, N. Y. Practically all of the existing regulations of the board have been recommended by the National Fire Protection Association, and were prepared by the various technical committees of that association, the membership of which committees includes in all cases a representative from the engineering department of the board. Special consideration has been given recently to specifications for the construction of automobile tank trucks, regulations on signaling installations, oil-storage rooms and buildings, pyroxylin finishes, fusion gas welding, the use of compressed gases for lighting, heating, and cooking, and dry-cleaning establishments; municipal fire-alarm systems; dust explosions in starch factories; gasoline vapor-gas machines; lamps, and systems; gravity and pressure tanks; foam-extinguishing systems; dip tanks; spraying operations; rotary and centrifugal fire pumps. In the standardization of fire-hose couplings the board has been very active, and to date in about 2,300 cities and towns standard couplings are used. The regulations of the board for the installation of hazardous and protective devices have been issued in 46 pamphlets. 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. Its future standardization work will consist in revising existing regulations to keep them up to date. The board is joint sponsor for two sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, 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). The board is represented on four additional sectional committees functioning under A. E. S. C. procedure. 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. The machinery and equipment of the boot-and-shoe industry is standardized probably to a greater extent than any other industry in this country, due largely to the fact that the majority of machines used are manufactured by one large machinery company and leased to the factories for a term of years. 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 Engineering Standards Committee, 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). The bureau is represented on 37 additional sectional committees functioning under A. E. S. C. procedure. The other work of the bureau has to do with standardization in a still more general sense, particularly the standardization of rating methods and practice for the various forms of casualty insurance.

National Canners Association, Frank E. Gorrell, secretary, 1739 H Street NW., Washington, D. C. Standardization committees appointed by this association are working in cooperation with the joint committee on definitions and standards of the United States Department of Agriculture on standard grades of various food products. 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. The association has developed a classification of accounts for members of the canning industry. Special attention is being given by the association to proper trade terms in connection with 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. Its tin-plate investigations are conducted in collaboration with manufacturers of steel, tin plates, and cans. It cooperates with Federal and State officials in the enforcement of uniform regulations pertaining to proper and intelligent labeling.

National Cinder Concrete Products Association, W. S. Giddings, secretary, Philadelphia, Pa. This association has a research committee authorized to carry on experiments to develop improved manufacturing methods, which has completed experiments regarding the following: Time of mixing concrete, grading of aggregate, and compression of material into forms. Experiments are now being made on screening and proportioning cinder aggregate, on pressure applied to material in the mold, and on water-cement ratio. No definite standards or specifications have as yet been adopted.

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 under the supervision of the Mining Standardization Correlating Committee. The association is officially represented on 13 sectional committees functioning under the procedure of the American Engineering Standards Committee.

National Committee on Metals Utilization, United States Department of Commerce Building, Washington, D. C. This committee was organized in 1926 for the purposes of carrying the principles of simplified practice more deeply into the metals-using field, to awaken a nation-wide interest in the need for eliminating industrial waste and to stimulate mass action in applying corrective measures. Its work has been closely coordinated with that of the division of simplified practice. During 1927 the committee assisted in the promulgation of the following recommendations issued by the division of simplified practice: Steel reinforcing spirals; wrought iron and wrought steel pipe, valves, and fittings; packing of bolts and nuts; metal spools and reels; spark plugs, piston-ring oversizes, brake linings; taper roller bearings; flash-light cases; solid section steel sash; and one-piece porcelain insulators. In the field of specifications the committee also cooperated with the division of simplified practice in the issuance of the recommendations covering classification of iron and steel scrap and the grading of new billet steel for concrete reinforcement.

National Committee on Wood Utilization, Axel H. Oxholm, director, United States Department of Commerce Building, Washington, D. C. This committee was organized at the direction of the President of the United States in 1925 for the purpose of furthering a closer utilization of wood and for better manufacturing, distributing, and wood-using practices. The aim of the committee is to make reforestation commercially feasible through increased utilization of the raw material. The committee is composed of 133 members representing various branches of the wood industry and trade. The following organizations are officially represented on the committee: The American Association of State Highway Officials, American Institute of Architects, American Institute of Mining and Metallurgical Engineers, American Paper and Pulp Association, American Railway Association, American Society of Agricultural Engineers, American Society of Civil Engineers, American Wood-Preservers' Association, Associated General Contractors of America, Building Officials' Conference, Chamber of Commerce of the United States of America, Columbia River Loggers Information Bureau, Council of American Shipbuilders, Dimension Lumber Manufacturers Association, Furniture Manufacturers Association of Grand Rapids, Longleaf Yellow Pine Manufacturers Association, Millwork Cost Bureau, National American Wholesale Lumber Association, National

Association of Builders' Exchanges, National Association of Purchasing Agents, National Association of Railway Tie Producers, National Association of Real Estate Boards, National Association of Wood Turners, National Automobile Chamber of Commerce, National Grange, National Lumber Manufacturers' Association and its affiliated regional and species associations, National Piano Technicians Association, National Retail Lumber Dealers Association, National Wood Chemical Association, National Association of Wooden Box Manufacturers, New Hampshire Lumbermen's Association, Paperboard Industries Association, Pine Institute of America, Plywood Manufacturers Association, United States League of Local Building and Loan Associations, and the West Coast Lumber Trade Extension Bureau. The committee has prepared a report on the marketing of short lengths less than 8 feet in buildi g and construction. This project is now being extended to industrial uses for short lengths. Another bulletin, on the end-matching of softwood lumber, has been prepared and distributed. This end-matching process facilitates the use of short lengths and effects an appreciable saving in the use of raw material. Work has been started in educating the consumers to the economy involved in the use of small dimension stock cut to exact size as needed by industry. Another bulletin, on the grade marking of lumber, has been distributed in more than 200,000 copies. The committee encourages the placing of grade designation on each piece of lumber produced, so as to insure that proper grades are used for each purpose. A treatise on wood distillation is nearing completion. It embodies recognized practices in vogue in the United States and abroad. Other projects now in process of development are as follows: Proper seasoning, handling, and care of lumber (four bulletins); retail distribution of preserved lumber; manual of wood construction, outlining how wood can be used to best advantage in building and construction. The committee is also conducting a survey of nonutilized wood in the State of Virginia with a view to encouraging the establishment of by-products industries. It is planned to extend this survey to include other States at a later date. Tests in regard to special types of machinery for the purpose of converting top logs into well manufactured lumber have been carried on for some time with good results. The committee is also promoting the use of American lumber standards and standardization of plywood panels for industrial uses. Through exhibits it is demonstrating the use of properly designed containers with a view to decreasing the weight without impairing the usefulness of boxes and crates. In its efforts to put these recommendations into practice, the committee is cooperating with various Government agencies as well as with private consumers. In the development of its projects the committee cooperates with official and private agencies, notably

with 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 the association has been employing consulting chemists to analyze the products of its members and others for adulteration. During 1927 the executive committee of the association authorized the president to appoint a committee to formulate plans for standardization and research work.

National Council of American Cotton Manufacturers, Russell T. Fisher, joint secretary, 80 Federal Street, Boston, Mass.; W. McLaurine, joint secretary, Charlotte, N. C. This organization has established no standards or specifications. However, its constituent members, the American Cotton Manufacturers' Association and the National Association of Cotton Manufacturers, have organized a joint committee which receives proposed specifications from the Federal Specifications Board and distributes copies to manufacturers interested in the particular article covered thereby. After criticisms have been compiled, the specifications are revised in accordance with the majority opinion and submitted for the information of the Federal Specifications Board. This joint committee has prepared a form of contract sale note for staple gray goods, which has been approved and adopted by the two associations.

National Crushed Stone Association, A. T. Goldbeck, director, bureau of engineering; J. R. Boyd, secretary, Earle 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 Engineering Standards Committee and the National Safety Council. It has organized a committee on welfare and safety and one on standards. The last mentioned is composed of three subcommittees on standardization of drilling equipment, standardization of commercial sizes of crushed stone, and standardization of quarry tracks and cars.

National District Heating Association, D. L. Gaskill, executive secretary, 112 West Fourth Street, 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, N. L. Godfrey, secretary, Peoples Gas Building, 122 South Michigan Avenue, Chicago,

Ill. This organization, which includes manufacturers who were affiliated with the former Wholesale Sash and Door Association and a number of others who were not, is strictly a manufacturers' association. Although its standardization program has not yet been laid out, it is maintaining contact with standardization work relating not only to fabricated products, but also to raw materials, grades, moisture content, etc., carried on by the Central Committee on Lumber Standards.

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. The following committees of this association are working on standardization: Committee on standards and training for the elementary-school principalship, committee on educational nomenclature, committee on retirement allowance, committee on ethics of the teaching profession. The association has published a pamphlet on standards for accrediting teachers colleges. An 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. Although the association has no authority to compel the use of the book, it is being utilized voluntarily by school boards throughout the country, and serves to establish uniform standards for the schools.

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. 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 Engineering Standards Committee, as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations), rules for electricity meters (Code for Electricity Meters) (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 sponsor for a sectional committee on miscellaneous line materials, and is also represented on 37 additional sectional committees functioning under the A. E. S. C. procedure.

National Electrical Manufacturers Association, Alfred E. Waller, managing director, 420 Lexington Avenue, New York, N. Y. This association was formed by the merging of the Associated Manufacturers of Electrical Supplies, Electrical Manufacturers' Council, and the Electric Power Club, the first of which became the supply division and the last named the apparatus division. Conference committees have been established in cooperation with the American Institute of Electrical Engineers, Association of Iron and Steel Electrical Engineers, Association of Railroad 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 the following sectional committees functioning under the rules of procedure of the American Engineering Standards Committee: Standards for insulated wires and cables for other than telephone and telegraph uses (with nine other organizations); standards for switch boxes and outlet boxes (with the American Institute of Electrical Engineers), standards for power-line insulators for voltages exceeding 750 (with the American Institute of Electrical Engineers), standards for industrial control apparatus (with the American Institute of Electrical Engineers), standard terminal markings for electrical apparatus and standard mounting dimensions of electric motors (with American Society of Mechanical Engineers). The association is also represented on some 40 additional sectional committees functioning under A. E. S. C. procedure. 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, 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. The Handbook of Radio Standards

is published semiannually, and the supply and apparatus handbooks of standards annually.

National Federation of Construction Industries, W. S. Hays, secretary, Drexel Building, 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. Although it has not formally adopted any standards, it is officially represented on four sectional committees functioning under A. E. S. C. procedure.

National Fence Manufacturers Institute, C. M. Best, secretary, 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, Charles J. Brand, executive secretary, Investment Building, Washington, D. C. In its code of trade practices, the association pays particular attention to the economic desirability of reducing the number of grades of fertilizer. A committee of the association is actively engaged in making a study of fertilizer analyses with the view of eliminating the unnecessary multiplicity of grades.

National Fire Protection Association, Franklin H. Wentworth, secretary, 40 Central Street, Boston, Mass. In addition to individuals and State and municipal departments and bureaus, the membership of this organization consists of national institutes, societies, and associations interested in the protection of life and property against loss by fire. It is therefore largely an association of associations. Among the subjects upon which its technical committees 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 standardization

projects or sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Safety code for building exits, regulations for electric wiring and apparatus in relation to fire hazard (National Electrical Code, edition of 1925), 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 joint sponsor for specifications for fire tests of materials of construction and specifications for rubber-lined fire hose. The association is represented on 14 additional sectional committees functioning under A. E. S. C. procedure.

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 Engineering Standards Committee and is represented on two additional sectional committees under the auspices of the A. E. S. C.

National Hardware Association of the United States, George A. Fernley, secretary, 505 Arch Street, Philadelphia, Pa. This association has been active in the elimination of excess sizes and varieties of hardware under the auspices of the division of simplified practice, having 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; and package sizes for insecticides and fungicides.

National Hardwood Lumber Association, Frank F. Fish, secretary, Straus Building, Chicago, Ill. For over 30 years the entire activities of the association have been devoted to the establishment and maintenance of uniform rules for the measurement and inspection of hardwood lumber. It has formulated and keeps under constant review the only rules in use for this purpose. In addition to its general inspection rules committee, there are two special inspection rules committees dealing with plywood and veneer. 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, 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, G. B. Arthur, secretary, 927 Fifteenth Street NW., Washington, D. C. Field research is an important activity of this association. It 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, dyestuff and intermediates, calcium carbide and cyanamide, rubber, lubricating greases, animal glue and gelatin, varnish, and textiles. It has prepared recommendations as to use of lime in crop-growth protection, animal growth, animal protection, animal products, sanitation, including treatment of water supplies, treatment of sewage, and miscellaneous sanitary uses. 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 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 is an independent committee made up of hardwood manufacturers, distributors, and consumers which reports direct to the Central Committee on Lumber Standards, made up of representatives of the entire lumber industry. The tentative grading standards for hardwood lumber formulated in June, 1926, by the hardwood consulting committee, and recommended by it to the Central Committee on Lumber Standards, have been further developed by interested organizations of hardwood producers, distributors, and consumers, largely the National Hardwood Inspection Rules Committee of the National Hardwood Lumber Association, with the assistance of the Hardwood Manufacturers Institute, the National Lumber Manufacturers Association, and other interested organizations, and were formally established, under the auspices of the

Department of Commerce, by the Central Committee on Lumber Standards, June 16, 1927, as 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 Engineering Standards Committee, 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. E. S. C. 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 coming year will include the unification of patterns for worked lumber, standardization of the basis for the measurement of the dimensions and dryness of American standard lumber, further work on grading of hardwood lumber, standardization upon the so-called "7,000 series of moldings," and active cooperation with committees and organizations preparing building laws and codes for adoption by cities or States.

National Machine Tool Builders' Association, Ernest F. Du Brul, 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: Code of business practice, milling machine spindle noses and arbors, safety code for grinding machines, steel wheel guards for grinding machines, and tee slots for machine tools. The association is joint sponsor, with the American Society of Mechanical Engineers, for a sectional committee functioning under the rules of procedure of the American Engineering Standards Committee, on small tools and machine-tool elements. The association is represented on four additional sectional committees functioning under A. E. S. C. procedure.

National Paint, Oil, and Varnish Association (Inc.), George V. Horgan, general manager, 18 East Forty-first Street, New York, N. Y. Although this association has no committee on standardization, standardization activities 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 prepared and issued a dictionary of terminology for the set-up paper box industry covering several hundred trade terms, with their synonyms and accepted meanings 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 thicknesses of box board contained in simplified practice recommendation for this commodity.

National Paper Trade Association, A. H. Chamberlain, secretary, 41 Park Row, New York, N. Y. This association has cooperated with the National Association of Purchasing Agents and the division of simplified practice in developing standard sizes for catalogues and paper in sheets. Its recommended weights for writing paper have been adopted by the Writing Paper Manufacturers Association. It has adopted the standard sizes for tissue paper recommended by the division of simplified practice.

National Paving Brick Manufacturers Association, E. L. Beller, secretary, McCormick Building, Chicago, Ill. The leading part in the movement which has resulted in the standardization of the sizes and varieties of paving brick has been taken by this association, which initiated the work by requesting the United States Department of Commerce, through the division of simplified practice, to call a conference of representatives of manufacturers, distributors, and users of paving brick for this purpose. It has acted as the authorized agent of 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.

National Pickle Packers Association, C. J. Sutphen, secretary, Cunard Building, 140 North Dearborn Street, Chicago, Ill. This association has adopted standard specifications for cooperage used in packing pickles in order to eliminate the confusion resulting from the existence of packages of different dimensions, various thicknesses of staves, and various sizes of hoops. The association has adopted pickle standards and a uniform guaranty, which it publishes in connection with its code of ethics. It also publishes an official chart showing various sizes of 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. Its essential purpose is the promotion of research in the physical and biological sciences and the encouragement of the application and dissemination of scientific knowledge for the benefit of the Nation. It is composed of 11 major divisions. Its division of chemistry and chemical technology is closely associated with the following organizations, which are officially represented in its membership: The American Chemical Society, American Electrochemical Society, American Institute of Chemical Engineers, and the American Ceramic Society. This division 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, inorganic, and biological chemistry, the establishment of physical chemical standards, and the committee on annual tables of constants and numerical data. Cooperating with the division of engineering and industrial research are 12 organizations vitally interested in standardization which have appointed official representatives to serve on the division, as follows: The American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Society of Refrigerating Engineers, American Society for Testing Materials, American Society for Steel Treating, American Society of Heating and Ventilating Engineers, Illuminating Engineering Society, Western Society of Engineers, Society of Automotive Engineers, and the American Welding Society. The work of the division of engineering and industrial research 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 and the committee on heat transmission. In the division of anthropology and psychology two subcommittees of the committee on the psychology of the highway are concerned with standardization in the adoption of highway signs and of tests for drivers. The functions of these subcommittees 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. These subcommittees cooperate 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 subcommittee on 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. The subcommittee on tests for drivers has considered psychological methods to determine the competency of drivers. This subcommittee has cooperated with the committee on uniform laws of the traffic conference, and in the matter of tests for drivers, with the officers of numerous taxicab companies. It has suggested improved parking signs which have been adopted in part by the Baltimore police department. Under the auspices of the International Research Council and the National Academy of Sciences, the National Research Council has prepared the International Critical Tables of Numerical Data, Physics, Chemistry, and Technology, which is being issued in six volumes, the first of which was published in 1926 and the second in 1927.

National Retail Dry Goods Association, Lew Hahn, 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.

National Retail Hardware Association, H. P. Sheets, secretary, Meyer-Kiser Bank Building, Indianapolis, Ind. This association has cooperated with other organizations in eliminating excess varieties

and sizes of hardware under the auspices of the division of simplified practice. It 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 Safety Council, W. H. Cameron, managing director, 108 East Ohio Street, Chicago, Ill. The council has issued a total of 80 safe-practice pamphlets, the last six in 1927, as follows: Competition, and aid in promoting accident prevention; safety inspections, portable electrical hand tools; safety meetings; useful tables, formulas, etc., for the safety man; engineering—a factor in accident prevention. The council is sponsor or joint sponsor for 11 sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Safety code for construction work; identification of piping systems (with the American Society of Mechanical Engineers); safety code for floor and wall openings, railings, and toe boards; safety code for power presses and foot and hand presses; safety code for forging and hot metal stamping (with the American Drop Forging Institute); safety code for rubber machinery (with the International Association of Industrial Accident Boards and Commissions); colors for traffic signals (with the American Association of State Highway Officials and the National Bureau of Standards); codes on colors for gas-mask canisters; safety codes for textiles; safety code for paper and pulp mills; safety code for 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). The National Safety Council is officially represented on 35 additional sectional committees functioning under A. E. S. C. procedure.

National Sand and Gravel Association, V. P. Ahearn, executive secretary, Munsey Building, Washington, D. C.; Stanton Walker, director, engineering and research division. Standing committees of the association are actively engaged in standardization work on washed gravel ballast, standard specifications, standard depreciation scale, and engineering problems. The committee on washed gravel ballast has recommended specifications for grading of washed gravel ballast, prepared in cooperation with the American Railway Engineering Association. These specifications have been adopted as tentative by both associations. The committee is continuing its work for the purpose of preparing recommendations for properties other than grading and for the purpose of giving further consideration

to the tentative specification for grading. The standard specifications committee has recommended certain commercial sizes of sand and gravel and the form of specifications for gravel. The committee on standard depreciation has studied standard depreciation practices in the sand and gravel industry and has ascertained the economical life for different items of equipment, with particular reference to land operations. The committee on engineering problems, recently appointed, has recommended the establishment of a laboratory to be operated by the engineering and research division of the association and has outlined the procedure for financing it. This committee will continue active work in exercising general supervision over the activities of the laboratory after it has been established. 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 has issued technical bulletins entitled "Estimating Quantities of Materials for Concrete" and "Relation of Aggregates to Concrete" and a circular summarizing specifications for sand used in concrete highway construction.

National School Supply Association, T. W. Vinson, executive secretary, 53 West Jackson Boulevard, Chicago, Ill. This association has not organized any special committee on standardization or simplification. However, through its trade-relations committee it 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 preparations for a conference on wood portable and folding chairs and is making plans for additional conferences on various lines of school equipment.

National Slag Association, H. J. Love, secretary, Leader Building, Cleveland, Ohio. This association's engineering and problems committee has made a comparative analysis of all available existing specifications and suggested requirements for blast furnace slag for use in concrete structures and as road surfacing material. This committee is composed of members of the association, most of whom in turn are on one or more standing committees of the American Concrete Institute, the American Society for Testing Materials, and other technical societies. The association is cooperating not only with technical societies, but also with Government bureaus, universities, colleges, State departments, firms, and individuals who possess laboratories in which construction materials are tested. It maintains a research associate at the National Bureau of Standards, conducting investigations on the durability of slag as a mineral aggregate.

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. In 1925 it published its standard specifications for slate for floors, terraces, and walks in a folder entitled "The Charm of Slate Floors and Walks." In 1926 it published its standard specifications for slate for flat and sloping roofs in a book entitled "Slate 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, F. S. Laurence, executive 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 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. The association is officially represented on sectional committees on specifications for fire tests of materials and construction and architectural terra cotta and methods of setting, functioning under the rules of procedure of the A. E. S. C. It maintains three research associates at the National Bureau of Standards doing research work on the investigation of 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 the 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 goods 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 and is officially represented on two additional sectional committees functioning under A. E. S. C. procedure.

North Carolina Pine Association, The, G. L. Hume, secretary, National Bank of Commerce Building, Norfolk, Va. The inspection committee, appointed by the president of the association, handles all matters pertaining to the inspection, manufacture, and grading of lumber, with authority to investigate these matters and make recommendations which are acted on at meetings of the association as a whole. Its rules for the classification and inspection of pine include the American standard grades and sizes.

Northern Pine Manufacturers Association, The, W. A. Ellinger, secretary, Lumber Exchange, Minneapolis, Minn. The bureau of grades of this association is elected at each annual meeting to determine and publish what shall be the association's specifications for the standard and uniform grades of lumber. It has completed the revision of the association's grading rules to conform with the American lumber standards.

Northern White Cedar Association, Norman E. Boucher, secretary, Lumber Exchange, Minneapolis, Minn. This association has published standard specifications governing the manufacture and grading of northern white cedar products, and has been especially active in inducing adherence to these specifications. For carrying on its work having a bearing on standardization, the association has organized committees on the following subjects: Posts and shingles, poles, ties, and pulpwood. Special representatives of the association have been working with a sectional committee of the A. E. S. C. on specifications for wood poles.

Oak Flooring Manufacturers Association, W. L. Claffey, secretary, 228 North La Salle Street, Chicago, Ill. The association's standardization committee is appointed annually. It publishes oak-flooring grading rules, rules governing reinspections, standard thicknesses and widths, standard measurements, and standard counts of oak flooring. During 1927 standard names were adopted for grades of oak flooring, to become effective January 1, 1928.

Paperboard Industries Association, G. R. Browder, general manager, 608 South Dearborn Street, Chicago, Ill. This association,

which has taken over the activities of three heretofore existing associations, namely, the Box Board Association, the National Container Association, and the Folding Box Manufacturers National 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 shipments 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 is also working on proposed changes in specifications for shipping containers as prescribed by carriers. Members of the association are privile ed 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.

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 nonferous foundry practice, approved as "tentative American standard" under A. E. S. C. procedure.

Plywood Manufacturers Association, M. Wulpi, commissioner, 178 West Adams Street, Chicago, Ill. This association has taken an active part in the formulation 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 textbook.

Portland Cement Association, W. M. Kinney, general manager, 33 West Grand Avenue, Chicago, Ill. Organized to improve and extend the uses of concrete, this association has cooperated with the A. S. T. M. in formulating specifications and tests for Portland cement recognized as the American standard, and all of its members

manufacture in accordance with these specifications. It is officially represented on 8 A. S. T. M. committees, and on 15 committees of the American Concrete Institute. 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 on the building code committee of the Department of Commerce. It is officially represented on committees of the American Concrete Pipe Association, the American Mining Congress, American Petroleum Institute, American Railway Bridge and Building Association, the American Railway Engineering Association, American Road Builders' Association, American Society of Agricultural Engineers, American Society for Municipal Improvements, Building Officials Conference, National Fire Protection Association, and National Safety Council. It is a member of the American Engineering Standards Committee and is officially represented on six sectional committees functioning under A. E. S. C. procedure. The association maintains six research associates at the National Bureau of Standards doing research work on phase equilibria, synthetic cements, pure cement compounds, influence of minor constituents, catalytic effects, hydrolysis, hydration, disintegration, thermal effects in the setting process, consistency, solution equilibria, petrographic mineral analysis, optical constants of constituents, and the X-ray examination of clinkers. In the association's own research laboratory, investigations are being made of cement, concrete, concrete aggregates, cast stone, and cement stucco for the purpose of developing standard specifications.

Radio Manufacturers Association, H. B. Richmond, director, engineering division, 30 State Street, Cambridge 39, Mass. The standardization work of this association is conducted as one of the activities of the engineering division, the chairman of which is appointed by the board of directors. It has committees on standardization, appointed by the director of engineering. In its work the standardizing 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 Engineering Standards Committee. In order not to limit developments in the radio industry, the standards formulated are issued as "recommendations." The following important subjects have been covered by recommended standards: Arrestors and aerials; wiring devices, including a standard color code for battery cables, etc., rheostats; panels; condensors; dials and vacuum tubes. During the current year, other suggestions which are important to the industry will be taken up by the various subject committees. The committee has prepared proposed stand-

ards for antenna systems, loud speakers, panels, plugs, jacks and switches, power equipment, power transformers, receiving sets, and resistance units.

Refrigerating Machinery Association, The, Fred Nolde, secretary, 23 South Fifty-second Street, Philadelphia, Pa. Through its standardization committee, the association is officially represented on the sectional committee functioning under the rules of procedure of the A. E. S. C. under joint sponsorship of the American Society of Mechanical Engineers, the Heating and Piping Contractors National Association, and the Manufacturers Standardization Society of the Valve and Fittings Industry in the preparation of national standards for flanges, fittings, and valves. It is cooperating with the structural service department of the American Institute of Architects on the preparation of standardized specifications for refrigerating equipment. It is officially represented on a joint committee in the preparation of a national code of pressure piping. It is also represented on a joint committee with the National Electrical Manufacturers Association and the Compressed Air Society for considering standardized specifications for synchronous motors for use in connection with air compressors and refrigerating machines. 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 organized for the purpose of standardizing design and trade practices.

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, including automobile fabrics; clothing; flooring; rubber and canvas footwear; hard rubber; heels; soles; mechanical rubber goods; rubber-proofed fabrics; druggists' sundries; pneumatic, solid, and cushion auto tires and pneumatic inner tubes; and also of general committees giving attention to accounting, crude rubber, foreign trade, tax and traffic matters. The majority of the work of the association, all of which is carried on through its several divisions and committees, relates

to the standardization of practices within the several industries and to the standardization and simplification of the various manufactured products. 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. As a result of the work of a joint committee composed of rubber heel manufacturers of this organization and members of the National Boot and Shoe Manufacturers Association to consider recommendations for the elimination of various sizes and the adoption of standard sizes, 24 different sizes of rubber heels for ladies and juniors have been adopted. This represents a reduction of 18 sizes from the current 42 sizes. The sizes of men's whole heels and half heels were also reduced from 12 to 8, and 19 to 15, respectively. The work thus inaugurated is now being carried on by the rubber heel and sole department of the Rubber Association of America.

Sand-Lime Brick Association, G. W. Phelps, secretary, Flint, 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 organized a standing committee on simplified practice which keeps the association informed as to the degree of adherence to the simplified practice recommendations.

Scientific Apparatus Makers of America, J. M. Roberts, secretary-treasurer, 460 East Ohio Street, Chicago, Ill. Several years ago a committee was appointed by the association to confer with a similar committee of the American Chemical Society relative to the elimination of useless sizes, shapes, and designs. Questionnaires were sent to the various members to obtain their opinion concerning the desirability of continuing or discontinuing certain items. The report of

the results was submitted to a committee of the American Chemical Society to determine if the profession could dispense with certain poor sellers. Where agreement was reached the items were eliminated. A list of the sizes and shapes retained as agreed upon 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, W. C. Carroll, chairman; Clayton L. Patterson, secretary, Oliver Building, Pittsburgh, Pa. This committee, composed of representatives of sheet-steel manufacturers, has been organized for the purpose of improving and extending the uses of sheet steel. It conducts scientific research, including investigations on the application of coatings to resist corrosions, investigations to determine the cause of blistering of galvanized sheets under various conditions, investigations of proper paints for sheet steel, and tests for the purpose of ascertaining the resistance of sheet steel to fire and lightning in farm and industrial buildings, garages, and other structures. It has formulated specifications for galvanized sheets, and has adopted a designating brand (Master Brand) which can be used only by those participating companies whose product meets the specifications as determined by an analysis conducted by the committee's representatives. The product of these companies is subject to regular inspection by the committee. The committee is paying particular attention to various tests for the purpose of ascertaining the resistance of the member companies' products to fire and lightning in farm and industrial buildings.

Silk Association of America (Inc.), The, Ramsay Peugnet, secretary, 468 Fourth Avenue, New York, N. Y. This association has been carrying on the following standardization activities: Broad silk rules, cost-accounting manual for broad silk manufacturers, cost-accounting manual for commission throwsters, glove silk rules, raw silk rules, raw silk classification committee reports (first and second edition), rules and customs of silk-thread manufacturers, rules governing commission throwing of silk, specifications covering domestic raw silk waste, spun silk rules, standard Government specifications, thrown silk rules, and washing practice and standard test for washfastness. This work is being carried on by 13 standardization committees. Future standardization work in contemplation includes the completion of cost-accounting manual for broad silk manufacturers; possible addition to the raw silk classification system; extension of the work

in connection with promoting standard tests for raw silk throughout the world, especially in the Orient; and continuance of revision of market rules as trade customs become established. The association is cooperating with the Laundryowners' National Association, textile chemists, and soap manufacturers in the development of formulas for washing silk fabrics, taking into account the necessity of thoroughly cleansing the fabric without removing the color. It is officially represented on the sectional committee on rating of electrical machinery functioning under the rules of procedure of the American Engineering Standards Committee.

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 a wiring specification, an inspection, and an award. Basically, the wiring specification is a matter of numerical values; that is, the number of circuits, switches, lighting and convenience outlets, properly located to provide for the convenient use of the various lighting, heating, and power applications in a home. The inspection is provided locally by a representative of a duly authorized operating organization, who checks the specification 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. Further, as a prerequisite to the final and official award of the red seal emblem and certificate, the wiring installation must meet the National Electrical Code, or equivalent requirements.

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 rules of procedure of the American Engineering Standards Committee, 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 American Foresters, J. H. Fahrenbach, secretary, 314 Takoma Avenue, Takoma Park, Md. Although the society has never formulated or adopted any specifications for materials, it has taken an active interest in the work going forward under the auspices of the American Engineering Standards Committee, and is officially repre-

sented 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. For the formulation of engineering standards and recommended practices for the automotive and related industries, the council of the society annually appoints a standards committee, the chairman and vice chairmen of which are designated by the president. A proposed standard is submitted to letter ballot of the society membership and, upon approval, is published as a society specification in the society's handbook, which is revised and published in March and September each year. In the present edition of the handbook are more than 600 specifications. In 1927, 58 standardization projects were passed upon by the society's standards committee and approved by the society for adoption. Among these were specifications for revisions of present standards for automobile instrument mountings, automobile wiring systems and color codes, flywheel housing dimensions and tolerances, engine testing forms, iron and steel specifications, tail-lamp specifications, electric incandescent lamps, and clutch facings. One of the most important revisions related to the specifications for screw and bolt heads and nuts. The standard dimensions for mounting automobile bumpers were revised to meet present-day conditions, and several important additions were included in the listed sizes of taper roller bearings. Several important new specifications were adopted, including a strength and rigidity test for automobile head lamps, requirements for signal lamps, small rivets, plow bolts, round unslotted head bolts, T slots and bolts, definitions for heat treatments for steels, split and tubular rivets, and tables of detail dimensions for ground and cut-thread hand taps. Advertising in the 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. Of more than 100 current standardization subjects, many include various parts and materials for airplanes; thrust ball bearings; automotive power plants and mountings; material specifications and tests; automobile headlighting specifications; tires and wheel equipment; screws, drills, and taps; a variety of mechanical parts and fittings; paints, varnishes, and enamels; and materials, such as substitutes for upholstery leather. The society is joint sponsor for 10 sectional committees functioning under the rules of procedure of the American Engineering Standards Committee, as follows: Standardization and unification of screw threads (with the American Society of Mechanical Engineers); ball bearings (with the American Society of Mechanical

Engineers); bolt, nut, and rivet proportions (with the American Society of Mechanical Engineers); pins and washers (with the American Society of Mechanical Engineers); 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); numbering of steels (with the American Society for Testing Materials); wire and sheet metal gauges (with the American Society of Mechanical Engineers); small tools and machine tool elements (with the American Society of Mechanical Engineers and the National Machine Tool Builders Association). The society is officially represented on 13 additional sectional committees functioning under A. E. S. C. procedure. During 1927 the society was also represented on about 30 other committees or boards of other national organizations or governmental bureaus and departments, among which are the American Automobile Association; the American Bureau of Welding; American Society for Steel Treating; various committees of the American Society for Testing Materials, and committees of the National Bureau of Standards; Army and Navy aeronautic conferences; consulting committees of the Central Committee on Lumber Standards; National Advisory Committee for Aeronautics; National Research Council, advisory board of the Governmental Technical Committee on Lubricants and Liquid Fuels; National Screw Thread Commission; and the National Automobile Chamber of Commerce. The American Petroleum Institute and the National Automobile Chamber of Commerce maintain four research associates at the National Bureau of Standards doing research on 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 doing research on automobile headlighting. The society also maintains a production advisory committee and a motor vehicle fleet operation and maintenance committee for the advancement of all branches of the society's activities in these fields.

Society of Industrial Engineers, The, George C. Dent, executive secretary, 608 South Dearborn Street, Chicago, Ill. The society has a committee on standard management terminology studying laws and principles of the science of management. A second committee, consisting of six sections, is studying methods of eliminating preventable wastes in management and manufacturing, including standardization and simplification. A third group, time study engineering standardization committee, is working on simplification of motion-

time studies and more practical methods of setting production standards and equitable wage rates and incentives.

Society of Naval Architects and Marine Engineers, Daniel H. Cox, secretary, 29 West Thirty-ninth Street, New York, N. Y. This society has taken part in the standardization movement in cooperation with other interested organizations. It 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 American Steel Manufacturers, for the sectional committee on structural steel shapes functioning under the rules of procedure of the American Engineering Standards Committee. It is represented on 11 additional sectional committees functioning under A. E. S. C. procedure.

Society of Terminal Engineers, Charles H. Newman, secretary, 30 Church Street, New York, N. Y. This society is composed of engineers, transportation and terminal officials, private and public, professional and business men, manufacturers, builders, and others who are interested in the planning, building, operating, and financing of terminal facilities in the broadest sense. For these 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 carriers on no standardization activities, it has organized a research committee to make investigations relating to the engineering and operating phases of terminal development. Moreover, it is represented on two A. E. S. C. committees formulating safety codes for conveying and hoisting machinery.

Southern Cypress Manufacturers' Association, J. R. Black, secretary-manager, Barnett Bank Building, Jacksonville, Fla. The president of the association appoints annually a committee on grades and specifications with power to act in handling all matters pertaining to standardization. The committee's recommendations for changes in grading rules are discussed at general meetings of the association held in May and November. During the year this committee met in Chicago with the Central Committee on Lumber Standards, and brought all of the association's rules into conformity with American lumber standards.

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. Through the Central Committee on Lumber Standards and the National Com-

mittee on Wood Utilization it has cooperated with the Department of Commerce in the national wood standardization program. Its standardization activities are conducted under the supervision of its grading committee, appointed annually, which has charge of the association's inspection department. 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.

Southern Sash, Door, and Millwork Manufacturers' Association, C. B. Harman, secretary, Candler 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. During 1926 the uniform millwork contract committee prepared a uniform millwork contract and definition of millwork, including standard specifications of manufacture, which has been adopted by the association.

Southern Supply and Machinery Dealers Association, Alvin M. Smith, secretary, Smith-Courtney Co., Richmond, Va. The standardization committee of this association, which is appointed by the president upon authority of the executive committee, takes cognizance of all standardization programs; studies the same, and is prepared to participate in discussions at the meetings held for the consideration of a program. 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.

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 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. As a result of its request, a committee on foundry practice has been organized under the auspices of the United States Department of Commerce, to consider the placing of the weights of castings on blue prints sent to foundries.

Structural Service Bureau, A. Lynwood Ferguson, managing director, 112 South Sixteenth Street, Philadelphia, Pa. Although this bureau has not formulated any specifications, it has cooperated actively in the preparation of standards, building codes, and specifications which have been promulgated by the National, State, and municipal authorities, and 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, Herbert S. Blake, secretary, 74 Trinity Place, New York, N. Y. The committee 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, W. G. MacNaughton, secretary, 18 East Forty-first Street, New York, N. Y. This association has voted upon and adopted officially 24 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 committee 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 committee.

Telephone Group. In connection with the standardization activities conducted under the auspices and procedure of the A. E. S. C. the telephone industry operates as a group. The telephone group is sponsor or joint sponsor for two sectional committees functioning under the rules of procedure of the A. E. S. C. as follows: Manhole frames and covers (with the American Society of Civil Engineers) and specifications for wood poles. It is officially represented on two additional committees functioning under A. E. S. C. procedure. This group consists of the Bell Telephone System and the United States Independent Telephone Association. The A. E. S. C. 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. Within the Bell Telephone System the work of standardization of materials and methods is performed by groups of experts of the joint staff flexibly

organized. The representative of the United States Independent Telephone Association on the telephone group is appointed by the president of that association. The 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 to act for the association in its cooperative work with outside interests, such as the American Engineering Standards Committee, 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.

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 based upon a plan, in accordance with which each color is given a standard name and standard number consisting of four figures, which express as nearly as can be done the character of the color. This card, known as the standard color card, is 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. The association has formulated and adopted standards for rims, and 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, A. T. Hussey, secretary, Whitney-Central Building, New Orleans, La. This association sponsored and led the activity which resulted in the passage of the Harrison Act, which established Federal standards for color for rosin and provided for the establishment of standards for turpentine. It has also defined the various classes of turpentine and

rosin. The United States Federal standards for rosin and turpentine have been adopted by France and England and are recognized in all countries importing French and American rosin and turpentine. The use of these standards for sale of any of these commodities in interstate commerce is compulsory. In cooperation with the American Society for Testing Materials, the association has assisted in standardizing methods for determining foreign matter in rosin and it will ultimately establish standards in connection with this feature. Work is now being done in a similar manner on establishment of the melting point of rosin. Through the efforts of this association the rosin and turpentine producing industry has been brought to realize the value of carrying on technical and chemical research. The industry is attempting to standardize the rosin package through cooperation with various consuming industries.

Underwriters' Laboratories, Dana Pierce, president, 207 East Ohio Street, Chicago, Ill. For about 25 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. 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 Engineering Standards Committee, 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. It is officially represented on 23 additional sectional committees functioning under A. E. S. C. procedure. In cooperation with the National Board of Fire Underwriters, the National Fire Protection Association, and many other insurance, technical, and engineering societies, it assists, through its staff, in the formulating of standards and regulations covering fire-loss prevention, accident, and theft. It has formulated and adopted numerous standards for electrical materials and devices.

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 standards for the

use of those engaged in the practice of medicine and pharmacy in the United States, whereby the identity, strength, quality, and purity of certain recognized medicines and drugs may be accurately determined. 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. It is published by the board of trustees of the convention. 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 this 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. Though having no formal committee on standardization, this association is engaged in a number of standardizing activities. Its committees endeavor 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, the chairman of its research committee being chairman of the bureau's advisory committee on ceramics.

United Typothetae of America, Edward T. Miller, secretary, 600 West Jackson Boulevard, Chicago, Ill. This organization has published a dictionary of printing terms to include standard definitions of the various operations in printing and binding. It publishes a standard form of proposal for printing in which are incorporated the standard printing trade customs, 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 Eighth 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. The work of formulating these trade regulations was done by a special committee appointed for that purpose. Changes can be made in them only through the action of the association itself.

West Coast Lumbermen's Association, Robert B. Allen, manager, White-Henry-Stuart Building, Seattle, Wash. This association was organized in 1901 to promote west coast forest products and to handle the subject of grading, statistical information, traffic, and similar service. It has issued many publications having a direct bearing on standardization. All of its previous rules applying to the classification, manufacture, and grading of Douglas fir, Sitka spruce, west coast hemlock and western red cedar have been superseded by grading and dressing rules conforming to American lumber standards, now issued in a single pamphlet. In its technical bulletins are included recommendations of the United States Forest Service relating to working stresses for standard grades of Douglas fir and those of structural grades of American Lumber Standards as adopted by the building code committee of the United States Department of Commerce and by the American Railway Engineering Association. Membership in West Coast Lumbermen's Association is confined exclusively to mills of careful manufacturing practice. The by-laws of the association state that no mill may be eligible to membership in West Coast Lumbermen's Association whose grades are below the test of grades efficiency established by the board of trustees of the association, and that any member mill whose grades, over a reasonable period, shall fall below the test of grading efficiency established by the association, shall forfeit its membership in the association.

Western Pine Manufacturers Association, A. W. Cooper, secretary-manager, Yeon Building, Portland, Oreg. The standardization activities of this organization are carried on by the grading committee, which has for many years supervised the development of standard grades and sizes. These grades have been worked out and published. 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.

Western Red Cedar Association, F. S. Fulwiler, secretary, Peyton Building, Spokane, Wash. In 1918 and 1925 the association issued its own specifications for western red cedar poles and for butt treating

of cedar poles in open tanks. During 1926 it cooperated, through special representatives, with a committee of the American Wood-Preservers' Association and tentatively accepted, subject to future final action, the specifications reported by that committee for the preservative treatment of poles of the durable species by nonpressure processes. The association is represented on the sectional committee on wood poles functioning under A. E. S. C. procedure.

Wirebound Box Manufacturers Association, R. M. McClure, secretary-treasurer, 111 West Washington Street, Chicago, Ill. This association has a standardization and specifications committee composed of four members, each of whom is in charge of the specifications department of the firm he is serving. These men are appointed by the president with the approval of the board of governors. The function of the committee is 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, by the Army, Navy, or other branches of the Federal Government, or other regulatory agencies. To provide the data in support of their recommendations, 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. Its current activities are along this general line. The principal accomplishment in 1927 was the preparation of a set of general specifications for wire-bound boxes at the request of the transportation division of the Bureau of Foreign and Domestic Commerce and used by that division as a part of the material contained in its trade circular on wire-bound boxes, "Domestic Commerce Series No. 12."

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 those recommended by the National Paper Trade Association. It has approved a classification of cotton rags promulgated by the National Association of Waste Material Dealers.

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X. STANDARDIZATION OF MEASUREMENT

FLOW SHEETS

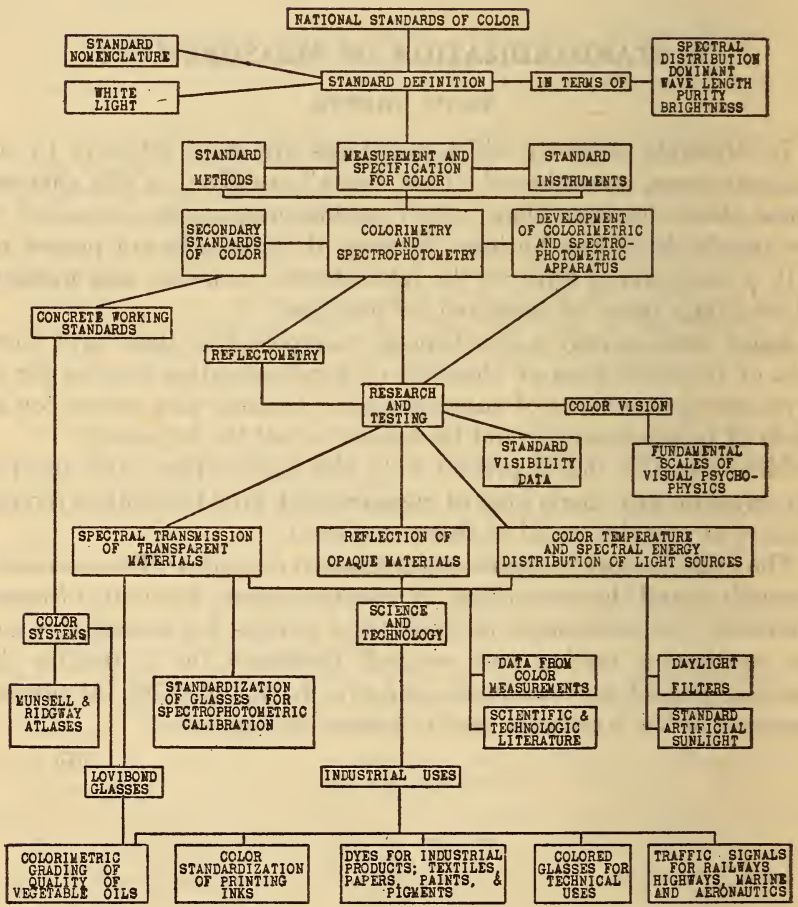
To illustrate steps by which standards are made effective to the ultimate users, a number of "flow sheets" are given in this chapter. These show the lines along which specific magnitudes embodied in the standards of the National Bureau of Standards are passed on with a minimum of error to the laboratories, factories, and markets where things must be measured for final use.

Space permits only a few typical examples, but these give some idea of the chief lines or channels of standardization flow so far as it relates to standards of measurement. Similar flow sheets for all kinds of measurement would be needed to tell the full story.

Obviously the charts present only the bare outline, and the full portrayal for any single kind of measurement would doubtless require a chart as complex as all of these combined.

The other factors in such standardization comprise: The standards themselves and their secondary or working copies; the units of measurements, the definitions, methods, and devices for measuring; and the continuous testing and research necessary for increasing the accuracy of such measurements, and even for maintaining the present precision of the standards used in science and industry.

Color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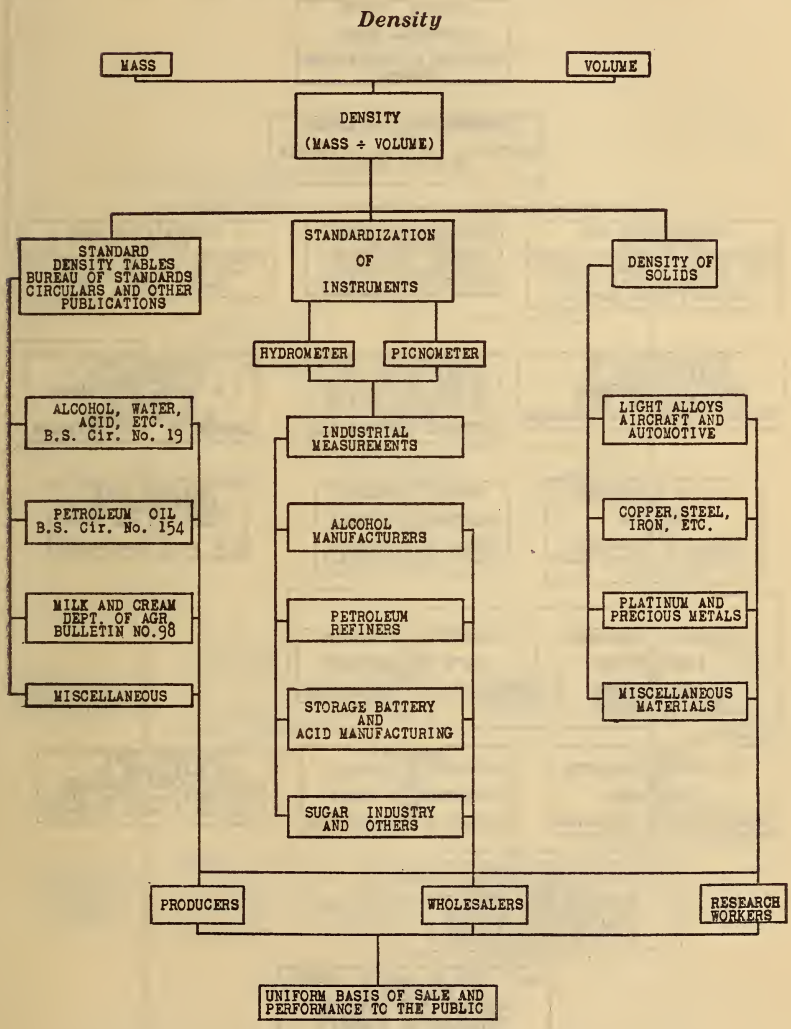
IN TERMS OF
SPECTRAL DISTRIBUTION
DOMINANT WAVE LENGTH
PURITY
BRIGHTNESS
STANDARD METHODS
MEASUREMENT AND SPECIFICATION FOR COLOR
STANDARD INSTRUMENTS
SECONDARY STANDARDS OF COLOR
COLORIMETRY AND SPECTROPHOTOMETRY
DEVELOPMENT OF COLORIMETRIC AND SPECTRO-PHOTOMETRIC APPARATUS
CONCRETE WORKING STANDARDS
REFLECTOMETRY
RESEARCH AND TESTING
COLOR VISION
STANDARD VISIBILITY DATA
FUNDAMENTAL SCALES OF VISUAL PSYCHO-PHYSICS
SPECTRAL TRANSMISSION OF TRANSPARENT MATERIALS
REFLECTION OF OPAQUE MATERIALS
COLOR TEMPERATURE AND SPECTRAL ENERGY DISTRIBUTION OF LIGHT SOURCES
COLOR SYSTEMS
SCIENCE AND TECHNOLOGY
DATA FROM COLOR MEASUREMENTS
DAYLIGHT FILTERS
MUNSELL & RIDGWAY ATLASES
STANDARDIZATION OF GLASSES FOR SPECTROPHOTOMETRIC CALIBRATION
SCIENTIFIC & TECHNOLOGIC LITERATURE
STANDARD ARTIFICIAL SUNLIGHT
LOVIBOND GLASSES
INDUSTRIAL USES
COLORIMETRIC GRADING OF QUALITY OF VEGETABLE OILS
COLOR STANDARDIZATION OF PRINTING INKS
DYES FOR INDUSTRIAL PRODUCTS; TEXTILES, PAPERS, PAINTS, & PIGMENTS
COLORED GLASSES FOR TECHNICAL USES
TRAFFIC SIGNALS FOR RAILWAYS HIGHWAYS, MARINE AND AERONAUTICS

FIG. 4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DENSITY OF SOLIDS
HYDROMETER
PICNOMETER
ALCOHOL, WATER, ACID, ETC. B.S. Cir. No. 19
INDUSTRIAL MEASUREMENTS
LIGHT ALLOYS AIRCRAFT AND AUTOMOTIVE
PETROLEUM OIL B.S. Cir. No. 154
ALCOHOL MANUFACTURERS
COPPER, STEEL, IRON, ETC.
MILK AND CREAM DEPT. OF AGR. BULLETIN NO. 98
PETROLEUM REFINERS
PLATINUM AND PRECIOUS METALS
MISCELLANEOUS
STORAGE BATTERY AND ACID MANUFACTURING
MISCELLANEOUS MATERIALS
SUGAR INDUSTRY AND OTHERS
PRODUCERS
WHOLESALERS
RESEARCH WORKERS
UNIFORM BASIS OF SALE AND PERFORMANCE TO THE PUBLIC

FIG. 5

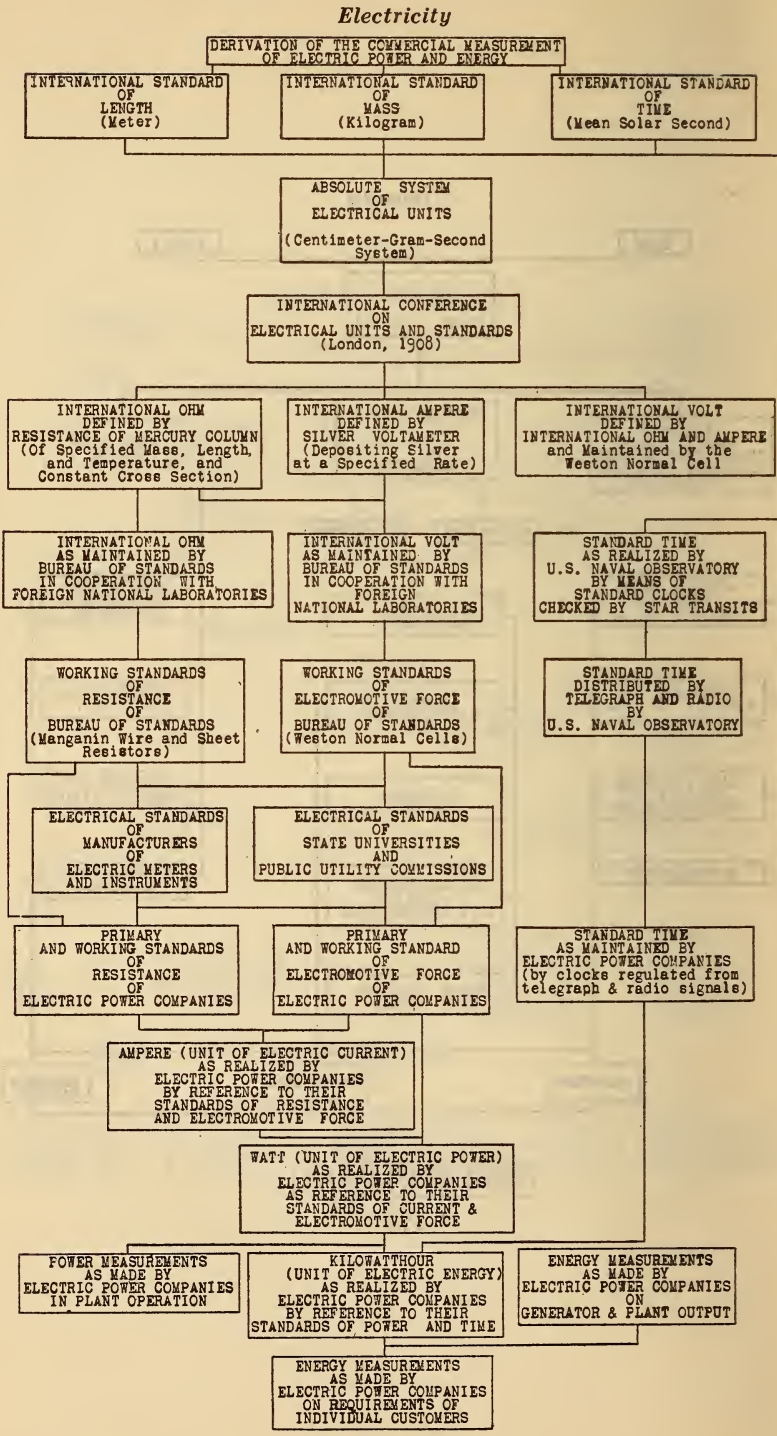
Electricity
DERIVATION OF THE COMMERCIAL MEASUREMENT OF ELECTRIC POWER AND ENERGY
INTERNATIONAL STANDARD OF LENGTH (Meter)
INTERNATIONAL STANDARD OF MASS (Kilogram)
INTERNATIONAL STANDARD OF TIME (Mean Solar Second)
ABSOLUTE SYSTEM OF ELECTRICAL UNITS (Centimeter-Gram-Second System)
INTERNATIONAL CONFERENCE ON ELECTRICAL UNITS AND STANDARDS (London, 1908)
INTERNATIONAL OHM DEFINED BY RESISTANCE OF MERCURY COLUMN (Of Specified Mass, Length, and Temperature, and Constant Cross Section)
INTERNATIONAL AMPERE DEFINED BY SILVER VOLTAMETER (Depositing Silver at a Specified Rate)
INTERNATIONAL VOLT DEFINED BY INTERNATIONAL OHM AND AMPERE and Maintained by the Weston Normal Cell
INTERNATIONAL OHM AS MAINTAINED BY BUREAU OF STANDARDS IN COOPERATION WITH FOREIGN NATIONAL LABORATORIES
INTERNATIONAL VOLT AS MAINTAINED BY BUREAU OF STANDARDS IN COOPERATION WITH FOREIGN NATIONAL LABORATORIES
STANDARD TIME AS REALIZED BY U.S. NAVAL OBSERVATORY BY MEANS OF STANDARD CLOCKS CHECKED BY STAR TRANSITS
WORKING STANDARDS OF RESISTANCE OF BUREAU OF STANDARDS (Manganin Wire and Sheet Resistors)
WORKING STANDARDS OF ELECTROMOTIVE FORCE OF BUREAU OF STANDARDS (Weston Normal Cells)
STANDARD TIME DISTRIBUTED BY TELEGRAPH AND RADIO BY U.S. NAVAL OBSERVATORY
ELECTRICAL STANDARDS OF MANUFACTURERS OF ELECTRIC METERS AND INSTRUMENTS
ELECTRICAL STANDARDS OF STATE UNIVERSITIES AND PUBLIC UTILITY COMMISSIONS
PRIMARY AND WORKING STANDARDS OF RESISTANCE OF ELECTRIC POWER COMPANIES
PRIMARY AND WORKING STANDARD OF ELECTROMOTIVE FORCE OF ELECTRIC POWER COMPANIES
STANDARD TIME AS MAINTAINED BY ELECTRIC POWER COMPANIES (by clocks regulated from telegraph & radio signals)
AMPERE (UNIT OF ELECTRIC CURRENT) AS REALIZED BY ELECTRIC POWER COMPANIES BY REFERENCE TO THEIR STANDARDS OF RESISTANCE AND ELECTROMOTIVE FORCE
WATT (UNIT OF ELECTRIC POWER) AS REALIZED BY ELECTRIC POWER COMPANIES AS REFERENCE TO THEIR STANDARDS OF CURRENT & ELECTROMOTIVE FORCE
POWER MEASUREMENTS AS MADE BY ELECTRIC POWER COMPANIES IN PLANT OPERATION
KILOWATTHOUR (UNIT OF ELECTRIC ENERGY) AS REALIZED BY ELECTRIC POWER COMPANIES BY REFERENCE TO THEIR STANDARDS OF POWER AND TIME
ENERGY MEASUREMENTS AS MADE BY ELECTRIC POWER COMPANIES ON GENERATOR & PLANT OUTPUT
ENERGY MEASUREMENTS AS MADE BY ELECTRIC POWER COMPANIES ON REQUIREMENTS OF INDIVIDUAL CUSTOMERS

FIG. 6

Electricity (Continued)
(Capacitance)

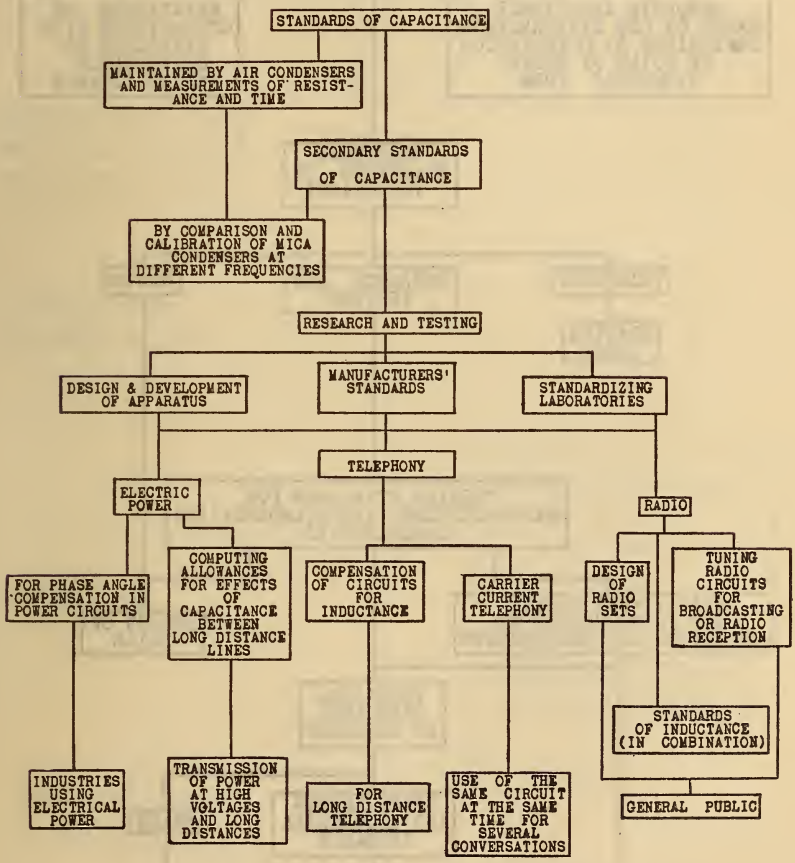

FIG. 7

Electricity (Continued)
(Inductance)

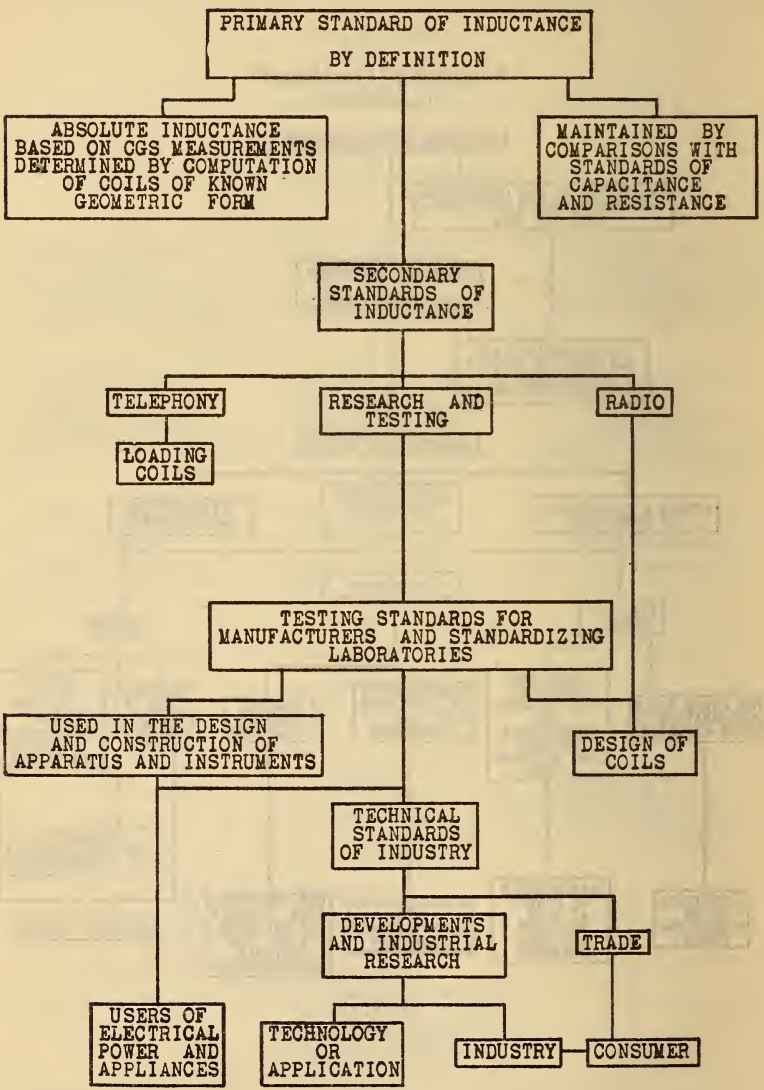

FIG. 8

Fineness
(Grain size)

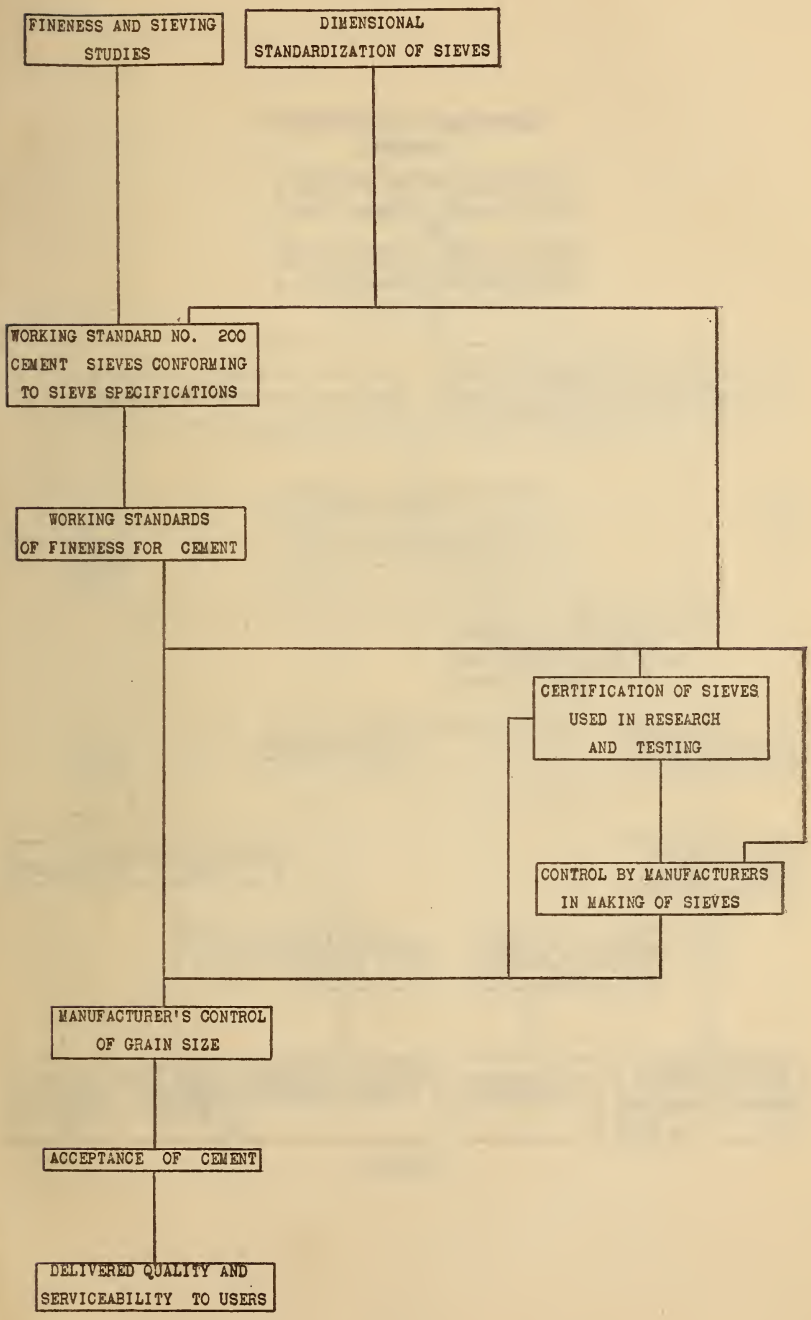

FIG. 9

91096—28——25

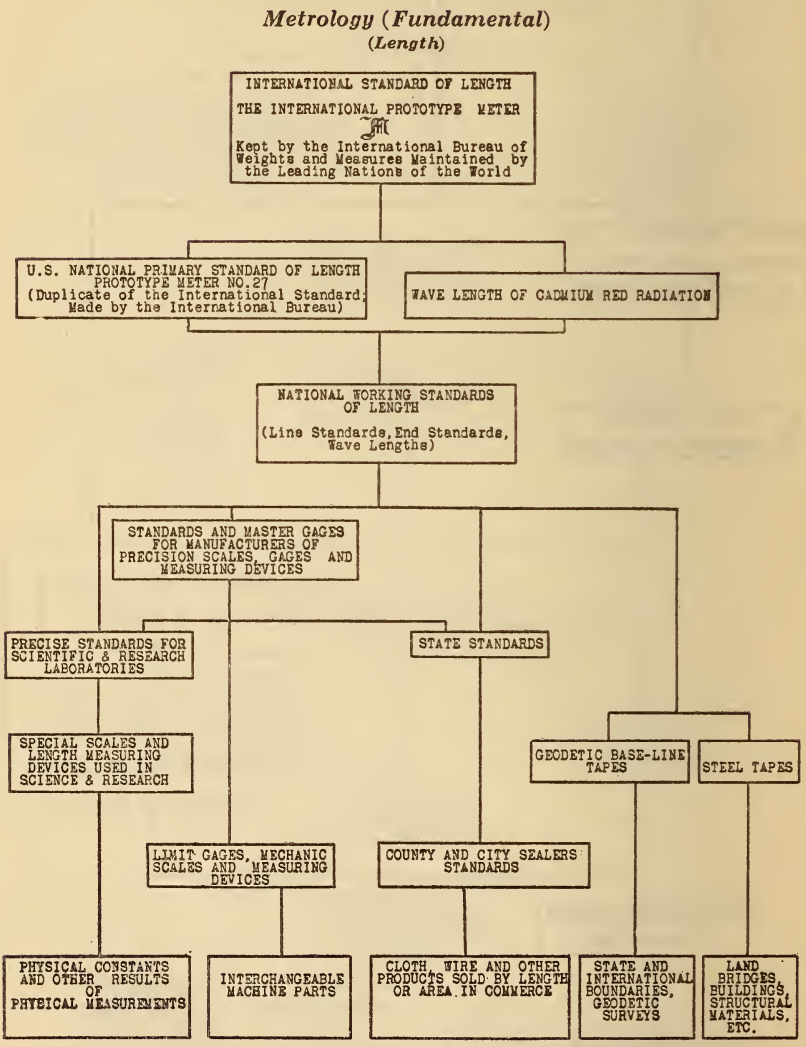
Metrology (Fundamental)
(Length)
INTERNATIONAL STANDARD OF LENGTH
THE INTERNATIONAL PROTOTYPE METER
Kept by the International Bureau of Weights and Measures Maintained by the Leading Nations of the World
U.S. NATIONAL PRIMARY STANDARD OF LENGTH PROTOTYPE METER NO. 27 (Duplicate of the International Standard; Made by the International Bureau)
WAVE LENGTH OF CADMIUM RED RADIATION
NATIONAL WORKING STANDARDS OF LENGTH
(Line Standards, End Standards, Wave Lengths)
STANDARDS AND MASTER GAGES FOR MANUFACTURERS OF PRECISION SCALES, GAGES AND MEASURING DEVICES
PRECISE STANDARDS FOR SCIENTIFIC & RESEARCH LABORATORIES
STATE STANDARDS
SPECIAL SCALES AND LENGTH MEASURING DEVICES USED IN SCIENCE & RESEARCH
GEODETIC BASE-LINE TAPES
STEEL TAPES
LIMIT GAGES, MECHANIC SCALES AND MEASURING DEVICES
COUNTY AND CITY SEALERS STANDARDS
PHYSICAL CONSTANTS AND OTHER RESULTS OF PHYSICAL MEASUREMENTS
INTERCHANGEABLE MACHINE PARTS
CLOTH, WIRE AND OTHER PRODUCTS SOLD BY LENGTH OR AREA IN COMMERCE
STATE AND INTERNATIONAL BOUNDARIES, GEODETIC SURVEYS
LAND, BRIDGES, BUILDINGS, STRUCTURAL MATERIALS, ETC.

FIG. 10

Metrology (Continued)
(Mass)

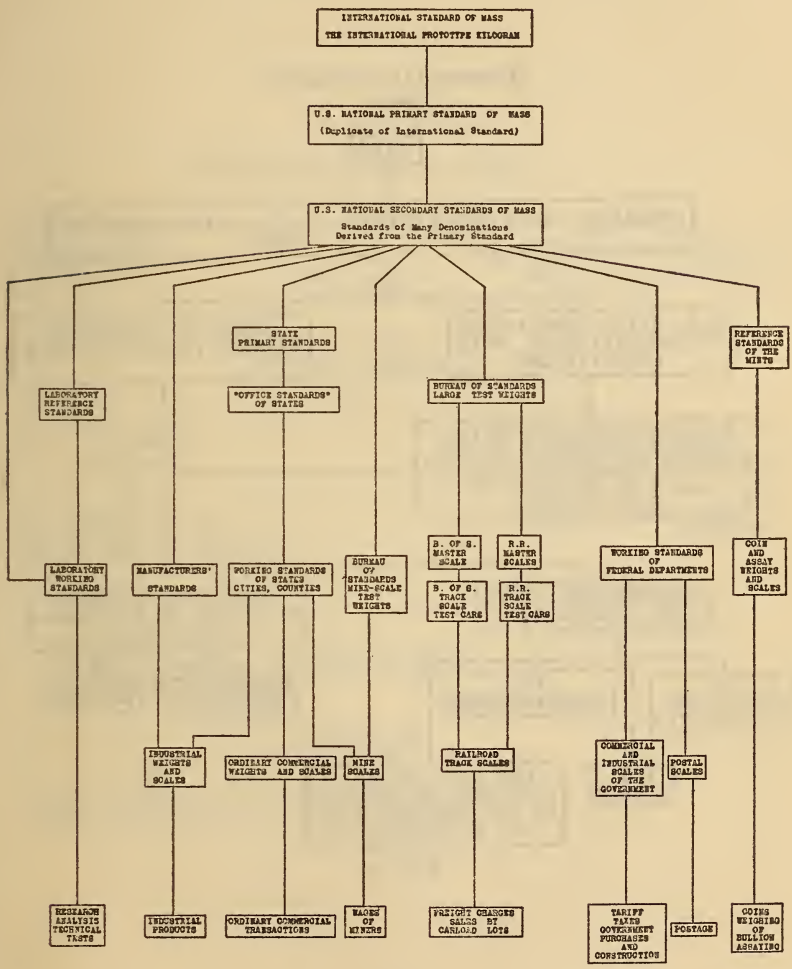

FIG. 11

Metrology (Continued)
(Time)

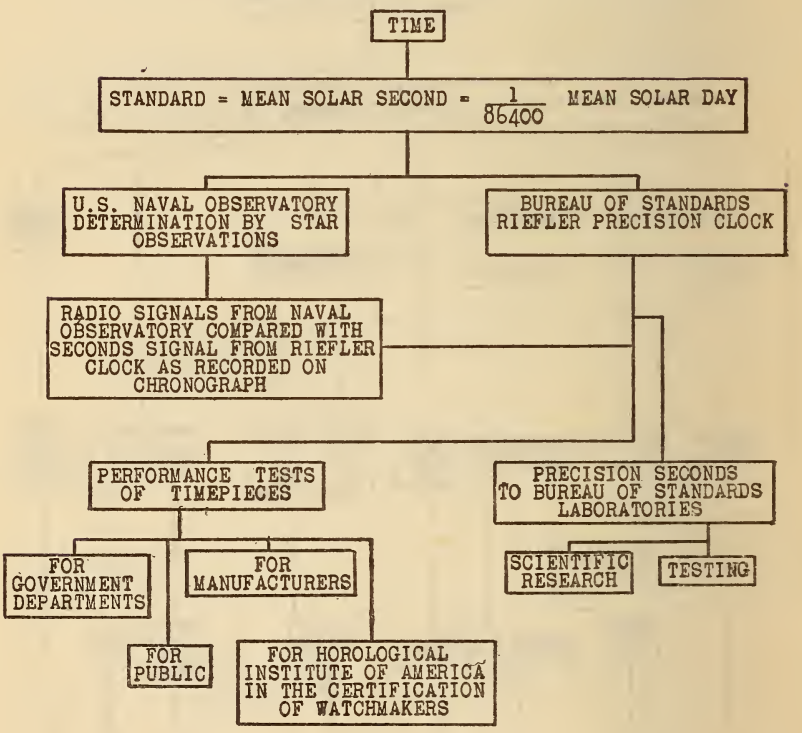

FIG. 12

Light

(Luminous intensity)

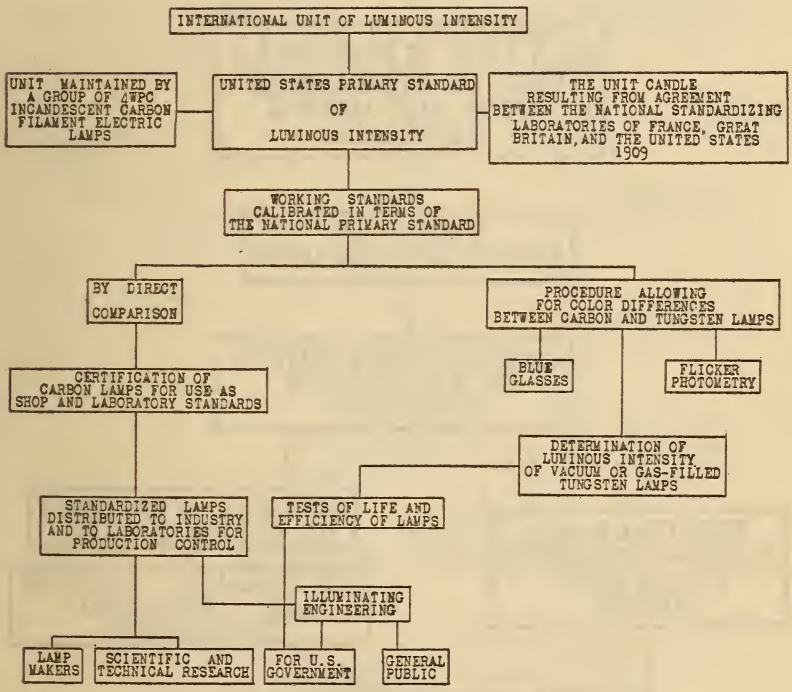

FIG. 13

Radioactivity

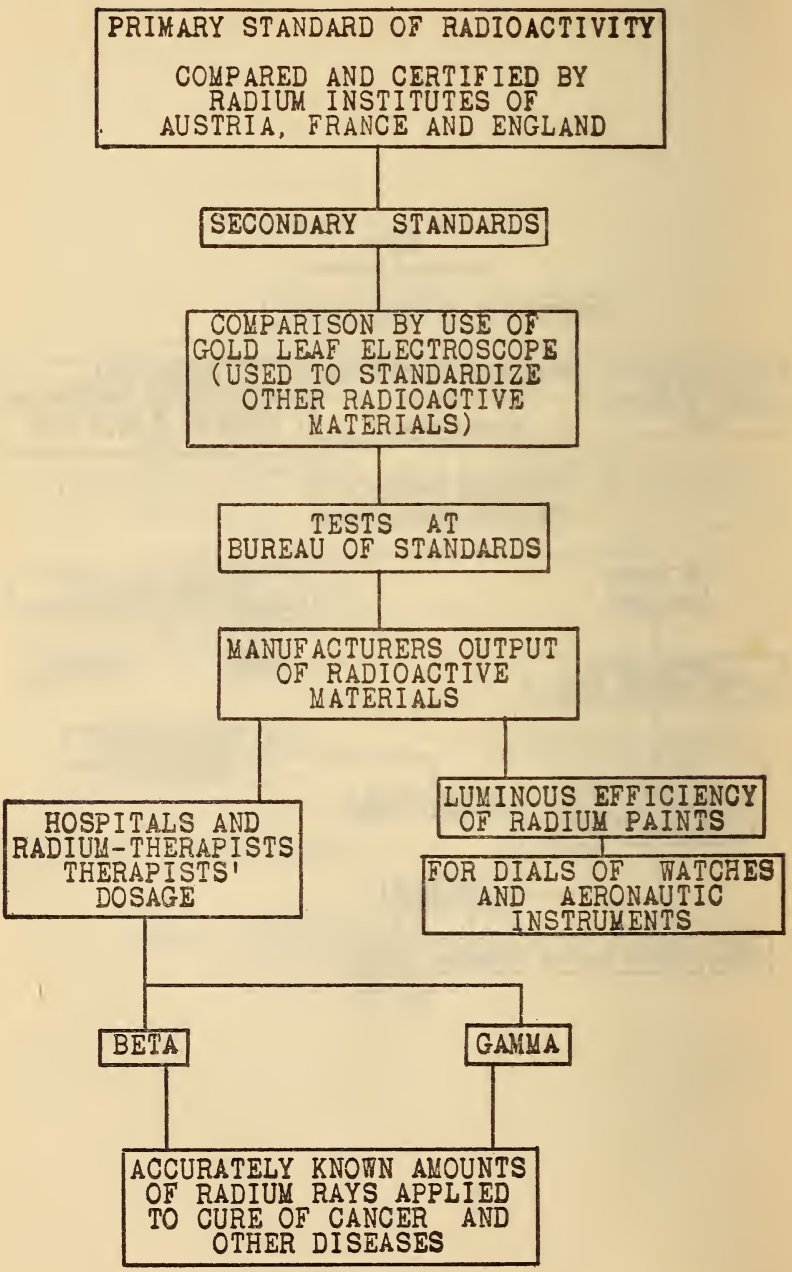

FIG. 14

Total Radiation
(Radiant energy)

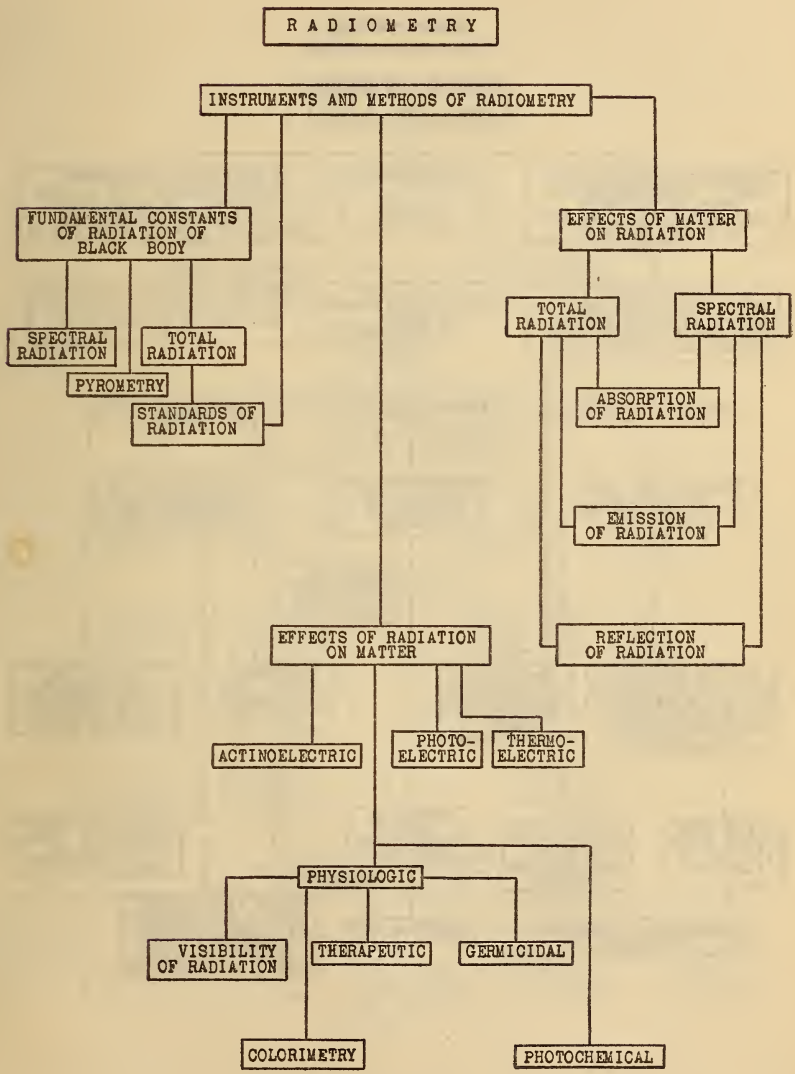

FIG. 15

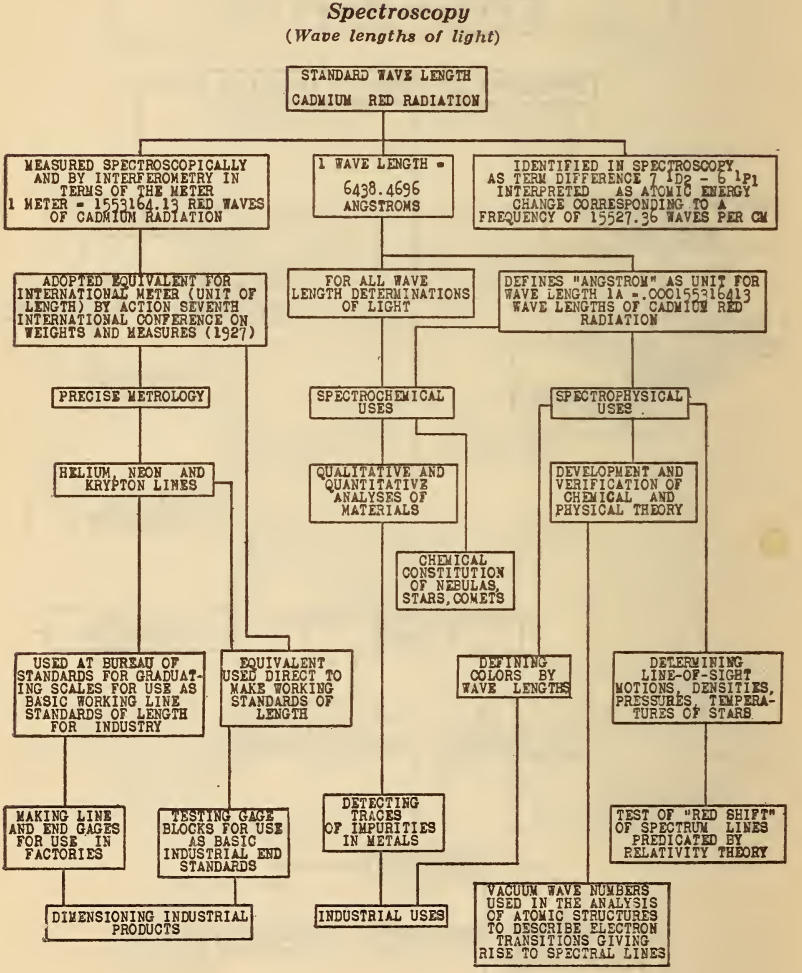
Spectroscopy
(Wave lengths of light)
STANDARD WAVE LENGTH
CADMIUM RED RADIATION
MEASURED SPECTROSCOPICALLY AND BY INTERFEROMETRY IN TERMS OF THE METER
1 METER = 1553164.13 RED WAVES OF CADMIUM RADIATION
1 WAVE LENGTH = 6438.4696 ANGSTROMS
IDENTIFIED IN SPECTROSCOPY AS TERM DIFFERENCE 7 1D2 - 6 1P1
INTERPRETED AS ATOMIC ENERGY CHANGE CORRESPONDING TO A FREQUENCY OF 15527.36 WAVES PER CM
ADOPTED EQUIVALENT FOR INTERNATIONAL METER (UNIT OF LENGTH) BY ACTION SEVENTH INTERNATIONAL CONFERENCE ON WEIGHTS AND MEASURES (1927)
FOR ALL WAVE LENGTH DETERMINATIONS OF LIGHT
DEFINES "ANGSTROM" AS UNIT FOR WAVE LENGTH 1A = .000155216413 WAVE LENGTHS OF CADMIUM RED RADIATION
PRECISE METROLOGY
SPECTROCHEMICAL USES
SPECTROPHYSICAL USES
HELIUM, NEON AND KRYPTON LINES
QUALITATIVE AND QUANTITATIVE ANALYSES OF MATERIALS
DEVELOPMENT AND VERIFICATION OF CHEMICAL AND PHYSICAL THEORY
CHEMICAL CONSTITUTION OF NEBULAS, STARS, COMETS
USED AT BUREAU OF STANDARDS FOR GRADUATING SCALES FOR USE AS BASIC WORKING LINE STANDARDS OF LENGTH FOR INDUSTRY
EQUIVALENT USED DIRECT TO MAKE WORKING STANDARDS OF LENGTH
DEFINING COLORS BY WAVE LENGTHS
DETERMINING LINE-OF-SIGHT MOTIONS, DENSITIES, PRESSURES, TEMPERATURES OF STARS
MAKING LINE AND END GAGES FOR USE IN FACTORIES
TESTING GAGE BLOCKS FOR USE AS BASIC INDUSTRIAL END STANDARDS
DETECTING TRACES OF IMPURITIES IN METALS
TEST OF "RED SHIFT" OF SPECTRUM LINES PREDICATED BY RELATIVITY THEORY
DIMENSIONING INDUSTRIAL PRODUCTS
INDUSTRIAL USES
VACUUM WAVE NUMBERS USED IN THE ANALYSIS OF ATOMIC STRUCTURES TO DESCRIBE ELECTRON TRANSITIONS GIVING RISE TO SPECTRAL LINES

FIG. 16

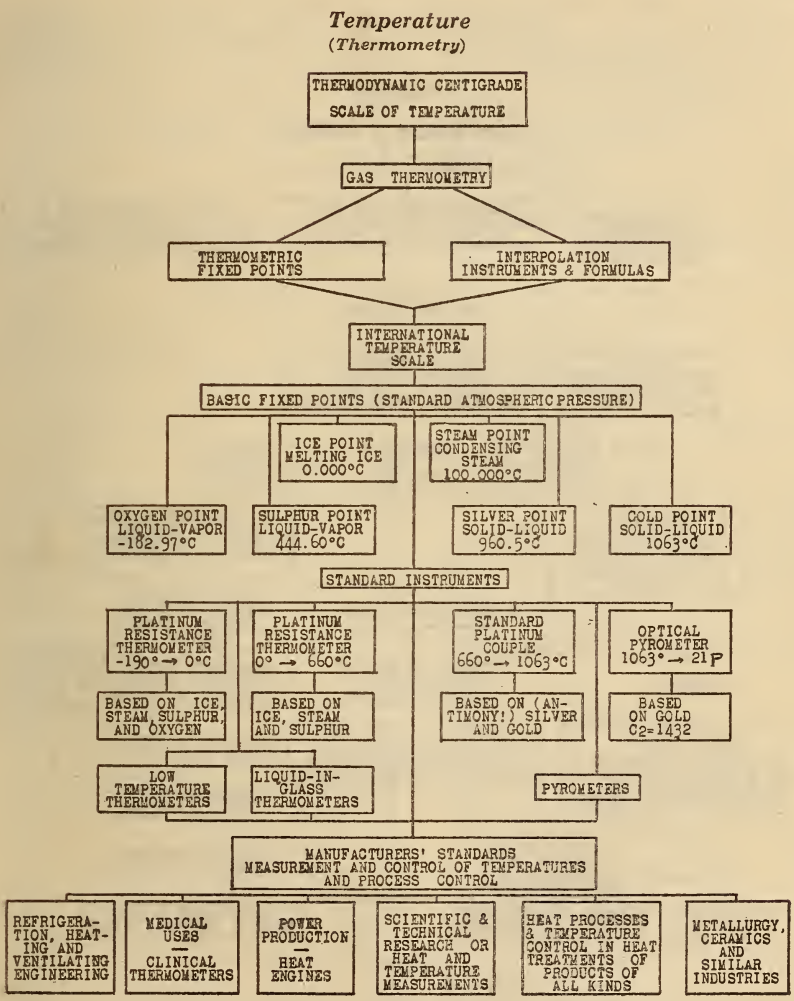
Temperature
(Thermometry)
THERMODYNAMIC CENTIGRADE SCALE OF TEMPERATURE
GAS THERMOMETRY
THERMOMETRIC FIXED POINTS
INTERPOLATION INSTRUMENTS & FORMULAS
INTERNATIONAL TEMPERATURE SCALE
BASIC FIXED POINTS (STANDARD ATMOSPHERIC PRESSURE)
ICE POINT MELTING ICE 0.000°C
STEAM POINT CONDENSING STEAM 100.000°C
OXYGEN POINT LIQUID-VAPOR -182.97°C
SULPHUR POINT LIQUID-VAPOR 444.60°C
SILVER POINT SOLID-LIQUID 960.5°C
GOLD POINT SOLID-LIQUID 1063°C
STANDARD INSTRUMENTS
PLATINUM RESISTANCE THERMOMETER -190° → 0°C
PLATINUM RESISTANCE THERMOMETER 0° → 660°C
STANDARD PLATINUM COUPLE 660° → 1063°C
OPTICAL PYROMETER 1063° → 21P
BASED ON ICE, STEAM, SULPHUR, AND OXYGEN
BASED ON ICE, STEAM AND SULPHUR
BASED ON (ANTIMONY!) SILVER AND GOLD
BASED ON GOLD C2=1432
LOW TEMPERATURE THERMOMETERS
LIQUID-IN-GLASS THERMOMETERS
PYROMETERS
MANUFACTURERS' STANDARDS MEASUREMENT AND CONTROL OF TEMPERATURES AND PROCESS CONTROL
REFRIGERATION, HEATING AND VENTILATING ENGINEERING
MEDICAL USES — CLINICAL THERMOMETERS
POWER PRODUCTION — HEAT ENGINES
SCIENTIFIC & TECHNICAL RESEARCH OR HEAT AND TEMPERATURE MEASUREMENTS
HEAT PROCESSES & TEMPERATURE CONTROL IN HEAT TREATMENTS OF PRODUCTS OF ALL KINDS
METALLURGY, CERAMICS AND SIMILAR INDUSTRIES

FIG. 17

Viscosity

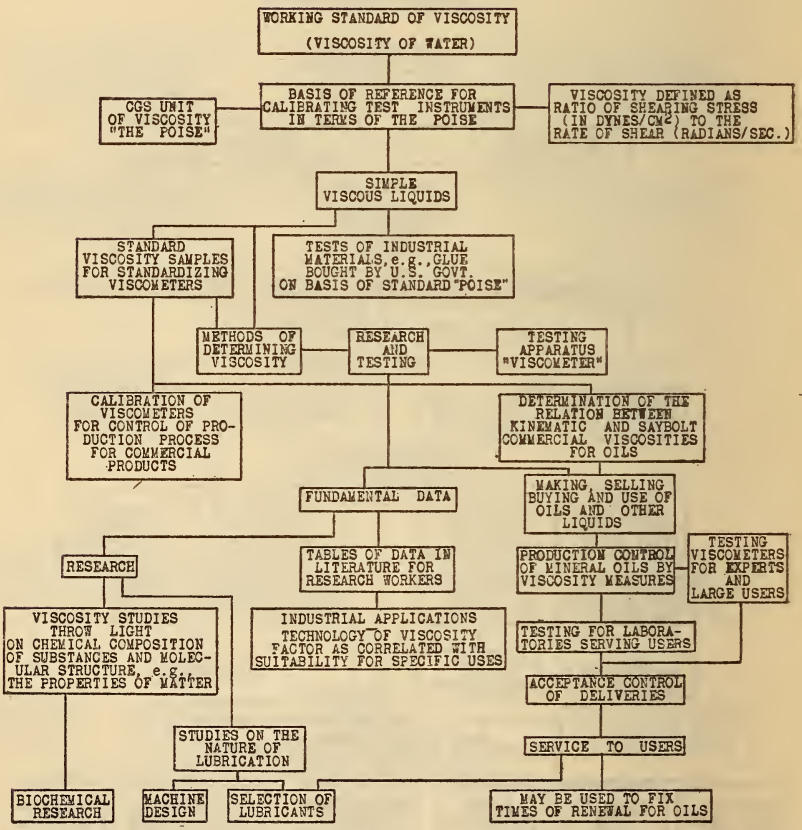

FIG. 18

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