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BUREAU OF STANDARDS
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TWELVE OUTSTANDING ACCOMPLISHMENTS OF THE BUREAU OF STANDARDS IN 1924

1. Volume of Testing

The past year the bureau has completed 135,852 tests, an increase of 17.5 per cent over 1923. This is one hundred and twenty-five times the number for the bureau's first year. In addition there were inspected 1,619,798 incandescent lamps for other departments of the Government. Government tests during the past year, including instruments and materials, compromised 99,204 items. This included 8,956 chemical tests and 12,041 physical tests of cement and concrete. Thermometer tests, mostly for the public, numbered 27,354; 1,111 radium preparations were tested; and 7,030 weights, balances, and scales, including 1,019 commercial track scales distributed over 38 States; 27,435 tests of ceramic materials were made; 6,143 of optical instruments and materials, including 2,798 sugar polarimetric tests; and 8,041 tests of leather, rubber, textiles, and paper. The demands from the Government departments and the public for tests by the bureau have long overtaxed the available personnel and the bureau has had to greatly restrict its testing activities. Preference is given to requests from the Government departments, with the result that the bureau is not able to meet the legitimate demands of industry in many fields.

2. Savings to the Home Owner Through Economies in Plumbing Installations

A standard plumbing code has been prepared by the bureau, based on a thorough study of actual installations as well as many tests in the laboratories.

After a survey of plumbing requirements in a large number of cities it was found that many altogether unnecessary variations existed, which of course greatly increase the cost of such installations. Likewise, it was evident that many of the requirements were based on no real reasons, but were the product of rule-of-thumb methods and local prejudice.

The code as finally drawn up has been issued as a 260-page circular, and contains many recommendations which will result in savings to the builder and owner of dwellings. One of the interesting facts brought out by the investigation of plumbing systems was that the 3-inch stack is perfectly satisfactory for ordinary dwellings, and can be used with success where the 4-inch stack was formerly employed. It is estimated that a saving of about $1,000,000 per year in building costs will result from this one item alone.

In referring to this code in a letter to the chairman of the building code committee, Secretary Hoover said in part:

"Economical and sanitary plumbing systems are a vital necessity for health in all settled communities and are hardly less essential in rural households. Although the American people have expended hundreds of millions of dollars for plumbing installations the principles of their general layout have never been thoroughly understood. Actual practice has been governed by opinions and guess work, often involving needless costly precautions which many families could ill afford. The lack of generally recognized principles is responsible to a certain extent for the contradictory plumbing regulations in different localities.

"Thanks to the work of the subcommittee and of the Bureau of Standards, the whole situation is altered, and there is now a scientific basis upon which State and local codes and small-dwelling installations may be based.

"The way is opened for effective standardization of plumbing supplies, with reduced costs to the industry and savings to the consumer."

The president of the plumbing goods manufacturers' association stated that he regarded this work as the most important now being done by the Government.

3. Elevator Interlocks

It is estimated that 75 per cent of elevator accidents fatal to the public occur as a result of the door being open when the car is not there, or of the car being moving while the door is open. To prevent such accidents interlocks are used. These devices are supposed to prevent the elevator being handled in such a way as to make it dangerous, but sometimes they wear out or get out of order.

At the request of the city of Baltimore, the Bureau of Standards developed a laboratory service test of such interlocks. The testing mechanism is designed to open and shut the door and work the controller in the correct manner, and it also tries to work the controller when the door is open and to open the door when the car is not at the door. These are the things the interlock is supposed to prevent, and each failure to prevent them is automatically recorded.

In this test interlocks may be run under good conditions or without grease, as desired. Provisions are also made for running them in a dust-laden atmosphere or in an atmosphere containing corrosive fumes.

Baltimore has adopted this test as a part of its elevator code and permits the use of no interlocks that have not passed the test. Other cities and States are expected to adopt it soon. Recently Dr. W. R. Whitney, of the casualty underwriters, suggested giving a 10 per cent discount in insurance rates on elevators using interlocks that have passed the test, and it is estimated that a saving of $500,000 per year in insurance would result.

4. Reduction of Unnecessary Sizes and Useless Variety of Articles in Common Use

A tremendous economic waste is caused in industry by the manufacturing and marketing of an unnecessary number of sizes of any given article as well as by a useless variety of articles for the same purpose. The division of simplified practice of the bureau has taken the lead in reducing this waste, and has accomplished a great deal during the past year.

Conferences are called by this division, at which manufacturers, jobbers, consumers, and the bureau are represented, and as a result of these meetings, simplification programs are decided upon where the conditions warrant.

The recommendations of the bureau have been adopted in the following fields, reducing the number of sizes of these widely used articles, as shown: Bed springs and mattresses, from 78 to 4; metal lath, from 125 to 24; woven-wire fencing, from 552 to 69; hollow building tile, from 36 to 19; building brick, from 78 to 2; milk bottles, from 49 to 9; milk-bottle caps, from 29 to 1; hotel chinaware, from 700 to 160; files and rasps from 1,351 to 496; bed blankets, from 78 to 12.

There is an opportunity for a great deal more work of this kind, and a large number of field surveys are in progress to determine the lines of work which ought to be considered in the immediate future.

5. Improvements in the Use of Gas

A surprising amount of ill health, and many deaths, result from the use of gas-burning appliances which generate carbon monoxide. This gas results from incomplete combustion due to defective adjustment of the appliance, or to the use of appliances unsuited to the local conditions of gas supply. Carbon monoxide is colorless, odorless, and very insidious in its action. Doses insufficient to produce death cause headaches and other symptoms which may be attributed to almost anything else, while a fatal dose is likely to produce collapse as its first symptom.

In cooperation with the American Gas Association, the Bureau of Standards has been engaged in the effort to remedy this condition. A thorough study has been made of the adjustment of burners, and of the relation of burner design to the nature of the gas supply. It has proved possible to point out the conditions under which appliances are likely to be dangerous, and to show which appliances are suitable to gas-supply conditions in a given locality and which are not. Those found unsuitable are being locally eliminated from the market, and it is believed possible to restrict each type to locations where it is suitable. Specifications and tests are being developed whereby the association may determine the suitability of an appliance to given conditions.

Another question concerning the use of gas in which the bureau has been interested is the value of the heat content expressed in British thermal units, as a measure of the utility of the gas. This question has been the subject of considerable debate among the makers and users of gas, some of the former contending that the B. t. u. content was not a true measure of its usefulness.

A large amount of data on this subject has been investigated, and the conclusion has been arrived at that the B. t. u. content is a direct measure of the usefulness of the gas to the consumer, and that it should be established as the standard in fixing the cost of gas. This standard is already in use in England.

6. Investigation of Dental Materials

Marked improvement in the service to be expected from inlays and other materials used in dentistry is expected to result from investigations of these materials made by the Bureau of Standards. The investigation was made in cooperation with manufacturers of dental materials and is being carried further in cooperation with the American Dental Association.

Studies were made of the various instructions and formulas for dental work, many of which were found to be defective. Measurements were made of the expansions of various materials in setting, and it was found that those made according to many formulas now in use give such poor fits that considerable length of service can not be expected. It is believed that improvements resulting from this investigations will bring about savings of millions of dollars annually in dental costs and even more important savings in health.

7. Standardization of Hardware Finishes

Under the leadership of the Bureau of Standards the committee representing the principal hardware manufacturers of the country agreed on the standardization of the finishes used on building hardware. Twenty-five standard finishes were agreed upon at the conference. These are to be maintained at the bureau and made available to all manufacturers. There had formerly been on the market a very large number of hardware finishes, each manufacturer having his own standards, which were liable to change. The reduction in this number is expected to result in considerable economy for the manufacturers and still more for hardware dealers and home builders.

8. Logging and Sawmill Safety Code

A code covering desirable safety provisions in the lumbering industry has been prepared in cooperation with lumbermen and sawmill operators. This code covers the various phases of the industry from the felling of the timber to the handling and storing of the finished product in the mills. It includes such details as the operation of logging railroads, rafting and driving of logs in rivers, handling of explosives, guards for sawmill machinery, and precautions against fire. This code is being received with much interest and favor by the lumber industry, and it is expected that considerable savings will result from following its provisions.

9. Levulose, A Sweeter Sugar

The preparation of levulose at a price low enough to permit of its being put on the market has been made possible by methods developed in the Bureau of Standards. This sugar is the sweetest and one of the most wholesome and nutritious of all sugars. Its preparation has heretofore been so expensive that it could not be sold for less than $30 per pound.

Levulose is prepared from Jerusalem artichokes, and the amount which can be obtained from a pound of artichokes is equal to the amount of sugar obtained from a like quantity of sugar beets. It is estimated that about the same tonnage can be raised on an acre as of sugar beets, and the cost of farming is considerably less. The cost for manufacture is less, or should be less, than for beet sugar, because it can be carried on for nine months of the year when the beet sugar factory is necessarily idle.

It will be recalled that some two years ago the bureau was successful in the establishment on a commercial scale of the manufacture of dextrose from corn. In contrast to levulose, the latter sugar is much less sweet than ordinary sugar. It has already found a large market such as in candy manufacture.

10. Measurements of Heat Radiation

Instruments devised by the Bureau of Standards for measuring the infra red radiation given out by bodies below the temperature of incandescence have been used for making measurements of the heat given out by planets, and the heat radiated from paints and other materials.

Such measurements were made on the planets Mars and Venus, using an especially sensitive instrument devised for the purpose, and gave highly interesting indications of the conditions on those planets. On Mars it was found that the blue-green areas, generally supposed to owe their color to vegetation, were considerably warmer than the reddish-yellow tracts believed to be deserts. It was also shown that the side of the planet on which the sun had just risen, was much cooler than the side where the sun was near setting. The surface temperatures of the planet during the summer season were shown to be similar to those encountered on cool summer days on earth.

Measurements on Venus showed a difference of temperature between the Northern and Southern Hemispheres and of the different portions of the unlighted side of the disk. These measurements are believed to indicate the possibility of a period of rotation for the planet comparable to the length of the day on the earth. Astronomers had previously believed that the planet always kept the same side toward the sun.

Radiometric measurements on paints and other materials showed that paints containing aluminum or bronze pigments are very poor radiators. The amount of heat radiated from surfaces painted with these materials is only a small fraction of that radiated from surfaces painted in other ways. Thus when such paints are used on household radiators, about 20 per cent more surface is required for the same heat effect as when other paints are used. On the other hand, the use of such paints reduces by

one-half the amount of heat from the sun which gets through the top of an automobile or an ice wagon. Tents painted with aluminum paint are found to let through only about one-fourth as much heat as unpainted tents. Aluminum paint is therefore recommended for automobiles and ice wagons, balloon hangars, tents, etc., but almost any other kind of paint is better for radiators.

The aluminum paint does not have to be removed from radiators before applying the other materials.

11. Radio Frequency Standardization

Interference between radio broadcasting stations and between other types of radio sending stations can best be avoided by assigning to each station a certain frequency and seeing that it keeps to that frequency. There is a tendency for a station to get out of adjustment, however, and to keep it right a wave meter or other method of checking its frequency is required.

The Bureau of Standards has therefore rated the establishment of radio frequency standards among its functions for a number of years, and to the propagation of these standards by standardization of wave meters it has recently added the broadcasting of standard radio frequencies with which amateur and commercial sets may be standardized. During the past summer this service has been extended to the Pacific coast, the standard frequencies being broadcasted from the station at Stanford University.

An improved method of establishing frequency standards has been developed making use of the harmonics produced by a simple type of harmonic generator whose fundamental is an audiofrequency alternating current. This method has the advantage that the fundamental can be checked during measurement against the frequency of a standard tuning fork, the comparison being made by means of a visual indicator. The indicator consists of a galvanometer so connected to the harmonic generator and to the oscillating circuit of the tuning fork that the pointer stands still when the two are in synchronism. If there is the slightest difference, however, the pointer waves back and forth, the frequency of the swings being equal to the difference of frequency of the two circuits.

A large number of harmonics, up to 100 and higher, can be utilized, since the use of the visual indicator permits of very sharp tuning.

12. Work for the Federal Specifications Board

The bureau has assisted the Federal Specifications Board in the preparation of 162 specifications of commodities for Government use the past year. The bureau staff holds chairmanships of 24 committees and is represented on nearly all of the 65 technical committees of the board. Many of these specifications have required elaborate preparatory experimental work in the bureau's laboratories. These specifications are of great value to the Government in unifying purchase requirements and effecting economies. They are also being widely adopted by public bodies and are being more and more used in industry.