

## DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS February 18, 1924.

WASHINGTON

TWELVE OUTSTANDING ACCOMPLISHMENTS OF THEBUREAU OF STANDARDS IN 19231. Automobile Brake Linings

Following the war when the Quartermaster Corps of the U.S. Army decided to place a large order for automobile brake linings the Government was confronted with a large number of salesmen all claiming to have the best brake lining. The Bureau of Standards was consulted but had no definite information to contribute. It was therefore decided to undertake a cooperative research to establish a satisfactory method of testing brake linings, and to determine the relative merits of the various brake linings on the market. In the preliminary tests it was found, instead of all brake linings being the best that the wear factor between the best and the worst was 20 to 1. In other words the best brake lining wore twenty times as long as the worst. The manufacturers who were unable to sell their product to the United States Government started immediately and vigorously to cooperate with the Bureau of Standards to improve their product, and all the manufacturers who stayed in the business made rapid progress. The leading automobile manufacturers as well as the brake lining manufacturers soon installed testing equipment similar to that designed by the Bureau of Standards, so that the improvement in all the brake linings installed in new automobiles has been enormously advanced. Within the last few months the design of the testing equipment has been completed in what is believed to be essentially the final form. A conservative estimate on the value of this work carried out with the cooperation of the Quartermaster Corps and the manufacturers leads us to believe that the quality of brake linings in the average car today is three times as good as that in use when these investigations started. This means approximately \$10,000,000 annual saving in the cost of brake linings and \$5,000,000 saving in the cost of installing brake linings. In other words the annual saving to the country from the brake lining investigations amounts to about \$15,000,000. Besides this there is unquestionably a saving of human lives which it is impossible to estimate.

2. The Establishment of the Dextrose Industry

For over forty years the corn products industries have sought to discover a commercially practicable method for producing chemically pure glucose, that is a white crystalline product similar in appearance to granulated sugar. The public has waited long for a pure, cheap carbohydrate food similar to sugar but without its sweetening power. It has been vitally needed in many industries



such as condensed milk, ice cream, etc. The Bureau discovered how to make this product commercially and one of its staff made 4,000 pounds of the pure dextrose in his first experiment at a large commercial plant. As a result of our laboratory work and this factory experiment new factories aggregating a cost of more than \$2,000,000 have just been completed for the purpose of producing dextrose. In addition one American company is now building three large factories abroad, in England, France, and Germany. The Bureau of Standards is responsible for the creation of this new industry and it is impossible to predict its ultimate value to the commerce and industry of the nation.

### 3. Making Gypsum Plastic

About two million tons of calcined gypsum are used annually as the basic ingredient in wall plaster. The chief fault found with this material has been its lack of plasticity, making it difficult for the plasterer to spread it on the wall. So important was this factor that gypsum plasters always contained admixtures of lime or clay to make them more workable. The Bureau has invented a process for improving the plasticity of calcined gypsum, the patent being given to the public. A recent survey of the mills in western New York shows that this process has been generally adopted, thereby reducing or eliminating the lime or clay admixtures. Since the lime and clay add to the cost and detract from the value of the plaster after it has hardened, the public can now obtain a better material at less cost, as a result of this invention. Other mills in Iowa and Canada are known to be using the process.

### 4. Automobile Tires

A part of the power required to propel an automobile is expended in deforming the tires. Recent tests conducted by the Bureau of Standards have shown that this power loss is much less in cord tires than in fabric tires, and that in consequence fabric tires heat up more on the road. On the average a saving of one horse-power is made by using cord tires on a car instead of fabric tires. The manufacturers have joined in pushing cord tires and the fact is the fabric tires are on a fair way to disappear from the market. At the present time we estimate that the fabric tire has so far lost ground in the market, that the reduced quantity of gasoline necessary to propel cars is saving the nation annually \$40,000,000. This does not of course in any sense mean that the nation has consumed less gasoline; it merely means that the gasoline that has been consumed has been used more efficiently.

### 5. New Sound-Ranging Device for Locating Survey Ships in Foggy Weather

Heretofore, Coast and Geodetic Survey ships engaged in depth-sounding measurements off the Pacific coast have been able to work only about 5 days a month owing to fog. A sound-ranging device has been developed in cooperation with the Coast and Geodetic Survey which will enable the ship to determine her position relative to shore stations in foggy weather, which means that the

$$\begin{array}{r} 12 \overline{) 15} \\ \underline{12} \\ 30 \\ \underline{24} \end{array} \quad \begin{array}{r} 1.25 \end{array}$$

~~20,000~~

$$\begin{array}{r} 1.25 \\ \underline{2} \\ 250 \end{array}$$

~~20,000,000~~

work can be carried on four times as fast as heretofore. The cost of operating a survey ship, whether surveying or waiting for favorable weather, is about \$15,000 a month, and the saving effected by the use of this device in carrying out necessary surveying operations will amount to hundreds of thousands of dollars.

#### 6. New Safety Release Device for Compressed Gas Cylinders

The Interstate Commerce Commission requires tanks containing compressed gases such as hydrogen and oxygen to be equipped for shipping purposes with safety release devices designed to prevent the tanks from exploding in the event of fire. The Air Service reports hydrogen losses in storage amounting to 15 percent per year due to the fatigue and failure of the safety release devices now used. At the request of the Air Service a new safety release device has been developed which obviates this loss and at the same time insures positive operation in the event of fire. The Secretary of the Compressed Gas Manufacturers' Association estimates that the annual shipment of oxygen in the United States amounts to 1,500,000,000 cubic feet. The retail value of this quantity of gas would be approximately \$20,000,000. Assuming the average storage period of the oxygen to be only one month and the loss due to premature failure to be that observed by the Air Service for hydrogen, it follows that the new device when generally adopted will effect a saving in oxygen alone amounting to \$250,000 a year.

#### 7. New Electrical Strain Gages

The Bureau has recently devised a strain gage which makes use of the change in electrical resistance of a pile of carbon discs to measure minute changes in the length of materials such as occur when building structures or bridges are loaded. The changes in length which occur with varying stresses are shown by electrical instruments which can be read at any distance from the gages themselves. Moreover the indications are practically instantaneous so that the gages show the actual strains to which structures are subjected, and not merely an average over a considerable time as is done by most instruments.

These instruments have been developed so far largely for the uses of the Army and Navy and have been used by them for measuring stresses in airplane stays, in the metal structure of dirigibles and in determining the forces exerted by the wind on airships.

The Bureau has received requests from a large number of outside sources for the use of the instruments in other engineering projects. One of these is an investigation of stresses in bridges to be made by the Iowa State Highway Commission and the American Society of Civil Engineers. Another is the measurement of actual stresses in the interior of concrete dams. The use of the instruments will make it possible to check up the theoretical calculations on which structural design is now based and will contribute very greatly to the development of safer, better and more permanent structures. Technologic Paper No. 247 describes this new instrument. The Bureau has used this device in bridge investigations.



### 8. The Properties of Ammonia

The Bureau of Standards has probably the best group of experts in the world for investigating the properties of fluids, such as steam and ammonia, used in the production of power and refrigeration. One group of five or six men has been working for over five years on measurements of the thermodynamic properties of ammonia. This work has been completed and will be accepted as authoritative for many years to come. It will command admiration for the ingenuity employed in solving difficult problems and for the high accuracy of the results obtained. The American Society of Refrigerating Engineers has cooperated with the Bureau in carrying this work forward.

The prime need for data of this kind is in the design, testing and operating of refrigerating plants. Refrigerating plants are designed to produce definite results and sold upon guarantees that these results will be obtained, and both design and testing require the use of accurate fundamental data. It is difficult to place a money value on the results of these investigations, but the efficient operation of the refrigerating industry, with an investment in this country of perhaps two billion dollars depends in part, upon reliable data of the kind provided by such investigations. The results are compiled in Circular 142 entitled, "Tables of Thermodynamic Properties of Ammonia." These tables have been accorded not only national but international recognition and acceptance.

### 9. Pure Platinum

One of the fundamental problems of this Bureau is to produce pure samples of all the elements as well as to determine their properties. This is of great importance because the progress in civilization hinges upon our knowledge of the materials surrounding us. After many years of the most difficult and painstaking work pure platinum has been produced. This is of very little concern just now to the jewelry industry but it is of much concern to American science and industry. Just recently there was occasion for a comparison and it was found that the Bureau of Standards platinum was not only the purest produced in this country but that it was superior to that of any other country.

The primary importance of pure platinum is in connection with its use in platinum thermocouples and resistance thermometers which are indispensable in the measurement of high temperatures such as are used in almost every metallurgical and manufacturing process. In other words the uniform success of the American manufacturer in a great many instances depends upon his ability to know and to duplicate his temperatures in furnaces, kilns, and ovens and this rests upon the question of the purity of platinum. The value then of pure platinum can not be measured in terms of the gold or platinum of commerce but rather in terms of steady improvement in the quality of American manufactured goods.

### 10. Investigations of Tableware

Some time back a representative of the American Hotel Association announced the policy of giving goods of better quality to the American hotels. He came to the Bureau of Standards for assistance. After explaining that the American hotels were one of the largest purchasing groups in the country he





inquired as to which materials would be the best on which to initiate work. Since the Bureau of Standards had already developed methods of test for tableware and specifications for the purchase of tableware for some of the Government Departments and since tableware on the average is completely used up once every three months in the ordinary hotel it was decided to undertake this work first.

The investigations of tableware were carried out in the laboratory with various samples of American and imported ware. The impact tests were made to measure the resistance to breakage in service such as occurs in dropping. Tests for crazing of the surface were made by interchanging the samples from hot to cold water, and also tests were made as to the absorbing power. Finally a satisfactory method for testing the surface scratching of dishes in use was simulated by studying the decrease of weight in a sample of ware after a column of falling sand had worn against the plate for a short interval of time.

It was found in carrying out these investigations that American manufactured tableware was superior to that imported in all respects except with regard to surface scratching. The American Hotel Association placed a large number of dishes of foreign make and American make simultaneously in service in several leading hotels. The results of these tests were consistent with the laboratory measurement.

#### 11. Minimum Requirements for Small Dwelling Construction

The Building Code Committee of the Building and Housing Division has prepared a book with the above title embodying a model building code for small houses, together with a very complete discussion of the data on which it is based. The code is in form suitable for adoption as a municipal ordinance. The appendix, which comprises two-thirds of the book, gives data on the strength and durability of building materials as determined by tests at the Bureau of Standards and elsewhere, and describes details of building construction in which mistakes are most likely to be made. Experienced architects, builders, building inspectors, and others were consulted in securing this data.

In his letter of acceptance of this publication Secretary Hoover said in part, "I am confident that -- this work will result not only in a very appreciable money saving to millions of American families, but that it will have a positive influence toward better housing that cannot be counted in dollars." The results of this work appear in a report published by the Government Printing Office.

#### 12. Radio in Navigation

For a number of years past the Bureau has taken an active part in developing the radio direction finder and auxiliary apparatus to make possible the use of radio in navigation. Automatic equipment for sending out definite radio signals from lighthouses has been devised and such sets have been installed in a considerable number of lighthouses. A simpler outfit which can be installed



on buoys to operate for considerable periods without attention is now being developed. Its use will make possible the substitution in some locations of buoys for the present very expensive lightships.

Another radio device especially useful for air navigation but applicable in certain places for ocean navigation is a beacon which sends out a beam in a definite direction so that airplanes or vessels with ordinary receiving apparatus can determine when they are following a specified line or are deviating from it. (This consists of crossed coils which send out signals alternately so that the navigator when following the correct line hears the two of equal strength. If he deviates from the direct line one signal grows louder and the other fainter.) This device is described in Scientific Paper No. 480.

