

file copy 11
(11/11) 11

ARMY INDUSTRIAL COLLEGE.
(Course, 1927 - 1928)

FUNCTIONS AND ACTIVITIES OF THE BUREAU OF STANDARDS.

Lecture.

Doctor George K. Burgess,
Director, Bureau of Stds.

February 9th, 1928.

INTRODUCTORY REMARKS - COLONEL IRVING J. CARR, S.C.

Gentlemen:

We are very fortunate in having with us this morning, in connection with our study of specifications, the Director of the Bureau of Standards who will speak to us on the general principles and growth of the system of standardization and simplification.

We must realize that our job is to get production. The very minute we do anything to wreck production we are permitting a very serious error and, conversely, if we are not reaching out and attempting to obtain information on all points that tend to slow production, from a mass standpoint, in meeting our requirements in time of war we are overlooking a very serious point.

You will find as you proceed in your studies in this class, and as I have previously pointed out, that there is much evidence during the last war of where we did fall down in our specifications, especially in those calling for uncommercialized processes, for patterns, spare parts, etc., unknown to the commercial life.

We now have a very large set up, both in commercial life and in the Government, to care for this feature and probably there is no other person more familiar with this set up than Doctor Burgess. The Federal Specification Board, the Engineering Standards Committee, the National Screw Thread Commission, and various other scientific research departments are all centered around him and he is either the Ex-officio Chairman or member of most of them. He is the "brass tack" man on the subject and has first hand evidence of everything being done along that line.

I take great pleasure in introducing Doctor Burgess.

FUNCTIONS & ACTIVITIES OF THE BUREAU OF STANDARDS.

Gentlemen:

Please do not be appalled at this mass of data. I find it convenient in going before the Committees of Congress to have my material with me and it sometimes makes a very good impression.

I am reminded from the remarks Colonel Carr has just made of the difficulties encountered during the war as to certain requirements in specifications. During the first period of the war the Italian Mission, in trying to buy steel for airplane parts, had a total sulphur and phosphorus requirement of .03 percent. You can well imagine that they could not buy any steel under that specification. It was a matter of education for them to find that the British, French and Americans were getting along with quite an added increase in amounts of sulphur and phosphorus. In Italy they might have been able to meet their requirements, for small amounts of steel, but it was impossible in this country due to the fact that it was not a commercial requirement.

Your Chairman has asked me to make a general statement regarding the Bureau of Standards, emphasizing in particular our relations with other bodies in the Government as well as in the engineering and industrial fields. I shall endeavor to get that information to you in as concise form as I can and will be very glad to answer any questions you may have in mind at the close of my talk.

Of course, as you perhaps already know, the Bureau of Standards represents two things - one is standardization and the other is research. Those two go hand in hand. We cannot have standardization and draw up our specifications unless we have an adequate knowledge of the materials which are concerned in the specifications. There is always a very considerable amount of laboratory and research work that must be done on material before a specification can be adequately written.

I do not remember a single case in which a specification has been gotten out by a group of men without someone raising the question as to whether the requirement was such or such - .04, .05 or .06 in the case of steel for instance. I might mention at the start that the supply of steel was a very serious question during the war. At that time it was considered desirable to determine, if possible, what should be the limitations of phosphorus and sulphur for steel for various types and uses.

This may serve as an illustration of some of the cooperative work involved. At that time the United States Railroad Association and the Bureau of Standards, together with the Society of Testing Materials, were cooperating in an effort to obtain standardization not only in railroad materials but in other materials of similar types. You can see that the railroads were in a peculiar position; they could not afford to haphazardly increase the properties or limitations of a steel, especially those elements which were recognized as deteriorious elements. If there is a wreck and it is shown that the phosphorus-sulphur contents of the steel is too high, the

15

railroad company is held responsible for the wreck.

The economic situation in the country at that time was such that it was very difficult to maintain an adequate quantity of sulphur and phosphorus, according to specification, for the different groups of materials. A committee, composed of such organizations as the Society for Testing Materials, was formed to ascertain certain facts in order that the different government departments and other interested bodies could write specifications based on those facts.

That movement was of very great economic importance, involving not only safety but a great many other factors, and the program had to be on a full scale basis. Laboratory experiments on small samples would not be satisfactory to the industries, particularly to the railroads. This committee was composed of representatives of the Bureau of Standards, the American Society for Testing Materials, the American Railway Association, the United States War and Navy Departments, the Society of Automotive Engineers, the Association of American Steel Manufacturers, the Steel Foundry Association of America, etc., and was formed in 1919 with two representatives from each member organization. We adopted what was then a new policy in outlining a program of work. This is of considerable importance and I believe worth while calling to your attention. We agreed at the first meeting that we would not sit on opposite sides of the table and make faces at each other but would sit around the table and do everything on a unanimous basis; also it was agreed that each individual representing a unit would bring in all his information on any subject and when we were outlining

our work and discussing the results thereof, he had to agree to put all his information before the rest of the group. He could never come back to the group at a later date and say that if certain things had been done other results might have been obtained. This scheme of agreeing in advance on unanimous consent, of pooling all information, has worked most successfully. Of course we have had discussions; no subject can be taken up without differences of opinion. Nevertheless those differences were thrashed out and we were really not concerned with them but with questions of fact.

The work to be done was handed out to those who could do it. The American Association of Steel Manufacturers was designated to care for the manufacture of steel for this committee, the Foundry Association for the foundry products, etc., and these Associations arranged to have their different companies produce the material. That material was sent to Annapolis and Washington, The Navy and War Department laboratories, and to the Bureau of Standards - all tests being made simultaneously on the materials. The Bureau of Standards was used as a re-check laboratory in cases of differences. The costs of these tests were maintained by the various industries conducting them. The results are published annually in the various reports of different industries and it is expected they will eventually be published by the Government through the Bureau of Standards' series. We are working on both a sulphur program and a phosphorus program; we have nearly completed the sulphur but have just started the phosphorus project.

The result of the committee's work has already had a very considerable effect on the economic production of steel on the one hand and a feeling of security in the specifications, in the determination of the various elements in steel, on the other.

That by way of introduction of one type of cooperative business, of work in which the Army and Navy Departments together with the Bureau of Standards are interested. I will now take up the Bureau of Standards itself.

The Bureau was founded in 1901 as an offset from the Coast and Geodetic Survey. Previous to that time it was a small office in the Coast Survey, concerned with standards of length, mass, and (to a small extent) temperature. That original unit of eight people has grown to a total of eight hundred and eighty-five, with sixty-five stations of research associations. Roughly speaking, we have an appropriation of two and a quarter million dollars; we have transferred to us from other Government departments between two and three hundred thousand dollars for projects carried on out at the Bureau.

When the Bureau of Standards Bill was up in the House Hearings and representatives from various departments of the Government were called on to testify for the Bill, one of the departments stated that it could see no possible use for a Bureau of Standards; that they had a good set-up of their own and would never use the Bureau. However, that department has used the Bureau more than any other of the services.

The history of the Bureau may be divided into three parts - the pre war period, the war period, and the post war period. In the

first period we were engaged in setting up our fundamental standards and carrying on investigations and laboratory work on projects and phenomena relating to physics and chemistry. We were let pretty much alone during this period by industry and the departments of the Government. We were going through that childhood state in which we were cutting our teeth and it was very well that we were let alone. We were very busy and laid a foundation for our future work very successfully.

War came on and it is very interesting as a fact to note that with an organization devoted to physics and chemistry, fundamental research and test, it was possible for the Bureau of Standards to change over night from civilian activities to activities for military departments with no change in personnel except the necessary increase and with our regular equipment with its increases. The work we did during the war is best illustrated in the "War Book of the Bureau of Standards", which describes some of the work accomplished for the military departments.

I consider it one of the greatest assets of the country to have on a civilian basis an organization available for such an emergency as it was proven it can be so available and is so available - an organization of scientists and engineers engaged in rather complex, varied activities in those sciences.

Regarding the organization of the Bureau of Standards as it is today. We have some nine technical divisions, also a Division of Simplified Practice and a Division of Building and Housing. A brief word regarding some of the technical divisions might be inter-

esting at this point. There is the Electricity Division consisting of nine sections concerned with standards and testing, also carrying out research in cooperation with industry as well as those projects originating in the several government departments. That particular statement is true for nearly all of the divisions. We have a Division of Weights and Measures, another of Heat and Power - with thermometers at one end and automotive and airplane engines at the other end of the scale. Then there is the Optics Division with its various sections - Spectroscopy, Polarimetry, Colorimetry, Optical Instruments, Radiometry, Atomic Physics, (Radium, X-rays), Photographic Technology and Interferometry Sections. Then we have a Division of Chemistry which is heavily charged with work for the other Government departments - more so than any other of our divisions. Its heavy work is in the field of analyzing supplies under purchase. They do some very excellent investigation and research work. We have a Division of Mechanics and Sound, applying not only to acoustic problems, question of transfer of sound through walls, etc., but also to some very complex acoustic problems for the military services and engineering work. We have two large machines, horizontal and vertical, available for engineer testing purposes. We have an Organic and Fibrous Materials Division which is concerned with Rubber, textiles, paper and leather. One of the outstanding pieces of work of that Division has been the improvement in our currency paper. We have a Division of Metallurgy. The Clay and Silicate Products Division is a very large one, devoted to clay products, white ware, glass, refractories, cement, etc.

5

We have recently, in connection with the demands for standardization work from the commercial point of view, set up an organization which is not yet completely formed but is rapidly taking shape - the Commercial Standards Group. In this group are included the Division of Simplified Practice, the main part of the Building and Housing Division as well as the Divisions of Commercial Specifications and Commercial Standards. We have considerable numbers of tie-ups and links with outside organizations coming under that Commercial Standards Group.

The above is the set-up of the Bureau of Standards as an organization. We also maintain some three branch laboratories for convenience in testing supplies in different localities. It is not desirable for the Government to use outside testing laboratories when government sources are available and there has been considerable pressure put upon us to increase our facilities for testing in these outlying branch laboratories.

I will now speak a word about the volume of testing. It is not quite evenly divided between the Government and the public but we, however, do almost no material testing for the public, mostly instrument testing. In the case of materials, we are so very heavily charged with work from the Government departments that we ask the public to take their work to outside laboratories - partly also because we do not wish to antagonize these laboratories. We will do the work in case of a dispute as to a material or something new which might be of national interest, both civilian and military, but such work is very limited indeed. We have issued a list of commercial

and college laboratories which will make tests to determine whether deliveries comply with specifications. Practically all the facilities of the country are included in that list.

Last year we started to issue what we call the Standards Yearbook. Its object is to compile each year a brief statement of the accomplishments in standardization activities for the whole country and to get it between covers. It is a convenient reference book for the progress in standardization. You get activities of all sources as well as government departments. The 1928 Yearbook will emphasize the activities in foreign countries. We expect that book to be of considerable use in showing progress in standardization from year to year.

A word more as to our cooperative activities. Perhaps the most fundamental cooperative body with which we are concerned is the International Committee of Weights and Measures. That Committee is made up of thirty-six states, meeting every six years in Paris, and its function was primarily to set up the metrology standards and carry on investigations on standards. They have a laboratory outside of Paris. The relation of the national laboratory to the international has come very much to the front. It is concerned primarily with the kilometer and temperature scale. The present status is, however, that the national laboratories are in a better position than the international to carry out a great deal of work which is to be accomplished. There has not been a complete uniformity in standards from one country to another. All standards work is based, in the last analysis, on the standards of mass, length, time and temperature. With these four you can get anything, and it is highly desirable from the international point of

view that these four be uniform throughout the world. Time is obtained from the stars and is easily checked at any time. The unit of length in this country is subject to considerable discussion. The meter is the international standard of length; the American and English yard does not quite agree but we have been endeavoring to get together with the British in obtaining the same length. In the Seventh Conference held in Paris in September and October, the Committee affirmed the definition of a meter in waves of metric light. Giving the ratio of the yard to the meter, it is easy to get the subdivisions of the yard with accuracy. The temperature scale has also been variable and at the last Conference was brought in a position agreeing with London and Berlin. It is a little different from mass and length and you cannot set it up in terms of anything you can keep but rather in terms of some phenomena. I call attention to this international activity as it is the fundamental basis for our standardization.

We have set up in this country the National Screw Thread Commission, established by Congress in 1918, composed of representatives of the Commerce, War and Navy Departments, as well as the American Engineers Society, the Society of Mechanical Engineers. The findings of the Committee, when approved, become mandatory on the part of the Government. They are not mandatory on the part of industry but the Secretary of Commerce recommends to industry the using of such findings. I can safely say that the reaction of industry towards these findings have been most favorable, our meetings being attended by representatives of the automotive and mechanical industries. They have aided us considerably in mapping out the work of the Committee.

are carried at present but the Government does not prefer to do so. The Bureau of Standards is interested in a great many of the items coming up before this Board.

When a specification is prepared by a committee, that committee is instructed to make sure that it has consulted every interested industry. Some of them have been more successful in that activity than others. The specifications are sent around to various bodies for comment; if there is no objection they are promulgated. If there is an objection, the committee is instructed to consider same and if an adjustment is required to make it. If these adjustments cannot be made the specification is promulgated anyway. Each Secretary of a department has the right, under an executive order, to waive the application of a specification to his department. No one has asked for exemptions under this set up but there have been cases, however, in which it was more or less evident that the requirement of a certain specification and the carrying out thereof involved a hardship.

Waivers are taken care of by application to the Chief Coordinator. The Federal Specification Board is under his jurisdiction and he can issue a waiver on the department concerned, showing cause therefor. The object is to have the government purchase under the most advantageous conditions and if it is not advantageous for an outlying station or post to be held to a certain specification, a waiver is granted.

Some of our unofficial cooperating bodies are made up of producers and consumers and certain other organizations and associations generally concerned in the question at hand.

From the start the Bureau has been very active on various committees by individual representation; it has also done great deal of work on the Committee of Standards, caring for the laboratory work in connection with the set up of same. I consider that Committee one of the most useful bodies in the country in supplying a set up both for materials and commodities and one in which there are represented both the manufacturer and the consumer. Such specifications as they get out are usually sound, workable and commercial.

I have not mentioned the Research Association scheme which carries out the projects industry wants done. We have spent some four hundred thousand dollars a year on research work in the Bureau.