SCIENCE

VOL. LVII JUNE 8, 1923 No. 1484

SCIENCE: A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

100 Liberty St., Utica, N. Y. Garrison, N. Y.
New York City: Grand Central Terminal.

Annual Subscription, $6.00. **Single Copies, 15 Cts.**

Entered as second-class matter January 21, 1922, at the Post Office at Utica, N. Y., Under the Act of March 3, 1879.

COOPERATION BETWEEN THE MAKERS AND USERS OF SCIENTIFIC APPARATUS IN AMERICA[1]

ALMOST exactly one year ago these two societies met upon a similar occasion for a joint dinner, following which there were presented several invited papers in which were discussed the importance of scientific apparatus in research, the good which might result from closer cooperation between the makers and users of apparatus and the lines along which such cooperation might take place. As a result of this discussion there was passed by the joint meeting a resolution urging the councils of the two societies to request the National Research Council to call a conference of representative makers and users of scientific apparatus at some convenient time during the forthcoming year.

In part as a result of this resolution the National Research Council called together early in January of the present year a small group for the purpose of discussing the desirability of calling a larger conference and of making arrangements therefor if such a larger conference seemed desirable. A very short discussion at once convinced those in attendance at the preliminary meeting that the larger conference was desirable. Accordingly the National Research Council through its division of research extension issued invitations to some eight different scientific societies and several government and semi-government departments to send representatives to such a conference to be held in Washington, March 23 and 24, 1923.

We are now met for the second annual joint dinner and it is appropriate upon this occasion to recount the results of the conference held about one month ago.

[1] Presented at the joint dinner of the American Physical Society and the Association of Scientific Apparatus Makers of the United States of America in Washington, April 20, 1923.

When the conference convened in the conference room of the National Research Council at 10:00 A. M., March 23, those who had been influential in calling the conference were very much gratified to find an attendance of nearly one hundred per cent. All but one or two of the original thirty or thirty-five persons invited either were present or sent substitutes. This large attendance seemed at once to answer the question which had frequently been raised: is such a conference worth while? The fact that thirty men were sufficiently interested to leave their busy offices and to spend two days in Washington discussing the American apparatus industry seemed to answer the question in the affirmative.

The conference was called to order by Mr. W. M. Corse, chairman of the division of research extension of the National Research Council. Dr. Vernon Kellogg, permanent secretary of the National Research Council, was introduced and in a few well-chosen words welcomed the conference on behalf of the Research Council and pointed out that such activities were quite in harmony with the ideals of the Council in furthering research. Following Dr. Kellogg's address Dr. George K. Burgess was elected permanent chairman of the conference. The success of the conference was due not a little to the skill of the chairman in encouraging discussion and in introducing the informality of a round table.

The program, as prepared in advance by the preliminary committee, was made up of four parts: (1) apparatus supply; (2) standardization of apparatus; (3) information service; (4) inspection service. It would, of course, be impossible at this time to give even a summary of the various papers and discussions. The stenographic reports of the conference cover some fifty single-spaced typewritten pages. But a few remarks may be made with regard to several of the papers in order to indicate some of the more important points brought out and discussed.

The first paper was by Mr. Walter Eimer on the importation of scientific apparatus. Mr. Eimer pointed out that previous to 1874 practically all scientific apparatus was imported. About that time, however, there was a desire for better service and for greater accessibility of supplies. As a result of this agitation the American apparatus industry was started. But as late as 1913, eighty per cent. of the total supplies and equipment needed in certain lines was being imported. The beginning of the European war greatly increased the demands which the American user made upon the American maker of apparatus. The maker of apparatus, however, in spite of difficulties in securing capable workmen and in getting the necessary raw material, rose to the occasion and in 1921 only five to eight per cent. of supplies in these same lines were being imported. At the present time manufacturing houses are adding one line after another with a consistent improvement in quality. In some cases the quality is superior to that which was formerly imported. For example, chemical glassware now available in this country has no equal in the European markets. Recent tariff legislation has resulted in preventing a European monopoly and in view of healthy competition does not seem likely to result in a monopoly in any line in this country.

The question of domestic apparatus manufacture was discussed jointly by the present speaker and Mr. M. E. Leeds. It was pointed out that the uses of apparatus may be divided into three main groups. First, apparatus required for instruction; second, for research; and third, for testing and control in industry. Apparatus intended primarily for instruction, whether for lecture or laboratory work, should be neat and attractive, should have the appearance of careful designing, but need not have the high precision required in research. For research, on the contrary, appearance is secondary while precision is a primary requisite. It was pointed out that it is desirable to develop a line of apparatus primarily intended for the individual demonstration of some of those phenomena in physics and chemistry which can not be demonstrated to a whole class and which nevertheless are of such a kind as can not be readily studied in the laboratory with the limited time available to the majority of students. Mr. Leeds spoke of domestic apparatus from the manufacturer's standpoint. The keynote of his talk may be indicated by the following quotation: "If we depend on foreigners for the development of our apparatus

we shall always be copyists and shall be one jump scientifically behind those from whom we buy." Not only is it important from the standpoint of our scientific work that we should develop our own methods and apparatus, but it is important that the manufacturer from his standpoint should cooperate in developing such new apparatus, since it frequently happens that a special laboratory instrument in a short time becomes a standard laboratory instrument for many types of measurements, or even an essential tool of a great industry. There is reason, therefore, for the closest cooperation between the maker and user of apparatus.

The subject of the instrument shop of the research and college laboratory was discussed by Dr. W. D. Collins. Dr. Collins pointed out that the laboratory shop could usually justify its existence because of the necessity in research and instruction for making repairs or special apparatus in a hurry and that in the construction of new apparatus it had the great advantage of bringing about personal contact between the designer and the maker, rendering unnecessary the rather expensive laborious task of making drawings, blue prints, etc.

The final paper on apparatus supply was by Dr. H. E. Ives on the subject of the manufacture of special apparatus not now made in the United States. Dr. Ives pointed out that a very great many of our most important pieces of apparatus for instruction and for research have originated abroad, as is indicated by the frequent use of foreign names in connection with instruments. Thus we have the *Lummer-Brodhun* photometer; the *Bragg* X-ray spectrometer; the *Dolezalec* electrometer. Although there are some pieces of apparatus bearing American names, nevertheless one is almost justified in concluding that there are more scientific ideas in Europe than in America, the moral of which fact being obviously of joint interest to makers and users of apparatus. The difficulties of manufacturing in America some of the special apparatus needed are very great. Among them may be mentioned such items as scarcity of skilled labor, high labor costs and the general tendency in America to quantity production. We ought, however, to originate more apparatus here and to cultivate a better respect for instruments and a better understanding between those who make them and those who use them.

The subject of standardization of apparatus proved unexpectedly interesting to those who had not given particular thought to this question. The first paper in this group was by Mr. J. M. Roberts on "Limitations of types and sizes." A systematic effort has been made by the makers of and dealers in chemical glassware and supplies, cooperating with the American Chemical Society and other users, toward the standardization of sizes and dimensions for the purpose of eliminating the large number of comparatively little used items and sizes. By means of a questionnaire it was found that a fairly large number of makers and users would agree upon certain eliminations. As an example of what was accomplished, in the catalogue of one supply house which listed one hundred forty-eight different types of gas burners, seventy were eliminated. Some of those eliminated had been designed fifty years ago. Out of two hundred twenty-seven items covering chemical porcelain, ninety-nine were eliminated. One hundred twenty-three out of one hundred ninety different forms of gas analysis apparatus were dropped; one hundred seven out of one hundred ninety-nine sizes and kinds of funnels. In all, the committee in charge of this work eliminated some eighteen hundred out of thirty-two hundred items without in any way restricting methods either in instruction or research. More difficulty was experienced in the standardization of physical apparatus. But even here a careful study made it possible to eliminate some six hundred fifty sizes and designs out of two thousand items listed. Mr. Roberts reported that the work was being continued and that the apparatus makers were cooperating with and would welcome further suggestions from the educational committees of the various scientific societies interested.

It is unnecessary to comment extensively on the importance of this study which Mr. Roberts and his associates have made. The savings as a result of economy of manufacture and of reduction in capital tied up in supplies are being passed on to the consumer in the shape of reduced costs. Already one manufacturer has announced reductions of from ten to twenty-five per cent. in net prices.

Mr. H. C. Dickinson discussed the standard-

ization of parts on the basis of the experience of the automotive industry, as an illustration of what might be done along, of course, somewhat different lines in connection with scientific apparatus. Mr. Dickinson pointed out that largely through standardization of parts and of methods a Ford car costs a very small sum to build, whereas were an engineer to start out from the beginning it would cost at least one hundred thousand dollars per car. In the automotive industry this standardization of parts has been accomplished without in any way restricting the designer. Similar standardizations could be made in scientific apparatus without restricting the scientist as to method or choice of apparatus.

Dr. G. K. Burgess spoke on standardization of method of measurement. If the eliminations in apparatus catalogs already noted have taken place without standardization of method, how much more might be accomplished if scientists could agree upon certain standards with regard to methods of measurement.

The subject of information service was discussed by Mr. Boulton Earnshaw, Dr. W. E. Tisdale and Mr. M. E. Leeds. Mr. Earnshaw pointed out from the standpoint of the purchasing agent the desirability of readily accessible sources of information as to where various supplies and pieces of apparatus could be obtained. One difficulty which he mentioned was the location of manufacturers of certain rare chemicals. Dr. Tisdale spoke of the Research Information Service of the National Research Council and stated that the Council was very glad to be of assistance in this connection. Mr. Leeds discussed the importance of scientific bulletins concerning the use of apparatus and stated that very frequently such bulletins prepared by manufacturers had actually been used for class purposes.

The final topic, inspection service, was discussed by Dr. E. W. Washburn, who stated that manufacturers of apparatus could perform a very valuable service to users by sending around well trained inspectors who could adjust special apparatus or make simple repairs. Frequently such a skilled repair man could do in a few moments what would take the laboratory mechanician several hours to do even though the apparatus did not have to be sent back to the factory for repair.

Perhaps the most important part of the meeting, as well as in some ways the most interesting, was the general discussion at the third half-day's session, March 24.

Those of us who had the privilege of attending the conference were convinced that our time was well spent and that we were amply repaid individually for our efforts. But we of course represented actually only a small number of users and makers and the question may well be raised, what was the value of the conference to American scientists and to the American apparatus industry in general. Was it simply another activity interesting enough in itself, but of no possible permanent or general value? The answer to these questions depends largely upon one's viewpoint.

The first and most important thing in my mind with regard to the conference is the simple fact that it *was* held. For the first time a group of makers and users of apparatus gathered together for a common purpose to discuss problems in which they are mutually interested. Whatever may be the outcome of this movement the simple fact is that this conference marks its beginning. If the solution of any problem is half completed when the problem is clearly stated, it is certainly true that an important step in the solution of any problem is the recognition of its existence. The conference discussed many things. And there can be no question but that the problem of closer cooperation between makers and users is an important one, whatever further work may be done in this direction.

Closely associated with this simple fact that the conference was held is a group of rather intangible results likewise of most importance to those of us who had the privilege of attending. Some three dozen men representing all branches of the apparatus industry and of research and pedagogical interests met each other, became more or less acquainted and came to have somewhat of an appreciation of each other's problems. The inevitable result of such contacts is to develop a spirit of tolerance and of good will. If we think that the bill which is rendered us for apparatus or supplies is a little too large we have only to keep in mind the fact that apparatus makers have no subsidy, that they must run their business with a reasonable margin of profit in order that they

may be able to undertake some of the newer developments which so many of us users desire. If the General Electric Company, for example, had not made money from its business and had not had the foresight to spend that money in research the whole world would not now be enjoying the economies which come from the use of the tungsten lamp. Could we have foreseen the immense value to civilization of the tungsten lamp it would have been commendable for the United States government to have spent a million dollars for research in this direction. We can see it all very clearly now, for our "hindsight" is always better than our foresight. And I feel confident that fifty years from now scientists can look back upon the present decade and the two or three following and point out the value of cooperation between makers and users of apparatus. It perhaps requires some courage now to think that the movement is worth while and is likely to produce tangible results.

To offset the indefiniteness of some of the results of this conference, valuable as those results are, certain steps were taken which are somewhat more tangible. It was realized at the outset that the conference would fail utterly if its influence were felt only by the few who attended. Accordingly there was passed by the conference a resolution requesting the National Research Council to form a permanent committee to be known as the "Committee of apparatus makers and users" which should consist of representatives (one or more as indicated) from the following technical societies and organizations: American Chemical Society, American Physical Society, American Ceramic Society, American Institute of Electrical Engineers, Optical Society of America, American Electrochemical Society, Manufacturing Chemists Association, American Society for Testing Materials, Bureau of Standards (two representatives), Association of Scientific Apparatus Manufacturers of the United States of America (six representatives) and additional members at large to be appointed by the committee itself. It was suggested that there should be formed an executive committee of the main committee, which should consist of seven members selected by the main committee. It would be the duty of this executive committee to initiate such projects as might be suggested by the several members of the larger committee or by others interested. The executive committee subsequently added the Society of Automotive Engineers and the American Society for Steel Treating to the list named above. It is proposed to have a meeting of the large committee once a year, which meeting should discuss the general question of apparatus manufacture and use and which should be open to all interested.[2]

Among the questions which doubtless will come up for discussion and which may result in the initiation of important problems of a cooperative nature may be mentioned the question of facilities for making special apparatus, further standardization of apparatus and supplies, the development of an inspection service and the like.

It is to be hoped that all of those interested directly or indirectly in American science, whether from the standpoint of actual users of apparatus or from the standpoint of those who profit financially or otherwise from scientific research, will heartily support this movement to build up a strong apparatus industry in America to the end that American science may be strengthened. Those of us who are interested in this movement are not thinking of the question from the standpoint of narrow patriotism, for a scientific fact is just as valuable to the civilized world whether discovered in America or in Europe. But we do feel that American science, just like the American citizen, has an individuality and an independence which, from the standpoint of our contribution to world service, we can well afford to cultivate.

CORNELL UNIVERSITY F. K. RICHTMYER

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SUMMARY OF THE PERMANENT SECRETARY'S SEMI-ANNUAL REPORT, MARCH 31, 1923

THE work of the association has proceeded satisfactorily during the first half of the fiscal

[2] The National Research Council announces that through its division of research extension it has formed the Committee of Apparatus Makers and Users essentially along the lines of the resolution passed by the conference.