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The Month in Focus

By LINUS PAULING

PROPOSED FEDERAL AID TO RESEARCH IN SCIENCE AND MEDICINE

THE great contributions to the war effort made by scientists during the past five years have made the public aware that the welfare of the nation depends upon adequate support of research in science and medicine. Moreover, we are beginning the postwar period with a great deficit—not only a deficit of trained scientific personnel, resulting from the interruption of the education of the 165,000 men who, except for the war, would have received scientific or engineering degrees during the war years, and were prevented from receiving these degrees, but also a deficit in the body of fundamental scientific knowledge. The contributions made by scientists during the war years were very largely based on fundamental discoveries made before the war. Further progress in industrial development and in medicine will be possible only if proper support is provided for basic scientific research.

NECESSITY FOR AID

It has been clear that the sources of funds drawn upon in the past for support of basic scientific research will not be adequate in the immediate future. Franklin Delano Roosevelt on November 17, 1944, sent to Dr. Vannevar Bush, director of the Office of Scientific Research and Development, a letter in which he said, "The information, the techniques, and the research experience developed by the Office of Scientific Research and Development and by the thousands of scientists in the universities and in private industry, should be used in the days of peace ahead for the improvement of the national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living," and in which he asks for recommendations about the part that the federal government could play in fostering scientific and medical research for the good of the people.

The reply to this request was made by Dr. Bush in a report, "Science: The Endless Frontier," sent to President Truman on July 19, 1945. This report was prepared with the aid of four advisory committees, dealing respectively with medical research, research in the natural sciences, the discovery and development of scientific talent in

American youth, and the publication of information about the contributions to scientific knowledge which have been made during our war effort.

As a member of the Medical Advisory Committee, I had an opportunity to see how great an effort has been made to find a way of providing the needed federal aid to research in science and medicine without invoking the evils such as political influence and mediocrity of performance which may characterize government activities. It is my opinion that the recommendations made by Dr. Bush are sound, and that the nation will benefit greatly if they are followed.

PLANS

These recommendations have been embodied essentially in a bill, S. 1285, which was introduced by Senator Warren G. Magnuson. This bill and an alternative bill, S. 1297, introduced by Senator Harley M. Kilgore, are now under consideration by the Senate Committee on Commerce and the Senate Committee on Military Affairs. The bills have been discussed by many members of the staffs of the California Institute of Technology, the Mount Wilson Observatory, and the Huntington Library at an informal weekly seminar on world affairs which is now being held under the chairmanship of Professor Earnest C. Watson, and a statement about the opinion of this group has been formulated and sent to the members of the two Senate committees and to the senators and representatives from California. This statement is presented below. In addition, a national committee of 43 members, the "Committee Supporting the Bush Report," has sent to President Truman a letter in which closely similar recommendations are made; this committee includes four members of the staff of the California Institute of Technology, Professor Carl D. Anderson, Professor Carl Niemann, Professor G. W. Beadle, the new chairman of the Division of Biology of the Institute, and myself.

I recommend that you read the Bush report, in order to obtain a sound basis for an opinion as to the possibilities of future progress in research in science and medicine and of the need for support from the federal

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but they were all high-priced cars, ranging from \$2,500 for the four-cylinder car of 1905 to \$6,500 for certain later models. A seven-passenger, six-cylinder model appears in *Fig. 12*.

By 1915, it had become clear to me that mass production methods would eventually spell the doom of the high-priced car. I was in ill health at the time, and, having received an excellent offer from the Westinghouse Company for our plants in Chicopee Falls and Springfield, I accepted the offer and retired. This move I have never regretted.

Testing and Metering in Natural Gasoline Operations

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The equipment now almost universally employed for measuring gas volumes is the orifice meter. Its operation is based upon the principle that the rate of flow of fluid is a function of the pressure drop caused by the presence of a suddenly restricted opening or orifice of known size inserted in the line.

For every combination of pipe size, orifice size, flowing pressure, and temperature and specific gravity of gas, a given differential pressure across the orifice corresponds to a definite rate of flow of gas through the line. Tables are available for relating these quantities.

Of the factors named above, pipe size of course remains constant. The size of orifice may be varied at will simply by removing one orifice plate and inserting another. The specific gravity of the gas from a particular source is usually so nearly uniform or changes at such slow rate that periodic determinations of this property are adequate. Temperature is either taken daily at a time representing average conditions, or, where large volumes of gas are involved, it may be recorded continuously. Continuous records of both line pressure and differential pressure are usually made on clock-operated charts attached to the orifice meter. These charts are usually changed daily.

The charts are sent in to a field office, where the pressures indicated on them are averaged. From carefully kept records of the other conditions existing at each meter, the corresponding volumes of gas are computed with the aid of the tables mentioned above.

Fig. 4 is a photograph of a number of orifice meters installed on gas lines from gas-oil separators in which fluid from individual wells is separated into wet gas and crude oil streams ahead of the natural gasoline plant. *Fig. 5* is a picture of a number of orifice meters located inside a natural gasoline plant to measure streams entering or leaving processing equipment.

METERING LIQUIDS

Orifice meters are applicable to the measurement of liquid flow as well as gas flow and are widely employed for this purpose in natural gasoline operations. Typical locations are on lean oil streams to absorbers, feed and reflux streams to fractionating columns, etc.

On the other hand, orifice meters are less reliable in determining rates of flow of volatile liquids than in measuring the flow of gases and vapors. Accordingly, while they have been widely used for operating control purposes, they have been considered unsuitable for measuring volumes of finished stocks produced at natural gasoline plants. For this service, positive displacement meters of the general type used in domestic water and gas service are often employed. The use of meters

on finished product streams makes possible the observation of rate of production without the necessity of accumulating large quantities of highly flammable liquids in gauging and shipping tanks in the plant area where boilers and gas engines might present an ignition hazard.

As has been the case with most industries, there has been tremendous technological progress in the last 25 years in the natural gasoline industry and the related liquefied petroleum gas industry, which actually developed from infancy to maturity during that period. Improvements in metering and testing methods have contributed effectively to that progress.

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government. This report can be obtained from the Government Printing Office for 30 cents.

November 13, 1945

To the Members of the
Senate Committee on Commerce
and the
Senate Committee on Military Affairs
Gentlemen:

We have a feeling of deep concern regarding the pending legislation on federal aid to science. We share the belief of the sponsors of this legislation that expansion of our scientific work can yield returns of great benefit to the nation.

The manner in which this aid is administered is vital to the success of any program undertaken. We have studied this matter, and we transmit to you our considered opinion on the two administrative plans which you now have under discussion.

It is our belief that the top authority in the proposed National Research Foundation should rest in a board or commission of scientists and laymen chosen by the President on the basis of interest in and capacity to promote the purposes of the Foundation, and not in a director who would be aided by a board with only advisory duties. The responsibilities of the top authority will be so great and the fields to be covered are so extensive that only a broad and representative board of most able men could effectively assume this responsibility and authority.

We believe that the Foundation can achieve its objectives better by grants to institutions for the support of broad fields of scientific research and scientific education than by contracts for research on specified and closely limited problems.

We believe that the Foundation should not supervise or direct research activities of other government agencies, and should not have the duty of surveying these activities, but should arrange for suitable interchange of information between government agencies and research men carrying on work with the support of the Foundation; and that officers of other government agencies should serve *ex officio* on certain advisory panels of the Foundation, such as Advisory Panel to the Division of National Defense, but that no such *ex officio* members should serve on any board or commission of this Foundation to which authority is delegated.

Recognizing the great need of study of human relationships, we believe that the Foundation should provide suitable support for the social sciences and humanities as well as for the medical and natural sciences, that the social sciences and humanities should be suitably represented in the membership of the board or commission, and that provision should be made for scholarships

and fellowships in the social sciences and humanities as well as in the medical and natural sciences.

It is our considered opinion that Bill S. 1285, which was introduced by Senator Warren G. Magnuson and is based on the report, "Science: The Endless Frontier," made to President Truman by Dr. Vannevar Bush, conforms far more closely to the requirements stated above than does Bill S. 1297, which was introduced by Senator Harley M. Kilgore, and we urge that you recommend passage of the Magnuson Bill S. 1285 (Committee Print of October 12, 1945), in order to achieve the maximum benefit from scientific research for all of the people.

Yours very truly,

(This letter was signed by 84 members of the California Institute of Technology Weekly Seminar.)

C. I. T. NEWS

NOVEMBER ALUMNI MEETING

THE November meeting of the Alumni Association was held at the Kaiser Steel Plant at Fontana, Calif., on November 15, 1945.

Interest in the plant and in association activities was adequately demonstrated by requests for reservations from 350 C.I.T. alumni in the Los Angeles-Pasadena area.

The meeting, which had been arranged by Donald R. Warren of the Donald R. Warren Company, a Tech alumnus, assembled for dinner in the Kaiser Plant cafeteria. After the dinner, Chuck Varney, president of the Association, introduced M. W. Sahlberg of the Warren Company. Mr. Sahlberg related the story of the construction of the plant, portions of which were designed by the Warren Company. In an amazingly short time what had been raw land became a fully integrated unit capable of transforming the ore from the Vulcan Mine at Kelso, in San Bernardino County, Calif., and from Utah to finished steel products.

Construction started in March, 1943, and nine months later the blast furnace began to deliver the metal which has gone into the hulls of hundreds of ships needed for victory, as well as into countless other war materials. Mr. Sahlberg told of the important part in the structural design and engineering which had been played by Jim Fox, chief engineer of the Warren Company and a C.I.T. graduate of the class of 1936.

The members of the Kaiser Steel Company who were to act as guides and hosts for the inspection tour were then introduced. They were:

Thomas M. Hart, assistant general superintendent
W. A. Vogt, plant engineer
Thaddius Kay, assistant plant engineer
Wright M. Price, material and cost engineer
Franklin C. Frye, special combustion engineer
Nathan Hittelman, project engineer
Warren Hubbard, Sr., project engineer
Lynn Jones, electrical engineer
Harry Riegel, superintendent of utilities

Itinerary of the trip included the coke ovens, capable of processing 1728 tons of coal per day; the blast furnace, with 1200 tons capacity; the five stationary and one tilting type open hearth furnaces, of 185-ton capacity each; and the plate and structural mills and merchant mill. The plate mill is designed to roll plates

from three-sixteenths inch to one inch in thickness and up to 92 inches in width. The structural mill—rated at 70 tons per hour—produces I-beams, channels, angles, blooms and billets. The merchant mill produces light structural sections, rounds and squares and reinforcing bars. Stops were also made at the power plant, the soaking pits, and the ore and coal storage structures. The trip afforded spectacular views of the tapping of the blast furnace and the unloading of the coke ovens as well as a splendid opportunity to see the scope of the whole process of steel making.

The Alumni Association wishes to express its appreciation to the Kaiser Company and the Donald R. Warren Company for making the trip possible.

SEMINARS REVIEW CURRENT EVENTS

MEMBERS of the faculty of C.I.T., of the staffs of the Huntington Library and Mt. Wilson Observatory are meeting in weekly seminars at Caltech to discuss the relations of science and technology to society and government.

Attendants at the seminars, which have been held throughout October and November, have heard reports from Dr. C. C. Lauritsen and Dr. Paul Epstein on the necessity of arriving at a method of control of the atomic bomb, a discussion by Dr. Linus Pauling of two bills before the Congress proposing federal financial aid to science, reports from Professor Horace Gilbert on the effects of concentrated British-U. S. bombing of German industry, and an eye-witness account from Commander J. T. Hayward of the damage done at Nagasaki and Hiroshima by the atomic bomb. At the seminar of November 27, Dr. Edwin F. Gay reported on the work being done in the social sciences and the funds being expended for projects and investigations in the field of the humanities.

Out of these seminars have come two newsworthy documents; first, the open letter to the President of the United States, setting forth the belief of the members of the seminar that control of the atomic bomb and atomic development must be established at any cost on first a national and then on an international basis. The complete text of this letter was carried in the November issue of *Engineering and Science*.

Following the letter on the atomic bomb, and indirectly related to the same subject, a second document, addressed to the members of the Senate committees on commerce and on military affairs, stated the group's majority conclusions on the subject of federal aid to science. This letter appears in connection with Dr. Linus Pauling's editorial in the "Month in Focus." The reports by Professor Gilbert and Commander Hayward on the effects of bombing against Germany and Japan brought to light many startling facts, and as this information is released by the government, *Engineering and Science* will relay reports to its readers.

THOMAS HUNT MORGAN

DR. THOMAS HUNT MORGAN, 79, one of the world's foremost authorities on heredity and 1933 Nobel Prize winner, died December 4 at Huntington Memorial Hospital, Pasadena, after a brief illness.

Professor emeritus of biology at the California Institute of Technology, to which he came in 1928 as a leader of research in at least five fields and as president of the National Academy of Sciences, Dr. Morgan won the \$40,000 Nobel Prize in medicine for his investigations concerning the eugenic function of the chromosomes.