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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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 educational 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.)