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## THE KILGORE BILL<sup>1</sup>

By Dr. VANNEVAR BUSH

DIRECTOR OF THE OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT

As I promised in my letter of August 18, I am now writing you a further letter in regard to S. 702. It is a long letter, for I have commented not only on the bill itself, but also more broadly on the general subject, in the attempt to give you my thoughts in a constructive manner. These comments apply not only to S. 702 but also to its companion bill, H.R. 2100, which was introduced by Mr. Patman on March 5, 1943, and was referred to the House of Representatives Committee on Patents.

This problem that we both have been studying is exceedingly important. Since it may well involve the future health, comfort and safety of this nation to an extraordinary degree, its importance warrants all the effort which you and your committee have been devoting to it.

It has two phases. One is the appropriate organization of science and technology for the prosecution

of the war. The second is the corresponding problem in times of peace.

In my opinion, these two phases can not be treated as a unit. In times of war this great democracy does many things that are aimed at a relatively brief intense effort. We centralize authority, subject ourselves to rationing and restraints and send our sons to fight under the necessary rigors of military organization. Events have already shown that a democracy which thus girds itself for war can contend successfully with the most rigid of totalitarian states. In fact, it can overcome them, for the resourcefulness, initiative and self-reliance which are engendered in a people by the privileges of democracy, when marshalled under a temporary authoritative war organization, can surpass by far the performance of any permanently regimented people in the complexities and technicalities of modern war. We have already proved this in Africa, in the Far East and over Europe, and we will prove it again and again as the war progresses.

<sup>1</sup> Letter to the Honorable H. M. Kilgore, United States Senate, Washington, D. C.

I trust that we as a people will never forget what we have learned and are learning during this war period.

Thus, in time of war, I believe in a centralized control, and I believe such control can appropriately be applied to science and its applications, if every effort is made in the process to preserve the independence of action of scientific and technical groups within their assigned spheres of action to the maximum possible extent. This has been the philosophy of the Office of Scientific Research and Development, and the record will show that it has been successful in its fields of development of new weapons and military medicine.

As applied to the war period, S. 702 seems to have four major objectives. First of all, it would alter the existing administrative organization of scientific activities by setting up an Office of Scientific and Technical Mobilization having the powers specified in Section 4 of the bill. Secondly, it would further amend the provisions of the Selective Training and Service Act of 1940, as amended, by setting up a separate procedure for the granting of occupational deferments to people having scientific or technical training and experience. Thirdly, the administrator of the Office of Scientific and Technical Mobilization would be given certain powers with respect to the requisitioning of scientific and technical facilities during the war. Lastly, the bill would vest in the Office of Scientific and Technical Mobilization very broad and far-reaching patent rights. I think that it may be helpful for you to have my comments on and reactions to each of those wartime objectives.

As I pointed out in some detail in my letter to you (dated December 7, 1942) commenting on the bill (S. 2721) that you introduced at the last Congressional session, there is an adequate existing administrative setup handling the necessary scientific war activities. Under Executive Order 8807, the President granted rather broad powers to OSRD, a temporary war agency, concerning the planning, coordination, initiation and support of scientific and medical national defense research activities. These powers have been carefully scrutinized for the past several years by the Congressional appropriation committees, and the Congress has seen fit to finance OSRD's operations by providing the necessary appropriations. Acting under that authority provided by the President and the Congress, OSRD has become the keystone of a closely integrated, highly cooperative organization of war research and development work for the Armed Services. That such an organization has been and is successful is best evidenced by the great confidence shown in it by the Armed Services and by the extremely important results that have been achieved.

It seems to me that it would be ill-advised and dangerous to throw a "monkey wrench" into such finely

meshed machinery at this late date by such a major administrative change as is reflected in S. 702. Because of the inevitable disruption and confusion that would result from such a major organizational change, it seems to me that the Congress might better concentrate its efforts on remedying any flaws that you may find in our existing organization rather than attempt to superimpose an over-all organization at this late date in the war period.

The second major wartime change reflected in S. 702 concerns the better utilization of our scientific personnel by amending the Selective Service Act. Subject to that Act and all the powers and regulations of the War Manpower Commission, OSRD has mobilized a large percentage of the best qualified scientists and technicians of the country, primarily by means of the execution of contracts with educational institutions and industrial organizations whereunder specific war projects are conducted. However, OSRD's powers concerning the utilization of scientific personnel in war work have not included any authority to affect in any way the operations of the Selective Service System by controlling generally the disposition and utilization of men having scientific and technical training. The relationship of our scientific manpower to the Selective Service procedure has not, in my opinion, been clearly defined, and the procedure for ensuring that men of this special training are used to full advantage in places where their talents could best further the war effort has been ineffective. It seems to me that the prosecution of modern war requires the treatment of scientific men as a special group to be specially allocated for work in the fighting services and in civilian research, and that this can not be done adequately under the present procedures of the Selective Service System. There is no question here of shielding a special class against the rigors of war. It is rather the question of the intelligent use of a great nation's asset. The young men who make up this group should be under orders to serve where needed and, if the public interest indicates that they should remain in the laboratory rather than serve in the field, they should be retained in the laboratory. Likewise, when they are needed in the field they should be transferred there under orders to share the combat hazards with the members of the Armed Services in performing their duties. In other words, the scientific group should have their own selective service system, adapted to placing them exactly where needed.

My comments on this point are not intended to be in criticism of the efforts of the present Selective Service System because my point is directed rather to the legislative basis on which they operate. As a matter of fact, in spite of its inherent difficulty, much progress has been made on the job by the cooperation

between the various governmental agencies involved. The problem is far from solved, however, and even at this late date I think that it would be advisable to enact legislation placing the matter on a firm basis. Therefore, I suggest that the Congress might well consider Section 5 of S. 702 along with other pending legislation affecting the operations of the Selective Service System in order to work out as soon as possible a solution to this problem that is consistent with the solution to other manpower problems.

Concerning that part of S. 702 dealing with the requisitioning of scientific and technical facilities needed by the Government for war purposes, it seems to me that no such legislation is needed because the present patent and war emergency laws are adequate for the purpose. Under existing legislation, the Government has the right to requisition facilities and to use patents needed for war purposes in cases where it is not possible to negotiate with the owners. Although such power is now available for use, it has been the experience of OSRD that it is necessary to exercise such powers only in the most exceptional cases. As a whole, we have found the owners of facilities and patent rights to be more than willing to turn over the use of their property to the Government for war work on a reasonable basis.

The last point covered by S. 702 in wartime concerns the vesting in the Government of certain patent rights. On this point, I think that it is important for you and your committee to consider the possible effects of such legislation on the prosecution of the war. Since the declaration of the National Emergency on May 27, 1941, the Government has entered into thousands of contracts calling for work in connection with the development and improvement of war weapons. At least in the case of OSRD, all research and development work has been done under such contracts on a non-profit basis, both by educational institutions and commercial organizations. In handling inventions made by commercial organizations under its contracts, OSRD has followed the lead of the Army and Navy by providing in the contracts that the Government shall receive a royalty-free license to such inventions for specified purposes and that the title to such inventions shall vest in the contractors. In a great many such cases, of course, the contractors concerned have worked for many years, spent considerable sums of money and accumulated many patent rights before they arrived at the point of development reached at the time of the execution of their first Government contracts. Thus, work under government contracts frequently involves only minor adaptations of past inventions made by the contractors, and in such cases the contribution to the final product attributable to the work financed by the Gov-

ernment is relatively insignificant. In all such cases the Government has followed the theory that it should pay reasonable royalties for the use of inventions made prior to the Government contract and should receive only a royalty-free license for developments made under a Government contract.

The theory expressed in Section 7 of S. 702 constitutes a radical departure from the theory heretofore followed by the Government in dealing with war contractors concerning patent rights. I think that it is important to recognize the fact that such a radical departure undoubtedly will be vigorously fought by those persons and organizations opposed to the theory that the Government should be the owner and custodian of all inventions made since May 27, 1941, under contracts or other arrangements whereby the Government has contributed "any money, credit, physical facilities, or personnel." Even though provision is made for the payment of fair and just compensation for the seizure of such property rights, there will be many who will protest that the Government has broken faith with those who have relied upon equitable contractual agreements entered into in good faith by organizations whose primary purpose has been to make more effective the prosecution of the war. It is my considered judgment that the storm of controversy that would arise upon the enactment of such far-sweeping legislation, especially from those large commercial organizations whose complete cooperation and attention is vitally needed in the war program, would do irreparable harm to the united and concerted program for the development, improvement and utilization of war weapons that is now being carried on so effectively. Therefore, I suggest that consideration of a radical departure from the present governmental system of handling patent rights at least be deferred until after the war is won and that it then be made the subject of very careful study before action is taken.

On the general question of the advisability of such patent legislation, I wish to point out that the President has appointed a Patent Planning Commission which has been working on this general problem for some time. I regard the first report of the commission as being a valuable step toward effectuating certain advisable changes in our patent system, and I understand that the commission is now at work on a second report dealing with the problem of Government ownership of patent rights. In view of the complexity of the problem, I believe that it is advisable to await the results of the commission's study before any attempt is made to enact legislation.

My personal views concerning our patent system have been expressed before the Temporary National Economic Committee, but perhaps it will be helpful to summarize them here. In my opinion, one of the

primary factors bringing about our extraordinary technical advancement and our high standard of living has been the fact that this country has had a sound patent system stemming from the Constitution. That system now needs some revision in order to make it consistent with modern conditions and to benefit from our past experience. Any such revision, however, should be made deliberately and with great care so that the fundamentals which have proved so valuable to the country over a long period of time are not injured. I believe that it is essential to the health of our industrial life for us to have a constant influx of new, small and aggressive companies, and our sound patent system up to date has made possible the advent of such companies. Thus, it seems to me that basically our present patent system furthers the public interest.

Of course, it is inevitable that over a period of time the Government should accumulate a large number of patent rights, especially considering the present number of Government employees and Government contracts providing for such acquisition. I agree with other commentators that at the present time we have no fully adequate method of handling such patent rights for the full benefit of the public, and I am in complete sympathy with the attempts of the Patent Planning Commission to work out a uniform administration applicable to all Government agencies that will be in the best public interest. However, inasmuch as the patent system problems cover many issues that are complicated by war conditions and are quite unrelated to the general scope of S. 702, I think that the problem requires separate legislative treatment and full consideration by all the Congressional committees having jurisdiction over patent problems.

Summarizing my views on the wartime aspects of S. 702, it seems to me that (i) the proposed administrative changes are undesirable and would be detrimental to the effective prosecution of the war, (ii) the proposed requisitioning power covering scientific facilities is not needed, (iii) the proposed change in the Selective Service System concerning scientists and technicians should be considered carefully by all the Congressional committees studying the manpower problem, and (iv) the proposed changes affecting inventions and patent rights should not be made during wartime because it would be a source of confusion and dissatisfaction that would be harmful to the war effort, but certain such proposals might profitably be referred to the Senate and House Committees on Patents for consideration along with other suggestions concerning the improvement of our patent system. Thus, I conclude that no over-all legislation of the type embodied in S. 702 is needed at this time con-

cerning the organization of scientists in connection with the war effort.

That leads me to approach S. 702 from the standpoint of studying its proposals concerning the appropriate peace-time organization by the Government of the scientific affairs of the country. This aspect is fully as important as the first, especially since we are getting along reasonably well in applying science to the war effort, and it is important for the prosperity and safety of the country that equally successful relations between the Federal Government and the scientists be maintained in the years of peace to come.

You and I have in view the same end; namely, the best furtherance of science for the benefit of the country. Although we may differ in our analysis of the methods to be followed in achieving that objective, I think that the matter is of such importance that it should be studied from every angle and every shadow of thought explored in an attempt to reach the best solution. It is in what I think is a spirit of constructive criticism that I find myself in disagreement with details of the peacetime aspects of S. 702 and even more strongly with the underlying philosophy upon which they are formulated. I am in agreement with other aspects of the bill, however, and I shall attempt to emphasize these and point out the means which my experience in science and Government leads me to believe will form the basis for beneficial legislation.

Before discussing the effect of the proposed legislation on different scientific groups, it seems advisable to point out that my analysis is based on the assumption that "all agencies and departments of the Federal Government," as used in Section 4 (f) of S. 702, means "all agencies (of the Federal Government) and departments of the Federal Government." If a broader meaning is intended under which the power of coordination given to the Office of Scientific and Technical Mobilization would extend to non-governmental agencies as well as agencies of the Federal Government, many of the comments which I shall set forth below would be quite different. The question of interpreting properly the quoted words brings up what I think is a fundamental inconsistency between the extremely broad purposes set out in Section 1 of S. 702 and the much more limited powers that would be given to the Office of Scientific and Technical Mobilization under Section 4 in order "To effectuate the purposes of this Act, . . ." It seems to me that this inconsistency should be recognized by a narrower definition of the purposes of the Act.

There are three great groups of scientific and technical men in this country: those in public service, those in industry and those in universities and non-profit independent scientific institutions. In considering the

need for central control over science by the Federal Government beyond that which existed prior to the war, it is necessary to examine and analyze these three groups separately.

We should, of course, continue scientific activities on the part of agencies and departments of the Federal Government, and the Congress should support such activities generously because there are many phases of scientific work that can best be done by men in the Government service. As a nation we can be proud of the accomplishments of many of our Government laboratories, such as the Bureau of Standards, the Public Health Service, several of the Department of Agriculture laboratories, and so on. In the past there have been several proposals to centralize all government scientific work in a single department, possibly making this a new Department of Science with cabinet representation. This idea is attractive to many, especially as it would seem to give an added recognition and support to science in Government departments. There are, however, several disadvantages to such a full unification of governmental scientific effort that should be weighed carefully before any such move is effected.

The greatest difficulty would lie in divorcing each separate Government scientific effort from close association with the department most interested in its work. For example, the scientific work of the Bureau of Entomology and Plant Quarantine, the Bureau of Agricultural Chemistry and Engineering, and other such bureaus, are almost inseparably connected with the work of the Department of Agriculture as a whole. Similarly, the Geological Survey derives strength by being a part of the Department of the Interior. Examples of this sort could be multiplied. I am sure that centralized control by a new independent agency of all scientific work in Government departments would be strongly resisted. Certainly the War and the Navy Departments would insist that they control absolutely the secret work on new weapons which they conduct in their own laboratories in times of peace, much as they might be willing to supplement their own activities by requesting and receiving help from the universities, industry and other governmental laboratories. Therefore, I have come to the conclusion that it would be difficult to gather all science activities of the Government into one organization without serious sacrifice. As a matter of fact, I judge that you have reached the same conclusion because I do not find any such complete integration of governmental research in the bill.

In Section 4 (f), however, I do find a provision for the coordination of the governmental research activities of the various federal agencies and departments.

This, I judge, is not intended to imply either power to direct or power to control, independent of the heads of departments and agencies, but rather a central scientific clearing house set up for the interchange of data and plans in order to prevent overlapping and to facilitate that cross-fertilization of scientific effort which is often highly valuable. I have long thought that a body set up for this explicit purpose might perform a very useful function. It should certainly have joined with it an advisory scientific group, drawn on a voluntary basis from the best qualified scientific personnel of the country. There has been an increasing tendency in recent years, much to be welcomed, for individual bureaus to establish such advisory groups for their own purposes. They have often acted as reviewing bodies for the heads of the departments concerned, and their influence has been important and beneficial. A central body would form a desirable linkage between these.

In passing, allow me to present a thought in this connection which is not a part of the bill, but which is allied with this matter. I have often wondered that the Congress and its committees do not avail themselves more freely of the advice of the scientists of the country. True, the Congress has available all the scientific men in the executive departments for aid when it approaches a problem of scientific nature, but it does not often call upon more widely constituted groups. The departments and agencies often seek advice in this manner, turning usually to the National Academy of Sciences, which was constituted by Congress for this explicit purpose. Some agencies, notably the National Advisory Committee for Aeronautics, include scientific men in their organizations who serve on a voluntary basis, and I think that all will agree that this has worked well in the case of the N.A.C.A. But the committees of Congress themselves seldom use the scientists of the country directly, much as these men are willing to thus contribute their services voluntarily to their country's welfare and interests, and I feel that this could be done to advantage.

It may well be asked, how does one select scientists for this and similar purposes, in order to be sure of their ability and disinterestedness. Such a question is pertinent to a discussion of the bill, for I feel that its provisions for the selection of the necessary scientific personnel are not adequate for ensuring the services of men of the necessary caliber.

There is only one sound criterion for estimating the standing and capability of a man of science, and that is the evaluation of the way in which he is regarded by his colleagues in his profession. If there were only one way of doing this, perhaps it might not suffice, but there are many. Membership in scientific societies of

standing is important, wherever such membership is dependent upon evaluation and election. Recognition by learned bodies is a guide. There are even lists of outstanding scientists, prepared by taking ballots among scientists themselves. Some of the scientific bodies, notably the National Academy of Sciences, have the recognition of the Congress in their charters. The American Association for the Advancement of Science, through a carefully prepared system of representation, integrates the large membership in very many scientific organizations throughout the country. It seems to me that some of this existing machinery should be utilized in the procedure of selecting representative scientists for a governmental purpose in order to select representative men having the confidence of scientists generally. It can safely be assumed that men selected for eminence in science by scientists themselves will also generally be disinterested, for men can very seldom rise to real prominence in science in the estimation of their colleagues unless they place science itself first in the ordering of their professional careers.

In reviewing the bill, and in thinking of post-war scientific organization generally, I believe this point is important, and it seems to me that the present provisions in the bill for securing the services of scientists in the contemplated organization are not designed to secure the best men possible. Furthermore, these same comments apply to the membership of the so-called National Scientific and Technical Board and the Advisory Committee.

My summary, then, so far as this first group of Government scientists is concerned, is that the bill does not now provide adequately for the correlation of their efforts, that it would be inadvisable to extend the bill to the point where unitary control of all governmental research would be exerted, but that there is an opportunity in this field for beneficial correlation of effort.

The second group of scientists and technical men to be considered are in the research laboratories of industrial organizations. There are over two thousand such laboratories, large and small, and their work is of great importance, particularly in view of the growing tendency in this country among large industrial laboratories to carry on research of a fundamental scientific nature and to publish the results.

During the war these industrial laboratories have been of great importance in the development of weapons, working under contracts with the Army, the Navy and the Office of Scientific Research and Development. As far as the latter is concerned I can testify that we have had effective cooperation from the group at every point, that they have accomplished

results of great importance, and that with negligible exceptions they have decidedly placed the interests of the country first and have not allowed their commercial interests to interfere with their contributions to the general cause. I have already discussed the provisions of the bill that would alter in several ways the relationship of these laboratories to government in the prosecution of research on new weapons during the war, and I have noted that I do not feel that new legislation is needed for this purpose.

The position of this group of scientists under the bill during the post-war period is hence the primary point for consideration. As I interpret the bill, they would not be greatly affected because most of the clauses which would alter their relationships are limited to the duration of a state of war. Presumably, the funds of the new office would be used, in times of peace, either to construct and operate new governmental laboratories or to utilize the facilities of existing laboratories under contract. While some industrial units might elect to operate their laboratories in that way, the chances are that in time of peace most industrial units would not wish to perform any substantial amount of their scientific work under government contract, especially considering some of the provisions in S. 702 concerning patent rights. Furthermore, I doubt if these industrial laboratories would accept in peace-time contracts consistent with the OSRD non-profit theory as applied to research and development contracts. The alternative of including a large profit under the contracts, in the attempt to enlist the voluntary participation of these laboratories in a peace-time plan, is certainly not an attractive procedure.

As a matter of general policy, I do not believe that it would be wise for government to attempt to control the operations of these industrial laboratories, as might possibly be implied in the purpose specified in Section 1 (4), although presumably not within the scope of the powers and duties that would be given the new office. The industrial laboratories form an integral part of the industries with which they are associated, and form a part of the mechanism by which units in a single industry, and entire industries, compete with one another. Moreover, their particular part in such competition is directed explicitly toward the provision of better products for public consumption. The maintenance of such an atmosphere of competition, as opposed to close government regulation of monopolistic combinations engaged in manufacturing the products which the public needs, has been the philosophy behind a large amount of legislation during the past generation, and I believe that such a philosophy is in the public interest. Undoubtedly our laws regarding trade combinations can be improved,

or at least clarified, in order to render the system more fully beneficial, but the general idea of having various units in an industry competing on the basis of which one can supply the public with the best goods at the lowest cost, is hard to improve upon in theory, and in general it has worked well in practice wherever it has been truly operative. The industrial laboratories are an essential part of this process, and I feel that they should be subjected to as little centralized control as possible.

That brings us to a consideration of the proposed post-war effects of the bill on the third class of scientists; namely, those in universities and non-profit independent scientific institutions, and it seems to me that this group may be primarily affected.

In time of war it seems to me that the public interest demands that this group should be closely organized in order to apply their accumulated scientific knowledge to the direct needs of the Armed Services for developing new weapons and equipment and for meeting the needs of military medicine, and this organization has been accomplished by the Office of Scientific Research and Development, a war agency. Although such organization is necessary in time of war, it seems to me that in time of peace the scientists in this group should be given a maximum of freedom and a minimum of control from any source. Therefore, I think that it would be a mistake to attempt to control their activities through a Federal agency.

Of course, in view of the fact that many private institutions may be unable to finance an appreciable amount of scientific research activity after the war, it may be advisable or even necessary for such institutions to look to the federal and state governments for financial support. Our past experience in this country has shown us that it is possible for such governmental financial support to be given without being attended by stifling control, but the factual situation may be different after this war. For example, it seems to me that the high scientific standards of which quite a few state-financed institutions can be proud are attributable in no small part to the fact that up to the present time such institutions have been competing against privately endowed institutions with exceptionally high standards which were in a position to attract very outstanding scientists who felt that their efforts in state institutions were too closely controlled. If such competition is still present after the war, I can foresee many advantages and few disadvantages of federal financial support of the research activities of scientists in universities; if, however, there is no such strong competition, we must be careful lest federal financial support carries with it features of undesirable control.

Thus, I think that federal subsidy of the independent science of universities and other institutions in this country may be beneficial, and it may in fact be necessary in the years to come if we are to preserve that preeminence in science as a nation which is essential to our progress. But, unless we have the wisdom to extend support wisely, it may do much more harm than good. If federal support is to be given, strenuous efforts will be necessary to ensure that it furthers the work of the best and most brilliant scientific minds, and does not merely increase the bulk of mediocre work. And the support should be divorced from governmental control of the scientists and laboratories themselves, or it will stifle rather than expedite their true accomplishments.

The presence of a great body of highly able scientific men in this country has recently been an indispensable asset in time of danger. We must be sure that it is again present if we are again threatened, and science of the highest type flourishes best when it seeks its own objectives and pursues its own uninhibited ways. If we perpetuate in this country in the years to come a scientific atmosphere and body of men of the caliber that we now have, I will fear no threat from any source, for in time of need they will again respond, they will again direct their full energies in a patriotic effort, working under a closely unified and controlled program of the application of science in the prosecution of war, and they will thus do their full part in the protection of this country.

In conclusion, I wish to point out that there is another aspect of this whole subject of the furtherance of science. It extends beyond the mere application of the fruits of science to improve the comfort of the people, and it is on a more fundamental basis even than the safety of the country to external danger. The broad object of science is to increase the knowledge and the understanding of man. It aims at extending his grasp of the environment in which he lives, and his appreciation of the vast and intricate system of nature by which he is surrounded, from the study of the remote stars to the constitution of the smallest atom. We need science for this as well, so that as we live we may derive satisfaction by growing in knowledge.

Since after many years I have come to the realization that science flourishes to the greatest degree when it is most free, I feel strongly that, when peace comes, we should bend our efforts, not to perpetuate any of the necessary wartime controls which we have created for our defense, but rather to return the maximum of independence to our scientific institutions and our scientific men, wherever they may be located.