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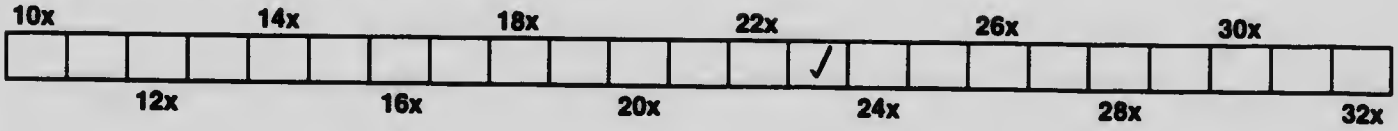

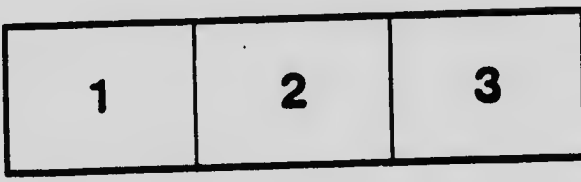

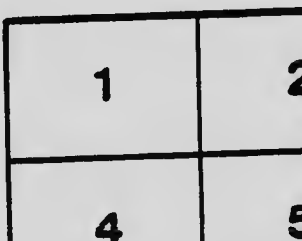

DOMINION OF CANADA

THE HONORARY ADVISORY COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

BULLETIN No. 1

THE NEED FOR INDUSTRIAL RESEARCH IN CANADA

BY

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THE NEED FOR INDUSTRIAL RESEARCH IN CANADA.

One of the great facts which is being driven home by the present war is the striking part which scientific research and discovery is playing in this terrible conflict. It is, moreover, equally clear that this new factor will play a dominant role in the intense industrial competition which will follow upon the declaration of peace. Industry is the great basis of national prosperity, and if Canadian industry is to be placed in a position which will enable it even to hold its own in competition with the great nations of the world whose industries will be "speeded up" to the highest point, the Dominion must in this New Era strain every nerve to secure increased efficiency in its manufacturing by the introduction of the most advanced and scientific methods and the widest market for its manufactured products by the most advanced and modern methods of co-operative distribution.

The extent to which Germany has benefited by scientific research in the present war is not even yet generally recognized.

One of the foremost requirements for the waging of a successful war is an unlimited supply of nitrates—for these are indispensable in the manufacture of gunpowder and all kinds of high explosives. It is also one of the most important constituents in artificial fertilizers, which are necessary when heavy crops are obtained by intensive farming for the support of a dense population. The great world supply of nitrates is derived from Chili. Germany had imported enough to suffice for the duration of a short war, and she did not contemplate a long one. The war was, however, indefinitely extended by Great Britain joining in the struggle, and the British Fleet having cut off Germany's access to Chile, the war ought to have been brought to a speedy conclusion. The industrial research chemists, however, had found out a method by which the nitrogen of the air might be fixed and converted into nitrates, and as there was an abundant supply of this raw material, ample supplies of nitrates were thus secured for the continuation of the war. Another prime necessity for the manufacture of gun-cotton, which is the basis of the more important high explosives, was

cotton. The Germans again had secured large supplies of this in preparation for the war, and again the British Fleet eventually cut off their supplies of this staple. Once more German research came to the rescue, and a method was devised for securing the necessary supplies of cellulose, formerly obtained from cotton, by the chemical treatment of wood. When cattle food ran short large supplies of it were obtained by the chemical treatment of the waste refuse liquor from the German pulp mills. When the supplies of copper ran short, industrial research developed certain alloys which could be used to replace it, and when nickel for the manufacture of nickel steel failed they found other metals which might be substituted for it. Germany thus developed her full equipment for scientific research and trained her host of skilled workers in the field in times of peace, and was fully prepared to obtain from organized scientific knowledge all the assistance which science could render toward the solution of the successive problems with which the country was brought face to face in time of war.

In its broadest sense research means simply the acquisition and application of new knowledge. Without new knowledge, no industry can continuously flourish. In the least organized industries new knowledge comes as the result of the accumulated experience of the worker. As conditions become more exacting and refinements necessary, the assistance of the technologist is required in seeking and providing scientific knowledge. In the largest and most progressive firms, staffs of men are provided to make and turn to account new scientific discoveries. It is indisputable that an industry must stagnate unless continually kept up to date by some such methods and a firm that effectively carries on research cannot but triumph over its less progressive rivals.

An aftermath of the war will be "footing the bill". Whatever material wealth—if any at all—may be collected from our enemies, will be insignificant compared with the losses to be made up. To meet these losses we have one main source of supply to draw upon namely, the latent energy—mental and physical—of every worker of every grade. Education and research are the two channels by which this treasury may be tapped.

Considering the various aspects of research, attention will first be given to that of the manufacturer.

It is clear that to the manufacturer research is of the utmost importance. Possibly its greatest field for usefulness lies in the

development of new or improved materials. As examples of recent achievements in this direction mention may be made of glass, tool steels, light steels employed in automobile work, high quality magnetic materials, aluminium alloys of great strength and lightness, and numerous other alloys, ferrous and non-ferrous as well as many organic products.

The next field lies in the development of new and improved processes for cheapening production. In this respect there is no limit or finality.

The benefit of research is by no means confined to the manufacturer, it is also of interest to the worker. Primarily because any factor which makes for prosperity in industry ultimately makes also for the well being of the worker engaged in it.

Research is of importance to the financier in that it provides him with new fields for the profitable employment of capital, and as such contributes to the industrial prosperity of the community. Further, by means of research facilities, opportunities are afforded for careful testing of new financial propositions embodying features of a technological nature which may or may not be on sound lines, and in this manner the waste of capital may be avoided.

The educationalist is vitally concerned in research because it broadens his scope in all directions. For the prosecution of research, increasing numbers of highly trained technologists and scientists are required. Moreover, it is equally necessary that every grade of worker be educated to appreciate the importance of research, whether he works with his hands or with his head.

Among the striking results of far reaching importance which have been achieved by research in recent years in fields apart from technology, but of the greatest importance to the whole world, may be mentioned the prevention of malaria and the construction of the Panama Canal, and the developments of aviation dependent upon the petrol motor. Again research has pointed out the means by which tuberculosis may be stamped out and will thus when its teachings have been put in practice have a marked effect in conserving the man power, and, therefore, the productive capacity of the community. Physiological researches into fatigue and efficiency of working may have far reaching importance. The researches of Taylor on the conservation of human effort, however misapplied his results may be, are in principle of very great significance. A research which would solve the problem of dealing

satisfactorily with the difference between labour and capital would be of the greatest conceivable benefit to industry. A research which would seriously reduce infantile mortality would add immensely each year to the workers in industry and the energy available for production.

All civilized countries are now becoming thoroughly awakened to the vital necessity of encouraging research. Great Britain, the United States, France, Australia, New Zealand, South Africa, Japan and even little Finland, have taken very definite action along this line. In Great Britain a Committee of the Privy Council for Scientific and Industrial Research, with an Advisory Council composed of a number of the most distinguished men in the scientific and industrial world, was appointed in 1915, for the special purpose of furthering research in the British Isles. This Committee has issued two very able and practical Reports outlining the work which it has already taken up. Last year the British Government transformed this Council into a regular Government Department, that of Scientific and Industrial Research.

The British Government has placed a special fund of one million pounds sterling at the disposal of the Research Department which proposes to use this fund to aid in the establishment and maintenance of laboratories engaged in research in the interest of a special industry or of a group of allied industries, these laboratories to be partially supported from the start by the industries interested, and after a period of five years at the longest, to be taken over and wholly maintained by the industries in question. It is, therefore, evident that the prosecution of industrial research on a co-operative basis is to be largely delegated to the interests themselves. While standing ready to give every stimulus and encouragement, the Research Department realises that the ultimate success of these researches is mainly dependent upon the interest and support given to them by the industries actually to be benefitted.

In the United States not only is an immense amount of research work being carried out by the great Government Institutions, such as the Bureau of Standards, the Bureau of Mines, and several of the other Government Departments, and by separate research laboratories such as the Mellon Institute of Pittsburg, but a very large amount of research work is being undertaken by great industrial concerns for the development and extension of their own businesses. There are over fifty industrial concerns in the United

St[illegible] which have established research laboratories on an extensive sca[illegible] and many of these expend from $100,000 to $300,000 annually on research work alone. They know that it pays and, consequently, they extend and expand these laboratories year by year. Among these may be mentioned: The General Electric Company, Schenectady; the Eastman Kodak Company, Rochester; The H. K. Mulford Company, Philadelphia; the Dupont Powder Company, Wilmington; the Edison Company, Orange; the American Rolling Mills, Middleton; the National Cash Register Company, Dayton; the Westinghouse Electric Company, Pittsburg; the Pennsylvania Railway Company; the National Canners' Association, Washington; and the Vacuum Oil Company, Rochester.

The General Electric Company organized a Research Department in 1901, on which this Company has now made a capital expenditure of over half a million dollars, with an annual expenditure of about $250,000, and a research staff of about 200 men. The Dupont Company in times of peace have 250 chemists in their employ—now they have no less than 652.

The results which keen scientific research has accomplished within the past few years, when applied not only to new industries, but to some of the oldest occupations of the human race, are most striking. As a single instance of this the researches into improved methods of making bread recently carried out at the Mellon Institute of Pittsburg, Pa., may be cited. A company of bakers doing a very large business established at this remarkable centre of research a "Bread Fellowship" for the investigation of the question as to whether an improvement in the very ancient art of bread making might not be effected by the application of scientific methods. With the expenditure of some $5,000 certain discoveries were made almost immediately which enabled the company to effect a saving of $500,000 per annum in its business. The company paid the investigator a bonus of $10,000 and requested him to continue his work. By the end of four years the investigation had produced such important additional results that the company paid the investigator an additional bonus of $10,000, and again requested him to pursue his investigations still further. So successful have these researches been and so profitable have they proved to the company that a third bonus of $10,000 will probably be paid in the immediate future. All this saving in cost of manufacture has been

accompanied by a distinct improvement in the quality of the bread produced.

The Government of Australia has just established an Institute of Science and Industry for the purpose of carrying out extended researches on subjects of especial importance for the development of the natural resources and industries of the Commonwealth.

In the Far East Japan has during the past year voted large sums from the Imperial Treasury for a like purpose.

The question may be asked—What is Canada doing to develop her industries by scientific and industrial research? Several of the larger universities of the Dominion, and some of the Departments of the Dominion and Provincial Governments, have done and are now doing important and valuable work in this direction. The volume of this work needs, however, to be greatly expanded, and it should receive more adequate financial support.

In order to further develop this important factor in our national life, the Government of the Dominion of Canada following the example of the Government of Great Britain, have appointed a Research Committee of the Privy Council, with an Honorary Advisory Council for Scientific and Industrial Research to advise them on all matters connected with this subject.

In order to train up in Canada a body of young men capable of carrying out industrial research and scientific investigation such as are engaged in this work in other countries, the Government has already, on the recommendation of the Research Council, established a series of studentships and fellowships which will be awarded to young men of ability and promise, thus enabling them to follow advanced courses of study which will qualify them to undertake this important work.

The Council has also taken a census of the industries of the Dominion, in order to ascertain the problems presented by Canadian industries at the present time, and has investigated for various industries a large number of questions and solved many difficulties which were presenting themselves in various manufacturing enterprises.

A number of important researches directed to the improvement of various manufacturing operations and the development of new industries are now being carried out.

On the Council's advice the Government established a Forest Experiment Station at Petawawa, Ontario, and has inaugurated a

very important series of researches into the best methods of preserving the forests of Eastern Canada from the destruction that is at present overtaking them owing to the methods of cutting which are now employed, and to determine which of the methods of forestry practice developed in the older countries of Europe is best adapted to Canadian conditions and will be most effective for the preservation of our Eastern forests.

The Dominion Government in co-operation with the Governments of Manitoba and Saskatchewan, are also, on the advice of the Research Council, about to undertake the erection and operation of an experimental plant for the conversion of the low grade lignite fuels of southern Saskatchewan into a high grade domestic fuel having the general character of anthracite to supply the needs of the population of the eastern plains.

The Research Council has also secured the close co-operation, as Associate Committees, of the leading technical men of the Dominion in Mining and Metallurgy, the Chemical Industries, and in various industrial activities of the Pacific Coast, and is with them now engaged in developing its work for the furtherance of Canadian industry in a number of important fields.

There can be no doubt that after the war commercial competition will be much more intense than ever before, since every country will seek to increase its production and export, for the purpose of meeting the enormous debts which have been piled up. Those countries which improve the quality of their products while cutting down costs through the introduction and adoption of the best and most advanced methods which can be developed by industrial research—and who at the same time by the adoption of co-operative action can market their goods cheaply and on a large scale—will capture the competitive markets. In other words, as has been recently remarked, big business, progressive methods, and scientific research must come together. Syndicating businesses and organizing scientific education and research are the aspects of the same operation.

If Canada is to maintain and improve its position among the countries of the world it must do so by learning how to work up its abundant raw materials into the cheapest and best merchantable products by the application of scientific knowledge to this work in hand. More extended facilities for research and a greater number of highly trained men are needed now in preparation for the for-

ward movement which Canada must make on the resumption of peace if she is to retain her place among the nations of the world. And above all the people of Canada must awake to the necessity of action in the matter of industrial research and recognize that if millions of dollars are being expended by governments and by individual companies in other countries for the development of industrial research, Canada cannot hope to achieve results unless she is willing to meet the necessary outlay.