

12th October, 1916.

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**PRESIDENTIAL ADDRESS**  
DELIVERED BY MR. J. W. BRAGG

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In his admirable address given at the end of our last session, Professor Barraclough referred to the status of the profession of Engineering in Australia and to the disadvantages under which it labors as compared with many of the other leading professions. He also indicated how the important work of technical education might be applied to better advantage than at present. I shall, in the course of this address, make reference to these two subjects.

The value of Professor Barraclough's address is fully recognised by us, and I have no doubt but that it has been read and studied, not only in Australia, but by many members of the kindred Associations with whom we interchange our volumes of Proceedings. It is in no way the fault of such an address that results commensurate with the value of the suggestions it contains do not always follow; we are interested for the time while we hear it, we feel grateful to the giver, and perhaps intend to take a keener interest in the subjects brought forward, but we are mostly men with fixed duties in life, and our thoughts naturally revert to matters calling for our immediate attention, and before long we remember little more than that the address was a good one on an interesting subject. Not many of us are in a position to introduce into our lives ideas which are outside our business and to prosecute them with vigor, but it is more than probable that in our own interests we may shortly be forced to study keenly questions which hitherto we have been content to pass by or to take only slight notice of.

In previous years Presidents of this Association have mostly framed their addresses on technical subjects with which their life's work has made them familiar, or in which

they have specialised. I have found some considerable amount of interest in reading over some of these while casting round to see the character of the address which is expected from a President of the Association.

Perhaps the fact of having to prepare an address gives an additional interest to the matter in seeing what others have done in like case, and, although the liberty to choose a subject is a wide one, I have found it difficult to discover something new to work upon—something which will be of interest to the members of the Association of every grade.

The lines upon which I have worked differ considerably from precedent, and I have had doubts as to whether I am justified in leaving technical matters so severely alone as I have done, but the very fact of our Association including as it does amongst our members men of experience in almost every branch of Engineering, has made me hesitate to speak on any subject with which others have had more experience than I have had; further, to attempt to summarise the year's progress would, under existing conditions, be futile.

In throwing precedent to one side entirely, and in bringing into my address economics as affecting the practice of engineering, I have little doubt that I shall incur some considerable amount of criticism. However, I am strongly of the opinion that, by limiting our attention to technical matters, we are limiting our own powers, and even, perhaps, limiting the range of our usefulness as an Association.

Records of practical experience in engineering work, new designs, the behaviour of materials under certain conditions, the economics obtained from fuel consumption, and such like, are all interesting, and form useful subjects for papers and discussion at our meetings. We are, however, not engineers for the interesting side of our business alone, but for the more prosaic purposes of successfully applying our technical knowledge to commercial practice. Everything

that tends towards improving or reducing the efficiency of our work should come within our consideration, whether it is in the variation of relative strengths and values of materials, or whether it is the methods by which contracts may be completed with the least cost of labor and material, or whether it is the best means of educating our young engineers to be practical in their work as well as sound in their theoretical knowledge.

Recently our Federal Government have taken steps towards establishing a closer relationship between science and industry. This is a most important development, and one which, if carried onwards, as we hope it will be, should be of material advantage to engineering and the allied professions, seeing that it falls to us to forge the connecting links between the discoveries of science and the useful services to which these discoveries can be applied; and further, our position enables us, or should do so, to establish a better mutual understanding between manufacturer and scientist. But before we can educate others we must first educate ourselves to appreciate fully the advantages which will follow from a closer relationship between science and industry than has existed up to the present time; a material improvement in the commercial training of our coming engineers will be an effective factor to this end, and it is for this reason that I propose to include in this address several subjects which apply especially to the junior members of our Association, many of whom will, I trust, take a leading part in the future in organising systems to ensure a higher percentage of efficiency in all our operations. The pace of progress is now being seriously checked by ignorance, by indifference, and by distrust, and it is most certainly the business of science to remove all these.

The "motif" of my address, if I may borrow an expression from our musical friends, is "Business in Engineering." This is a subject which must appeal in some way to

us all. However sound our engineering knowledge, however complete is our acquaintance with scientific discoveries, all is of little value unless it can be applied practically for the ultimate good of the community.

Some years ago the King sent a message ringing through the Empire in these words: "Wake up, England." With his keen intuition he foresaw how we were in danger of losing our leading position in the world of commerce, and commerce is the very life's blood of the Empire's prosperity. Without it, we would become merely the servants of other nations more alive to their interests than we are to ours. They would secure, as we have had recently shown to us only too plainly, predominating influences within our very gates, and we should waken too late to recognise that we no longer occupied the position of masters in our own country. Engineering of the present day is closely intertwined with commerce, and the commercial side of Engineering is not to be lightly treated. It is a mistake to regard our profession as referring to matters of technical interest alone, and that it can exist without the association of commerce.

But even the Royal message, "Wake up, England," was not sufficient to arouse us from the lethargic state into which we were falling, or had fallen, and it needed the convulsive shaking of a world's war to galvanise us into action.

Even now all sections of this community do not recognise how close we were to losing our heritage. We are not out of danger yet by any means. I do not refer to the danger of a reverse to our armies in the war, but to the danger of our relapsing into that easy-going life of pre-war days when we were too easily satisfied and too contented to let matters continue as they were going.

A characteristic of our people, and it is one of which we seem to be rather proud than otherwise, is that we are difficult to get going. Our history shows that we have been

content to muddle through our difficulties, knowing that as a nation there is a tremendous amount of strength latent within us, which we could bring into action if we cared to make up our minds to do so. The time for that indolent condition of mind is gone. We are making no small effort in Australia to take up our part of the burden of the present war, but the peaceful war of commerce will be equally, if not more, strenuous, and it may prove to affect us individually even more than a military war. During the last two years many of us have felt, and we still feel, that we want to do something practical to assist the Empire in its struggle—something more than making a contribution of money to war funds. It is this desire to do something more which we shall have to carry into the war of commerce which will begin on the day on which peace is signed. The difficulty in such case is frequently that of not knowing just what to do and how to apply our energy, but as I shall show in this address, this must be overcome by initiative and vigor of mind.

I suppose that there is not one of us who has not considered many times how he may be affected as an individual by the war. It has been called an "Engineers' War," but it is more than that. It is a war of men in multitudes as soldiers, it is a war of finance, it is a war of skill and of temperament. In civil life our businesses are disturbed; we notice the war's effects in many ways on our private lives, and we must recognise that, after all is over, there is a different life waiting for us—a life which must be lived under entirely different conditions to what we have hitherto been used. The warring countries, conquering and conquered, will be compelled to make every effort to reimburse themselves for the wealth squandered in the prosecution of the struggle, and this they will do by making an attack on the world's wealth and commerce; and further, those countries, and one especially—I refer to the United States of America—which have so far kept clear of hostilities, will

be so wealthy with the money made from the manufacture of munitions for our Empire and for our Allies, that they will be much more efficiently equipped than ever in machinery and finance to compete with us for our own trade. They have, indeed, told us this, and apparently without a blush.

It is an ominous fact that in Australia wages are rising rapidly in all directions, much more rapidly than they are likely to fall, and this at a time when many of the old manufacturing countries will shortly be looking to supply us with goods which can be made in Australia; such countries will be obliged to reduce their living standards and to keep their wages within moderation if they are to secure the volume of trade which will enable them to pay their war taxes. Increases in wages would not necessarily be a brake on progress if similar increases obtained throughout the world, but this is not, and never can be, the case. So I maintain it is our duty to look carefully to our position and to prepare ourselves so that we may not find that we are as unprepared to fight the commercial war as we were in 1914 to face the military war. Not only must we struggle to keep in the lead, but we must see that we clear the hindrances which are likely to check our pace.

I hope that I have now said enough to show you my reason, which is in no way an excuse, for introducing into my address subjects which, up to the present time, have not been referred to, or only so to a limited extent, in our previous proceedings.

Outside the war and its immediate results there are two outstanding features in the history of the past year which are specially noticeable to us as engineers: First, the marked increasing attention which is being given to science in its relationship to commerce and industry. This is shown in the many addresses on the subject given before Associations such as this, and by the numerous articles on the

subject in our leading technical journals. The drawing closer of science and industry does not mean only the application of scientific discoveries to practical and commercial use, but it also means doing things better than we are doing them now; it means increasing efficiencies, mechanical and industrial; it must not be understood only as leading science to industry, but it also means leading labor to work more scientifically.

The second feature which is so prominent in the history of the year is the number of disturbances to commerce and industry caused by strikes on the part of labor, and this is a subject no less interesting to us than the other. Labor is so intimately associated with the practical work of engineers that if we confine our attention to technical matters and neglect the study of the labor problem as affecting us and our professional work, we can hardly hope to secure the high overall efficiency which is the mark of good work well done.

Genius evolves new ideas, but labor is necessary to carry them out, and however good are our designs, and however high the percentage of efficiency which we bring to bear on laying out engineering work of any description, we must, in order to arrive at the final commercial efficiency of the completed work, include the efficiency of the necessary manual labor. As engineers, we do not work entirely for the engineers, but for the public, who are our employers and our paymasters, and they look to us to protect their interests by the exercise of care and economy in the work which they place in our hands. Though the design be brilliant, if the cost of the execution of the design is loaded up with abnormal expenses and by delays, the result must be unsatisfactory, and yet it would appear that we do not give sufficient attention to that critical portion of our work which is in actual touch with, and is connected with, manual labor, and which is frequently responsible for the greatest portion of the cost; it lies with us to consider whether we

cannot direct to better advantage such labor as is available, and also to improve labor as we try to improve our machines and materials.

Taking the first of the two matters which I have referred to, namely, the relationship between science and commerce and industry, how do we stand, and how do we give our assistance towards securing more progress from a closer bond between these? I think we must acknowledge that we frequently show ourselves in many ways to be true descendants of our forefathers in our impatience to consider new ideas. Had we lived in the time of George Stephenson, can we conscientiously say that we would have at once recognised the value of his discovery, and that when others scoffed we should have taken up the cudgels on his behalf? Should we to-day, if the subject were an entirely new one to us, show patience with, or give our support to, a man who spent day after day blowing soap bubbles, yet by experiments made on soap bubbles we have come to a knowledge of light, and theories have been established which are of immense value when applied to practical science. Without such and similar experiments, which must have appeared of no practical value at the time they were being made, chance alone could have given us the valuable discoveries. The same is noticeable in many other directions. Most of us have lived to see valuable use made of things which at one time we despised or thought to be incapable of being applied to practical service, and we have had to modify our ideas fundamentally. Who, for instance, a little more than two years ago, would have considered it possible that the bombardier of Wellington's day could have again come into his own in a modern war? Such an idea would have been laughed at, and it was even said, not many years since, that in any future war long range guns would prevent the opposing armies coming even within sight of each other. As we know, the very opposite is the case, and armies of men



have lived for months, almost years, within a few yards of each other, and without altering their position. Again, the despised hobby horse of 60 or 70 years ago is probably the parent of the present day motor cycle with the quick firing gun mounted on it; yet the idea that there could be any evolution of the hobby horse to meet modern war conditions must have seemed almost too ridiculous to think of. New ideas have seldom been welcome. Even our national hero, Lord Nelson, is credited with having written to the Admiralty when they wished him to test an invention for the more accurate laying of guns, and, saying that he would be glad to try the invention, but as his mode of fighting was to lay his ship alongside that of the enemy, he did not see that the device, even if it were all that was claimed for it, would be of much use to him.

I have made the above reference with the object of placing before you the necessity of preparing the mind to take advantage of possible developments which may follow from the application of science to apparently insignificant and worthless ideas. We should be prepared to give reasonable consideration to scientific discoveries which to us may appear to be only petty playthings, but which may prove of great value when it is known how they can be applied in a practical manner. No man's mind is so comprehensive as to originate, experiment, and apply the discoveries of science to useful service. Several men are necessary to cover such a range, and, human nature being what it is, it is natural that each one should place the greatest value on the work with which he is chiefly occupied, and should view with some impatience the work of others. The practical man views science from an entirely different point to the experimenter who looks upon the wresting of another secret from Nature as his higher ideal, and leaves it to others to apply the

secrets, when won, to practical use, if they care to do so. The practical man has little sympathy with the labor of the experimenter, which too often appears to him to be far removed from what is useful. There is the story, perhaps true, of a commercial magnate who approached a distinguished man of science with the proposition that he should apply his powers of scientific investigation and invention towards making a fortune, and who received the unexpected reply, "But, sir, I have no time to waste in making money." The scientist was satisfied if his experiments proved his theories, and he was content to stop at that; but both the man of business and the scientist are necessary for progress, and what is equally necessary is the appreciation by each that the work of the other may be quite of equal value with his own. It is the establishment of a connecting link between science and capital, which may be represented as the manufacturer, which is one of the principal duties of engineers. Let us look at it more closely. Without the scientist there would be little progress; without capital the discoveries of the scientist could not be turned to useful purposes, and the reason for his existence would disappear. He would find it difficult to continue in his labor if he were unable to have his discoveries applied practically. The capitalist alone does not appreciate the value of the scientific discovery until it is brought vividly to his notice by the practical application of it to some useful purpose for the community.

The engineer forms, as I say, a necessary interconnecting link in the chain of material progress. If one of these links is weak, the capitalist, the experimenter, the manufacturer, and with him the engineer, there can be no strength in the chain. Notice the position of the aniline dyes at the present time in Great Britain. For the want of financial support some years ago the investigation in-