

been founded in Great Britain an institution which has for its particular object the restoration to Great Britain of its leading position in the creation of labour-saving machinery? It is reasonable that men should also desire to lessen the physical and increase the mental effort required for all onerous duties, and it is mostly the engineer's work to invent and construct the labour-saving plant to enable them to do so. The directions in which conditions may be made more comfortable for men offer a wide field for the ingenuity of engineers, for it is safe to say that practically all of the present extensive hand-labour work will ultimately be done mechanically, not only dispensing with the drudgery of most of it, but at the same time reducing the cost of carrying it out. On the other hand, if obnoxious vocations are displaced, and more ease and comfort provided for the carrying out of their duties, it is essential that the men thus relieved should give their quid pro quo of fair service. Whether wages will fall or not, it seems to be fairly certain they will never come down to the pre-war rates, and in order to obtain increased production now it is equally obvious that we should make the very best of things as they are, and set out to further develop machinery and not entirely scheme to force the human being to do more. It is unquestionable, I think, that rapid progress in the development of labour-saving machinery will take place. Just as the war forced the nations into wonderful progress in fighting devices, just in the same way will industrial war force along the development of peace devices, and it appears it is that nation which devotes its attention vigorously in this direction, and whose members give honest service, which will succeed in competition. Labour-saving devices, however, will never compensate for deliberate slowing down below reasonable effort, and the sooner men have settled down to

an acknowledgment that the destruction of capital will rather retard than hasten their own ends the better. The fighting atmosphere of the past five years has not yet subsided, but it is to be hoped it will, in time, be replaced by a common-sense spirit of mutuality, when the futility of the process of destroying capital by reducing output is borne in upon the minds of workers; and under the title of workers I suggest no classification. It is an absolute law that anyone who induces failure by the evasion of fair responsibility will himself be the greatest sufferer. It may not appear so at once, but sooner or later it surely will. The obvious interdependence of production, wages, and the cost of living will be better realised when it is understood that the continuation of rising wages and reduced production must lead to a high cost, and consequent low standard of living. Nothing is more certain. The best hope of the future lies in the belief that all classes will fully accept truly scientific means of observing cause and effect. Whatever social reconstruction takes place, progress demands that methods be improved and economies effected that will have an important bearing in easing the present stringency in the cost of labour and material, and in this regard the engineer's work is almost paramount.

Australian Manufactures.

Australians are being urged to use Australian manufactures almost exclusively, a policy that no true Australian will oppose, but the policy involves a great deal of responsibility upon those who manufacture, for it is an element of the law of progress that the best article available should be used. I have no doubt that Australian manufactures are in the main excellent, but if better are made available, it is almost destructive of incentive to continue to advocate

the use of inferior locally-made articles. I am purposely not referring to anything in the nature of other means of protection for industries, but it seems to me important that no possible inducement should ever be held out to encourage the idea that the country should be made to use inferior articles simply because they are made locally. There is only one way to uniform success, and that is obviously in the greater application of science to the improvement of our manufactures. Here, again, there enters very powerfully the services of the engineer, and in this matter it is important that a proper value be set upon standardisation, and the most intelligent estimate be made as to when it is useful and when it is not, for in many cases standardisation has led to stagnation. To lose faith in accepted methods or conclusions often means the stirring of the imagination, and the desire for further knowledge and improvement. This spirit of restlessness is the keynote of engineering practice, and explains to a large extent the reasons why such progress has been made in the mechanical art during the past decade. Standardisation must be always looked upon as an expedient promoting stability, and not as an inflexible standard irrespective of development.

In no other class of industry more than that which comes under the heading of metals and machinery is it urgently important to develop the local industries. Iron, steel, and coal are the very sinews of any nation, and no one who has even casually analysed the reasons for progress of the great nations of the world can fail to observe the correlative progress of their metal industries. If this fact is acknowledged, then what a great bearing on it has the application of science to industry.

Upon no other section of the community rests a greater responsibility in this matter than the engineers. Of the

£40,000,000 paid in salaries and wages in the factories of the Commonwealth, nearly one-third is spent in metal works and machinery, and in the production of heat, light and power, whilst the indispensability of a technical staff in almost every other class of industry would probably increase this proportion to one-half. In the use of fuel, no section is so deeply concerned with the economical handling of the £5,000,000 worth of fuel as the engineer, more than half of which is used in metal and machinery works, and for the production of heat, light and power. In the upkeep, maintenance and improvement of approximately £90,000,000 worth of land, buildings, machinery and plant in the Commonwealth manufacturing industries, there is tremendous scope for the development of economies. But the point I wish to emphasise particularly is, that to my mind, the more immediate necessity of the present is not that we should devote so much time to the somewhat uncertain realms of pure scientific research, but to closely study our industries as they now exist, and concentrate in the application of available scientific knowledge to the putting of them in a better and more efficient state.

There is an inclination in many quarters to look upon science and industry as two distinct and separate manifestations, and consequently the truth that they are inseparable and reduced to plain terms simply mean the rendering more productive of any occupation is liable to be lost. The scientific control of industry means just the elimination of waste and the full use of industrial energy, and if this was more generally understood there would be a greater tendency for the universal development of science, and it would not be looked upon, as it is now by very many, as an interloper. By all means we must proceed with research work, but let it not be overlooked that there

is ample ground here in Australia for much more scientific management on known lines of its industries, and it is certainly of no use whatever for Governments or private industrial concerns to set up or support bureaux for the application of science to the industry of others unless it can be shown clearly that the principles enunciated are being earnestly and fearlessly applied by themselves. Scientific management is certainly not new to Australia. There are many concerns that have maintained their businesses in a highly efficient state, and if the Government of the Commonwealth goes the right way about it there would not be found lacking a general response to a request for co-operation in the dissemination of much of their experience, and of the many ways in which National efficiency may succeed there is none more important than that Governments should pay the greatest possible heed to the experience and methods of private industrial concerns. There is, of course, nothing new in this statement, but the fact often escapes proper notice by its very self-evidence. I have no serious fears that the claims of science and technology will be ignored by the majority of the industrial executives in Australia, but if these concerns do apply science to their businesses, and succeed, and due consideration has been given by them to all persons dependent upon them, it is surely not contributing to National efficiency if undue interference follows. The manufacturer of to-day is facing tremendous problems. He must pay high wages, heavy taxes, erect modern plants and machinery, or he will certainly be outdistanced, and, if he is, then no one will be anxious about his welfare or come to his rescue.

With their unique opportunities for ascertaining information, obtaining the fruits of experience, and in more or less controlling industries, Governments should be so strong and

capable as to be able to take over every unsuccessful industry, and by the application of the scientific knowledge available from their bureaux turn such into successful ones. Then, indeed, would industrial prosperity be more universal.

If increased production was wholly dependent upon the improvement of machinery, one would have little doubt as to the result. It, however, depends upon the successful co-operation of labour, and it seems to me that wherever it is possible to encourage a man to feel that he is a co-worker in the application of science to industry with his employer, the best results are sure to be obtained; in this way increasing the general level of intelligence, so that some day employer and employee may have a proper and mutual appreciation of those scientific and financial problems facing the industries in which they should both be deeply concerned.

At the present moment, one cannot help turning over the question as to whether the minimum or living wage is scientific, but so many men are devoting their whole attention to a solution of this question that one hesitates to express an opinion. It certainly seems, however, that the basing of a living or minimum wage on an estimate of human needs has many faults. A high living wage certainly handicaps industry. It certainly leads to an increase in the cost of necessary commodities, and the minimum for a future period based upon the present cost of commodities cannot be scientific, because a large increase in the minimum wage must lead to an immediate increase in the cost of commodities. Thus wages keep mounting, and as the cost of commodities depends upon wages, or vice versa, a vicious circle is set up. If a maximum price for necessary commodities could be determined there would be no

scientific reason for an increase in wages, but earnings would increase, as is right, in accord with output, and not because a man could not live on less than a fixed amount. No one can seriously suggest that the average man's output at the present time is what he is really capable of. A minimum wage certainly sets up an artificial condition, for if it is enough for the needs of the majority, and more than enough for a large number, men cannot be expected to work their best. Some are idle part of the time because they are content with less, and a great many will not exert themselves fully because whatever happens they must get enough. It surely is more scientific that in whatever branch of industry a man is engaged his return should be according to his effort. Any other principle simply means the stagnation of the mental and moral qualities of the man, and the ultimate destruction of his efficiency. Perhaps in few other directions is it more important that science should be applied to industry than in this question of rendering effective the contribution of each unit of the community towards production. It is certain the question will have to be thought out, and the mistake should not be made of interpreting precedent for principle.

Nothing less than a war could have brought home so quickly and so fully to Australia the necessity for self-dependence, and, in fact, forced it upon her in many ways. During the past three years no less than 4600 applications were granted by the Commonwealth for the commencement of new industries, of which 2500 were from new companies. What could show more clearly the rapid development which has actually taken place? Woven more or less into the fabric of each one of these is the product of the engineer. If coal, iron and steel are the sinews of the nation, whether used for peace or for war, who, more than the engineer,

spends his life in scientifically developing the use of these constituents of the National frame? We have seen that the metal and machinery industry is one of the very greatest importance to the Commonwealth, and that it must grow more important still if the nation is to grow, for every great nation's progress has been marked by the correlative growth of its metal industries.

At a recent conference a prominent member of the Advisory Council of Science and Industry, in briefly outlining the Bill now before the Federal Parliament, frankly expressed certain fears—*one*, that the work of the Bureau might become too centralised; *secondly*, that the Bureau would not have the confidence of the people. With regard to the first, the engineers are deeply concerned with regard to this very matter, for they know the danger exists, and they know that Australia is such a vast country that unless the organisation of the Bureau is such that the community can obtain immediate access to laboratories, standards, etc., in all the important centres of the Commonwealth, the services of the Bureau will not be made proper use of; and if I may mention my personal experience as a privileged member of an organisation which, it is generally admitted, has appreciated the value of scientific control of its industry, one thing has always stood out as an important reason for success, viz., that at every factory there was available a laboratory for immediate reference, and the carrying out of tests and trials, without the vexatious delay that would be caused if every such matter had to be referred to a distant centre. Of course, such tests, trials, etc., are always reported to and co-ordinated at the main centre, where the assistance of a wide knowledge and consolidated experience is available for assisting the separate laboratories.

With regard to the second fear expressed, viz., that the community would not have confidence in the Bureau, here, I think, lies one of the very reasons why most careful consideration should be given by the Commonwealth Government to the appointment of its Directors, for upon the successful direction of the Bureau, of course, depends its useful existence. The Bill requires that two of the three Directors should be men scientifically trained; but this, I take it, does not mean that such men must necessarily be selected from those of high academic training, but that the Directors should be men whose training has been such as to imbue them with a full measure of the importance of the application of scientific methods to industry, and at the same time men who have had actual experience in commercial life, and who know just what is necessary in the way of scientific methods, and at the same time would not allow such ideas to subjugate the essential factor of commercial success. For instance, who would deny that the Commonwealth Bureau would be practically assured of success if men could be chosen to direct it such as have managed the Broken Hill steel industry, or some of the many other successful industrial concerns of the country? We want by all means to give science its right place, but one must feel deeply concerned if proper recognition is not to be made of those factors which are necessary to a successful issue. The engineers have certainly no other motive in this matter than that the direction of the Bureau should fall into the right hands, and there should never be lost the outstanding reason for the creation of the Bureau, viz., the *application* of Science to Industry.

Industry has to bear the burden of shorter hours and higher wages, and for it to do so systematic enquiry will be necessary to reduce the costs of manufacturing. Indus-

trial Research workers, to be successful, will have to be closely in touch with those who are directly engaged in the industries themselves, and it is important that those who direct the work should have a proper and sympathetic appreciation of the value of research workers. Unless the remuneration of such men is commensurate with their constructive ability, there will always be difficulty in obtaining a supply in competition with the less useful but more lucrative professions.

The Bureau of Science and Industry is a grand National conception, and the people of Australia rightly expect much from it. It has already done a useful work, but to ensure the ample fulfilment of its objects we must skilfully avoid the clogging of its machinery by those unfortunate factors that have rendered so many efforts futile. That sense of proportion which has been defined as the ability to determine essentials—to survey the whole field of endeavour, and to assign to each projected action the degree of importance warranted by its bearing on the main issue, and which I venture to say is more evident in private than in Government industrial undertakings—will have to be kept rigidly in view. No one wants to think on the lines of failure, and neither need we if the Bureau exercises a sense of proportion and will never allow itself to lose sight of the real object for which it was created, and in this direction nothing would appear to me so likely to contribute to its success as a continuous endeavour to tie the Bureau by cords of sympathy to the industries it seeks to improve, neglecting neither pure science nor the commercial requirement, the development of which it is almost wholly the object of the Bureau to ensure, and to thus bring about the realisation that science and industry are inseparable, industry absolutely depending upon the science for its gradual development and success.

Registration of Engineers.

This question, which has been before the Australian engineers frequently, is one that will have to be definitely met before long, and there is now in existence a suitable body to handle it. In the past, there has been much discussion as to whether it is feasible, or even desirable, to make engineering a closed profession, but when we have the oldest and most conservative institution in Great Britain now definitely asking its members whether they are in favour of such a course, it is clear that the idea is now much more seriously viewed than at any time in the past. In a recent address by the President of the Institution of Electrical Engineers, the retiring President brought before the engineers a charter for a suggested Royal Institute of Electrical Engineers, the Professional Council of which would, among other duties, undertake to confer "the right to practice in the different branches of Electrical Engineering." Again, the Engineering Institute of Canada has drafted a Bill "to establish by legislation the qualifications necessary to permit persons to act or practice as professional engineers," and as it is interesting to note their definition of a "Professional Engineer," the following words do so:—

"The practice of a Professional Engineer within the meaning of this Act embraces advising on, making measurements for, laying out and the design and supervision of the construction, enlargement, alteration, improvements or repairs of public and private utilities, railways, bridges, tunnels, highways, roads, canals, harbours, harbour works, river improvements, lighthouses, wet docks, dry docks, dredges, cranes, floating docks, and other similar works, steam engines, turbines, pumps, internal combustion engines, and other similar mechanical structures, airships and airplanes, electrical machinery and apparatus, chemical and metallurgical machinery, and works for the development,

transmission or application of power, mining operations and apparatus for carrying out such operations, municipal works, irrigation works, water works, water purification plants, sewerage works, sewage disposal works, drainage works, incinerators, hydraulic works, and all other engineering works. The execution as a contractor of work designed by a Professional Engineer, or the supervision of the construction of work as a foreman or superintendent, or as an inspector, or as a road master, track master, bridge or building master, or superintendent of maintenance shall not be deemed to be the practice of a Professional Engineer within the meaning of this Act."

It is intended to form an association of Professional Engineers in each Province, and only the members of such an association will be entitled to call themselves Professional Engineers. Five years' actual previous practice will entitle engineers to membership without examination, otherwise it will be necessary to submit to examination or produce credentials as may be required.

Close at hand, in Queensland, a qualified Engineers' Act has been drawn up for presentation to Parliament. It is a difficult question, but it is also certain that something must be done to prevent the present state of affairs to continue, when anybody or nobody can, under the present complete absence of organisation, call himself an engineer, and the degradation of the title continually turns one's thoughts in the direction of some definite means of qualifying, as is imposed on the other professions. At all events, as has frequently been pointed out, membership of the Engineering Institutions is the only way at present of judging an engineer's status, and there can be no doubt that it is largely to be attributed to the fact that engineers have no definite qualification by legislation that they are not properly appreciated, that Parliament knows little of them, and that the world in which their work is bestowed

seldom realises the duty of recognition. There is, however, a great deal of truth in the charge that we are now in our outlook somewhat badly equipped to interpret our work, that we have not made a really organised effort to instruct the ignorant, to educate the power of expression, and that we had, in fact, somewhat deliberately isolated ourselves, like the Anchorites of old. We hope, however, to have increasing opportunities to change the present state of affairs through the better organisation that the Institution of Engineers will provide.

And now, gentlemen, I must close my remarks to you, but before doing so I wish to tell you as earnestly as I can how very great a privilege I have always felt it to be a member of the Association, and how deeply conscious I have always been of the honour bestowed upon me by my election to various offices on the Council, and finally as your President for the past three years. Intimate association for so many years has long since engendered a feeling of great affection for the Association, and when, as I have often done, I tried to analyse what the real attraction was, the issue was always narrowed down through various stages to the same one thing toward which we are all, more or less, gravitating—the universal good; and if I have been able, in any measure, to help toward this ideal by performing my duty to the Association, then I am satisfied.

We are continually at the point of opportunity, and never was there a more solemn call than the present makes for fervent devotion and an absolute consecration of our services to the greatest of the professions. No one has any doubt that engineering has made remarkable progress, neither can anyone have any doubt as to the scope for future progress, but what concerns us most is not so much the past nor the future, which has infinite possibilities, but that we

take thought for the present, and by doing so we will bring ourselves more readily to the understanding that that which will ensure the greatest progress is, after all, service. What are we going to do about it? Are we going to give ourselves wholly and irrevocably to the great work of establishing upon a sure foundation an institution which will fulfil the high hopes centred upon it? Let us answer at once, and practically, and aright. No half-hearted effort will be good enough; let us work unremittingly in order to bring about the best results, and, above all, let us follow absolutely the issue that our outlook is now definitely broadened and our immediate objective is the good of the nation. Thus will we more fully contribute to the fulfilment of our bounden duty, viz., to bring into greater reality the meaning of our National title, "The Commonwealth."

Mr. HARRICKS then said it was his duty to vacate the chair in favour of Mr. Jas. Vicars, M.E. He felt sure they would appreciate the presence of the newly-elected chairman at their future meetings.

Mr. VICARS, in asking the members to carry a hearty vote of thanks to the retiring President, said that the untiring efforts of Mr. Harricks would never be forgotten, particularly his work in connection with the inauguration of the Institution of Engineers, Australia. This, the speaker thought, would stand out as a monument to his labour in this direction.

The vote of thanks was carried with acclamation, and the meeting terminated.
