XII.

THE ENGINEER POINTS THE WAY.

A report of a Broadcast Talk by Professor H. Levy and John L. Hodgson, M.Inst.Mech.E., on April 17, 1934. This report has been amplified at various points, as the time available for broadcasting was limited.

In his introductory remarks Professor Levy said, " I do not want you to think of Mr. Hodgson simply as ' the engineer.' Think of the numberless mass of research workers in problems on heat, light, sound, electricity, metallurgy, chemistry, physics, and even biology. Think of the scientific instrument makers, the mechanics and pattern makers, the welders and the rivetters, and their labourers and their labourers' mates; think of the theoreticians and the mathematicians, think of the organisation of the numerous research laboratories, and the problems of administration and direction of research, think of the development laboratories where the first tentative approach to a practical method in production is tried out; picture that vast medley of theory, experiment, practice, and the equipment, and realise that the man we are calling the scientific engineer typifies the last stage of all this complicated process where its product emerges in a socially useful form. In this scheme he stands for all that.

THE TALK

PROFESSOR LEVY: Now Mr. Hodgson, you're an engineer whose work has made it possible to eliminate very large industrial wastes. Tell me what you consider to be the function of the Engineer?

JOHN HODGSON: In answer to your question I can't do better than quote the Charter of the Institution of Civil Engineers. This Charter states that the function of the Engineer is "to direct the great sources of power in Nature for the use and convenience of Man."

L.: And you think that definition would be generally accepted by Engineers?

H.: I do.*

L.: Then the activities of engineers should create a high level of material prosperity for the whole community, and at the same time should provide men with ample leisure to follow their special bents and to combine to do the things that interest them?

H.: Certainly, that is what would happen if engineers were allowed to function freely according to the Charter I have quoted.

L.: We shall have to see shortly what you mean by *freely* in that connection. Now, in the first place, I should like you to tell me how you Engineers set about the design of any new mechanism.

H.: Well, we first make ourselves thoroughly acquainted with previous work, and then we try to combine existing mechanisms in the new ways so that they will do the job—never mind how haltingly. That is the first step. Then we improve this first crude mechanism, simplify it, pare off its useless parts, add useful gadgets, frame theories about its action, and generally adapt it to its purpose.

L.: Give me an example.

H.: The development of the motor-car epitomises the whole process. Here we started with a horse-drawn carriage and an engine. We took the horse out of

* It is but fair to state that in a Memorandum issued by the Council of the Institution subsequent to the Broadcast, and dealing with the activities of the Institution under the Charter, it is specifically stated that the object for which the Institution was originally incorporated was "the advancement of engineering science." The implications of the last vital seven words of the Charter are ignored.

the shafts and put an engine on wheels in its place, and from this crude beginning evolved the marvellous power-driven vehicles that we have to-day.

L. : And has this general method of approach proved satisfactory in your attempt to harness the great forces of Nature for the use and convenience of man?

H. : Yes, so far as the *harnessing* is concerned. In this we have succeeded to an extent that must be quite beyond the wildest dreams of the early engineers who framed our Charter.

L. : Tell me about this harnessing then.

H. : Well, consider what we can do! We can build ships as big as cities, and drive them smoothly through the water at headlong speed. We can stay the decay of foodstuffs by refrigerating machinery, and deliver fresh food out of season to all parts of the earth. We can make the generation of power in almost limitless quantities practically automatic. We can also make many of the industrial processes automatic. We have devised machines which speed up the output per man of such things and processes as shoes, flour, pig-iron, bricks, ploughing and reaping, from fifty to three thousand times. We can transport ourselves into the stratosphere thirteen miles above the earth's surface, and we carry out mining operations eight thousand feet below it. Our instruments enable us to measure time intervals that range from a thousand millionth of a second to a thousand million years. We can take photographs through bone and fog, and we can extract sugar and fertilisers from the air. Again, we can convert our almost limitless reserves of power, which are now used with less than one-quarter of the efficiency they might be, into radiations that can grow food in caves hidden from the sunlight. If necessary, we could grow all England's wheat and fruit supplies in underground chambers excavated under an area less than is covered by this town of London. For our delight, or to aid the ends of those who control us, we can create almost endless new materials—synthetic resins, glass hard metals, artificial silks, brilliant dyes, infusible earths, poisonous gases . . . We can also create new breeds of animals and plants. By our development of transport and communications we have

made the whole earth one. Yet at the same time our new machinery and methods have increased the capacity of every area to be self-contained.

L. : You claim then that to all intents and purposes the great forces of Nature are already under the control of the Engineer and his co-workers?

H. : Yes : earthquakes, tornadoes, and the energies within the atom seem to be about the only physical forces that elude us still.

L. : Now tell me about the second and unfulfilled portion of your task. You talked a moment ago of completing the harnessing of Nature in the *service* of man. This, I should imagine, is where a new class of difficulties begins, for here you begin to deal directly with human beings and not simply with pieces of machinery.

H. : Yes, when we Engineers look up from our labours which, for the first time in man's history have created the possibility of almost limitless plenty throughout the earth, we see around us a Society that is organised for scarcity and insecurity. We see coffee and wheat burned and fish thrown back into the sea, while people go in want for lack of these things. We see a host of useless activities engaged in. Obviously then, our most urgent task is to help to organise the plenty that our work has made possible, and to chase away the artificial scarcity of the present transition age.

L. : You feel, in fact, as an Engineer, that the way in which Society employs the results of your labours is so unsatisfactory that Engineers themselves must see to it that their labour is not in vain?

H. : Yes. For this is but the completion of the task set us in our Charter. You see, there are only two parties who are vitally concerned in the completion of this task : those who have created the possibility of Plenty and hate to see it wasted, and those who suffer unnecessary privation, hopelessness and helplessness because of the wastage.

L. : So, as thoughtful Engineers, you look beyond your purely technical work to discover what is wrong with the social machine? And what do you find?

H. : Well, as an example of what we find, let us take

the opening words of a circular issued by one of our great industrial organisations: Those are "The *only object* of engaging in manufacture is to make a money profit"—note, not service, nor use, nor the creation of plenty, but money-profit.

L.: The connection is not quite clear. How does the making of a money-profit by the manufacturer stultify the activities of the Engineer? Surely if one is in business one must make a money-profit in order to survive?

H.: That's quite true, as all who engage in business know to their cost. But what one *has* to do when one is caught in a mesh is not necessarily what one *would* do if one's judgments and activities were entirely free. Consider the actions forced upon the manufacturer. Continually faced by this necessity for making a money-profit, he has to "take the cream off the market" by selling expensive goods at high profit for as long as the market will stand it. He frequently has to produce goods that last only a fraction of the time they might do, so that he can make profit by their replacement, and to buy up and suppress new inventions because they interfere with his manufacturing programme. He is compelled to combine to maintain or raise prices. He is forced to sell unwanted goods in unwilling markets. Caught in the money-profit mesh, he sells in any market that will take his goods. He even sells manufacturing plants to foreign countries that will destroy his markets and his methods, and munitions of war that will destroy his countrymen. He has always to strive to reduce wage costs, while at the same time he has to call for every device which will enable him to produce more cheaply.

L.: Your charge, then, is that when Science is used for making a money-profit, there is no question of public good directly involved. This is clearly a waste of human effort and material. I wonder what is the magnitude of such losses to the community.

H.: My own estimate, given in my book, "The Great God Waste,"* is that they cause industrial com-

* Published by John L. Hodgson, Eggington, Beds., 2s. 9d.

munities, which are based upon the achievements of the Engineer, to waste uselessly at least *nine-tenths* of their activities.

L. : Yes, I've read your book. If I understand it correctly, your idea is that our economic system is like a leaky tank into which Engineers, Scientists and Organisers continually pour the new efficiencies which the money-profit motive calls into being, and that these efficiencies are for the most part wasted because the mass of the people are allowed insufficient purchasing power so that they may be controlled by impoverishment. That seems to me an over-simplification of a difficult problem.

H. : You may, of course, add complexities to my simplification. But the basic fact that I want to make clear is that when the Engineer has succeeded in eliminating an Industrial Waste, our strangely organised society as rapidly as possible balances the saving of human time and energy which he has effected by the development of some new Communal Waste. By Communal Waste, I mean any of the various ways in which those who control the money system of an industrial community cause its members to deprive themselves of goods and services they might enjoy.

L. : I'll ask you to tell me more about the Communal Wastes later on. But for the moment tell me how you Engineers deal with Industrial Wastes. Give me an example.

H. : Well, if you visit any large power station you'll find that almost all of them pour out large streams of hot water into nearby rivers or cooling towers. The heat energy contained in these streams of hot water is immense—about three times the electrical output of the stations. So we engineers are planning how to use this heat for baths, laundries, dwelling-houses, offices, greenhouses, and in connection with local industries. We have already succeeded in the case of large industrial plants which have their own power stations. Here the power stations are often designed primarily to supply heat; electricity being a mere by-product. Engineers have thus saved many thousands of tons of coal a year, and so reduced a particular Industrial Waste. But in this country alone some seven or eight million

tons of coal could still be saved by utilising the heat now thrown away in the cooling water of the power stations.

L. : Well, why is this not done?

H. : Mainly because of the money-profits that would be lost. Think of the disorganisation and distress that the saving of eight millions of coal a year would cause! Forty pits, twenty thousand colliers, and thirty thousand others dependent upon the colleries out of work. Our existing system has no mechanism for adequately compensating those displaced, or even for adding the value of the labour liberated to the current consumption of the country. You will appreciate how the lack of any such mechanism adds to the difficulty of the engineer.

L. : Yes, indeed. Now, give me some further examples of what you call Communal Wastes.

H. : Well, among them are such things as mass unemployment, strikes and lack of zeal† on the part of the workers; the various obstructive activites of vested interests; our curious habit of digging up gold at great expense and then reburying it as quickly as possible in bank vaults; most advertising activities; most of the activities of middlemen; the sabotage of factories, agricultural lands, raw materials and manufactured goods in order to restrict production and maintain prices; at least half of our foreign export of goods, for which—owing to the default of our debtors, and to other causes—we are never repaid in goods; the refusal to accept reparations in kind; most ticket-collecting, taxation and book-keeping activities; most wars; unnecessarily inadequate health, starved education, and so on.

L. : Some of these are certainly wasteful in the sense that a more efficient social organisation could be conceived that might dispense with or avoid them. I presume you would agree that cogent arguments could be put up in support of all the activities you have just condemned?

† Ford countered this by the invention of the travelling belt which automatically sets the pace for all workers.

H. : Most certainly yes. These activities are part of the existing structure of our Society, and men would not engage in them if they thought them useless. But my point is that they are the activities of men caught in the mesh of the money-profit motive, not of men desiring to get the necessary work done with the minimum of effort. Now there would be no Communal Waste in such activities if everybody had sufficient, and if men really liked doing these pointless things. But when it is gravely argued that the various " cuts " cannot be fully restored, that the milk that the nation's children need must be sent to factories to be made into buttons in order to maintain milk prices, that a man should be able to live on food that costs no more than 5s. 2d. a week, that the community cannot afford the food represented by 3s. to maintain a child for a week—and actually *millions* of our people have to feed themselves on *far less* than these amounts—then it is very obvious that there is something seriously at fault with the money-profit-seeking, price-raising activities that we all so readily take for granted.

The other day I looked through the Financial and Commercial Review of " The Times." The main heading on the first page was " Beginnings of Recovery," and on almost every succeeding page some *reduction* of output in order to increase money-profit was chronicled.

We all know of the Milk and the Pig Marketing Board, the Cotton Spinners' Association, the Wool Combers' Mutual Association and the many other industrial combinations enforced by the money-holders which restrict production and cause the sabotage of plant that it has taken generations of privation to create. We live helpless in a society that destroys its resources as if possessed by dementia. Yet the proximate causes of that dementia can be easily seen. If you first take away from the individual the ownership of the means of production by which he lives (and how many of us own the means of production by which we live?), and if you then vastly improve the methods of production on the one hand and keep wages, salaries and security as low as possible on the other in order to ensure control by impoverishment, you must necessarily waste prolifically in order to keep going at all.

L. : Have you evaluated the losses caused by any of the Communal Wastes?

H. : Yes, in a number of cases. Take unemployment, for instance. If we include with the unemployed men the women who would like to work and who are not allowed to, and the thirty thousand executive people who are at present out of jobs, it can be shown that this one waste reduces the material wealth we might enjoy by at least one thousand million pounds a year. That sum is approximately one-fifth of our total national productivity. Or, to put it another way, it would about pay all our taxes.

Just think of it! If we stood our unwilling unemployed shoulder to shoulder along the sea front in order to look at them, we should find that they formed an unbroken parapet around our two thousand miles of coast line. It has been estimated that if we do not reduce the rate of achievement, invention and discovery, or materially increase the general standard of living, or engage in war, we shall be able to double that parapet within the next ten years!

Then again, take gold-getting. Here is an activity that impoverishes us by some fifty million pounds a year, since to achieve satisfactory production and consumption within a country gold is quite unnecessary. All that is essential in a richly endowed and highly skilled community like our own is to assess the amount of production needed to give everyone sufficient, to organise so as to produce it, and then to issue tickets or credits to consumers which are cancelled on consumption. Any necessary exchange of home-produced goods for foreign ones is easily arranged for under such a system.

L. : I see. You regard it as a mere question of organisation. I wish I could see it as simply as that.

H. : The matter *is* simple if one's objective is merely to arrange for adequate production and consumption. The money system I have just outlined contains all the elements necessary to ensure adequate production and controlled consumption within a community living partly by foreign trade. It can of course be elaborated and adapted to any extent desired, just as the first

horseless carriage was elaborated and adapted as the motor-car developed. But our existing money system has other objectives than the maintenance of adequate consumption. Among these are the piling up of debt obligations, the creation of artificial scarcity, and the concentration of Credit Power.

L. : So you think the trouble resides with those who control the money system. What do you mean by Credit Power?

H. : I mean the power which enables monied men and those who control money—particularly the financier, the large industrialist and the heads of the Treasury—to decide the terms on which other men who are without adequate monetary resources shall do and use things. As far back as 1790, a great moneylending financier wrote, " Permit me to issue and control the money of a nation, and I care not who makes its laws." At present about four per cent. of the people hold eighty per cent. of the Credit Power. Under this arrangement a very few people control the rest—including most of us Engineers.

L. : And this is one of the evils we have to tackle, is it?

H. : Yes : and a very grave one ; since the holders of Credit Power are under no incentive to use this power in socially valuable ways. Actually, as I've said, they struggle among themselves to concentrate Credit Power still further. In so doing they use whole industries, social classes and nations as their pawns. And the end of this struggle of giant and competing organisations is War, which is the greatest of all the Communal Wastes, since it destroys life as well as opportunity.

L. : I gather that you consider the elimination of the Communal Wastes is a problem which the engineer himself must face, and that if this elimination could be carried through effectively we might all be ten times richer than we are at present without depriving the well-to-do of any of the material things they now enjoy. You suggest that we should create new wealth in abundance, rather than tax the rich in order to give to the poor. That is you idea, isn't it?

H. : Yes, considering our immense potentialities for production, that would seem to be the reasonable thing to do. Given the will, the general level of prosperity in this country could certainly be doubled within two years from now—just as production was increased out of all knowledge during the 1914-18 War.

L. : So the War created a great impression on your engineers?

H. : Yes, we saw and helped in the immense expansion of productive power that occurred during the War years. But being ignorant of the mechanism of the leaky tank system within which we now find we function, we said among ourselves, " When Peace comes there will be material prosperity such as the world has never known." To us the thing seemed obvious. The splendid factories and plants, the trained people, the improved methods of organisation and of agriculture, all were there. But when we saw the plants destroyed; government organisations disbanded and replaced by organisations that in the case of the cotton and the shipping control required a hundred times more staff; when we saw valuable and useful war material burned or allowed to rot; when we found the country was not to receive reparations in kind; when we found the bankers and the finance houses lending and losing money to our late enemies who had offered to make us rich with goods; when we found ourselves heavily taxed; when we saw the smaller firms crash, the farmers go bankrupt, and the land and the larger firms become mortgaged to the Banks; when we found it cheaper to buy English steel in Brussels than it was in Sheffield because of export bounties; when we found skilled members of our profession out of work; when we found it difficult to place our sons; when we saw whole industries being consolidated in order to restrict production and to reduce independence among producers; we could not help but realise that serious faults existed. It was the destruction of the war organisation, and the poverty that came in place of the plenty that we clearly saw was possible, that convinced many of us that it was high time we began to study the structure of the system within which we found ourselves compelled to function.

L. : And now, having made your analysis of the structure of society, what type of Society do you engineers visualise as possible?

H. : Well, obviously one in which there is no poverty and in which all have economic freedom. To achieve such a Society, there must be at least three main groups of Responsible Bodies; those vocalising desire, those guarding tradition and co-ordinating policy, and those carrying policy into effect. In such a society, men would strive to make dangerous or disagreeable tasks safe and pleasant, or else to eliminate them altogether. They would, however, retain many of the present mass-production methods, as these effect such great economies in human labour that it would be foolish to abandon them. But to avoid the production of robot-like individuals, they would make work in the mass-production factories and farms a holiday task for the many, instead of a life-stealing drudgery for the few. All this work need not be hurried. And it could be made thoroughly enjoyable. But, even so, it would not take more than three months per year per person, especially if everybody, old and young, shared in the doing of it. In such a society men wouldn't have to spend five or six days a week and all their best energies—often in ways that are distasteful to them, and which were against their better judgments—in merely acquiring the means to live. They would find themselves with something more than the dregs of their time and energy to spend in living itself. Quite obviously, they would be much less specialised than we are. They would have wider training and wider interests. It is the machines that would be specialised.

. . . . . .

But to define what men should do under a condition of abundance is really beyond the province of the Engineer as such. His job is to provide the Plenty, and to see that it is duly delivered to those who require it; that is, in the words of his Charter, " To direct the great sources of power in Nature for the use and convenience of Man."