ECONOMIC POWER PRODUCTION

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two countries in regard to commerce generally, and particularly with reference to textiles. In pre war days, we sent, in cotton goods alone, 30 million yards to Greece. Together with woollen and worsted goods, jute goods, and yarns, our exports of textiles represented more than half of the total value of our exports to that country.

The LORD MAYOR replied, and hoped the Congress of the Institute would be attended with every possible success.

Owing to pressure on accommodation at the Town Hall, a considerable number of members had to be accommodated at the Midland Hotel, where luncheon was served. The DEPUTY LORD MAYOR (Mr. W. H. Brocklehurst) presided, and proposed the toast of "The Textile Institute." On behalf of the Lord Mayor he warmly welcomed the visit of the Institute, and said the visit was a stimulus both to the City and the Institute. He reviewed the educational features of Bradford and called attention to the new Commercial Library which had been established—the third in the Kingdom. Mr. GEORGE GARNETT (Chairman of Council of the Institute) responded, and thanked the Lord Mayor and the Deputy Lord Mayor for the hearty welcome they had accorded the Institute.

VISIT TO THE BRADFORD TECHNICAL COLLEGE.

In the afternoon a visit was paid to the Department of Textile Industries of the Bradford Technical College. The visitors were received by the Principal of the College, Professor W. M. Gardner, M.Sc., and the head of the Textile Department, Professor E. Midgley, and staff.

Principal GARDNER, in the course of a short address, said he welcomed the Members of the Textile Institute because he believed the Institute should act as a focus for the various interests concerned in the scientific, technological, and educational aspects of the textile industries. Looked at from that point of view, the Institute had great opportunities and responsibilities in the period of reconstruction. These opportunities were very varied. One, he took it, referred to the development of co-operative action amongst those engaged in the industries; another had reference to the development of co-operative effort amongst employers and workmen. On the solution of the problem associated with the latter consideration depended, in large measure, the industrial peace of the future. Another subject upon which the Institute could and ought to take a lead was in regard to the training and education of those who were to be engaged in the textile industries. The only other matter he would mention was investigation and research in respect of all branches of the textile industry. In this connection, the work of the Institute and the work of the Universities and Colleges which dealt with textiles were mutually essential. The future success of British industry obviously depended upon brains, knowledge, and hard work on the part of both masters and operatives, and, again, on the full utilisation of science in industry. In the past, there had been a great

measure of association between the Institute and the colleges, but he was inclined to think that, to some extent, this had been based on wrong premises. A good many of our leading industrial men had done all they could to support the work of the colleges. But, to some extent, the work had been looked upon as being of a philanthropic nature, whereas, the co-operation should really be based upon a feeling of partnership. The development of this feeling of partnership was a most important matter to the future success of the work. As to textile research, there were practical difficulties which ought to be recognised in results. The variable character of textile raw material, for instance, set up an essential difficulty in all stages, and final results became a matter of opinion and individual judgment. Those factors peculiar to textile research should be carefully kept in mind in considering results. The great function of the Institute was, it seemed to him, to take advantage of, and bring to a practical issue by means of definite proposals and schemes, the great change of mind and the new attitude now permeating the whole of our industries with regard to the subjects of technical training and research. He did not think the Institute could take up a more useful work or a work of more far-reaching importance than that of doing whatever it could to permeate the industry with a full appreciation of the value of science, scientific work, and scientific methods, and to focus and render articulate the changed feeling and growing desire for new conditions and developments of all kinds at present in the public mind. They—the colleges—were ready and anxious, and believed they were in a position, to help along British industry on the scientific side, and in this matter they desired a co-partnership with those in the industry.

Subsequently, various departments were inspected and several lectures were given, of which the following summaries have been provided:—

ECONOMIC POWER PRODUCTION.

By Prof. G. F. CHARNOCK, M.I.C.E., M.I.M.E.

The economic production of power has become a matter of grave national importance. Nothing can contribute more to the successful reorganisation of industry after the war than a plentiful and reasonably cheap supply of power. It is agreed that it will be necessary to secure a considerable increase in output and in the means of production, which, in turn, will mean a large increase in the amount of power used for industrial purposes. Economy in the consumption of our coal supplies, therefore, becomes of vital importance to the nation and to the individual.

A careful study of the possible sources of energy at our command serve to show that there are no other directions in which further economy is likely to be effected except by improvements in one or other of the various types of heat engines already in use, and of which the reciprocating steam engine, the steam turbine, and the internal-combustion engine using gas or oil fuel have provided the most successful examples. Engineers are well aware that such engines are at best but crude contrivances for converting heat into

work, but probably few power users have any idea of the extremely wasteful nature of the processes involved in power production. The lecturer demonstrated this by reference to a heat diagram for a locomotive engine, in which it was shown that 95 per cent of the total heat of combustion passes out at the top of the chimney, comprising 36 per cent in the products of combustion, and 59 per cent in the exhaust steam. Thus, only 5 per cent reaches the cylinder of the engine, and, allowing for engine friction, not more than 4 per cent is available at the driving wheels for tractive purposes.

Can it be wondered at (the lecturer asked) that people are talking about electrification of railways? Without doubt very considerable developments in the transmission of power by electrical means will be made in the near future, but it should not be forgotten that electrical transmission does not in any sense get rid of the engine, which will remain as wasteful as before.

Another example of greater interest to textile power users was referred to in greater detail, showing the sources of loss in a highly economical mill engine. Probably the number of mill engines working continually on as low a consumption as 2 lbs. of coal per H.P. per hour is very small, but it is safe to say that if all the engines throughout the country did equally well, considerably more than 50 per cent of the fuel now used for power purposes would be saved.

There are 45,000 users of steam plant in Great Britain, and the amount of coal consumption for power purposes reaches 70,000,000 tons per annum. There is therefore no doubt that a saving of 35,000,000 tons per annum could easily be effected, and that we have now reached a time when it will pay to scrap all steam engines and boilers which do not succeed in converting into power at least 6 per cent of the total heat of the coal used.

The chief sources of loss occur in the chimney gases and in the engine exhaust, the former amounting to 22 per cent and the latter to about 60 per cent to the total heat in the coal. The former loss occurs, of course, in the working of the boiler, and the latter represents heat which is dissipated in the mill dam or cooling tower. Unfortunately, there is no known means of preventing or even reducing this loss so far as the engine is concerned, but post-war conditions will undoubtedly compel us to pay more attention to the utilisation of waste products, and in this connection the waste heat discharged from the condenser offers a wide field for research. The enormous waste of coal used for domestic purposes might be greatly reduced if it were possible to adopt some system of hot-water mains fed by waste heat from engines. The proposal to establish combined electricity and heat generating stations is not new, but it deserves far more attention than it has yet received. The internal-combustion or gas engine possesses the advantage that the heat rejected in the exhaust is more readily recoverable than in the case of the steam engine. A highly efficient gas engine converts about one-third of the total energy of the gas into useful work, one-quarter being lost in the cylinder jacket and about three-eighths in the

exhaust. A thoroughly practical solution of the problem is afforded by utilising the exhaust gases from a gas or oil engine for raising steam in a special type of boiler. Such boilers have been installed in large numbers in combination with gas engines where steam is required for heating or manufacturing purposes, enabling a substantial saving to be effected.

Regarding those sources of loss which admit of reduction, the greatest waste of fuel occurs in the boiler house, and comparatively few boiler plants are working at anything approaching the maximum possible efficiency. It is evident that mill-owners have it in their power to effect considerable economy at this stage. Proper instruments and appliances must be provided to enable the performance of the boiler to be recorded and checked continuously. Hence, it follows that the training of the fireman is of paramount importance, and it is idle to talk of effecting further economies unless power users are prepared to adopt a very different attitude in this respect to that which they have displayed in the past. The employer must come to see that in improving the training and status of the fireman he is not acting from philanthropic motives alone, but also in his own immediate interests. Hitherto, steam users have not been prepared to pay any higher wages for trained men than for the lowest class of unskilled labour, and no inducement has been held out to a man to make himself efficient.

From the power user's point of view, power production is purely a commercial and not a scientific proposition. The rational method of arriving at the cost of power is to include capital charges as well as running costs.

Several examples were given by the lecturer. It was shown that a very considerable reduction in capital expenditure per H.P. of a power plant occurs with increase in the size of unit, and also that a great improvement in efficiency results from the use of large units. It is, therefore, reasonable to conclude that a considerable gain will be obtained by centralisation and working on a large scale. But progress in fuel economy involves something more than increased thermal efficiency of the engine. The recovery of by-products which can only be economically effected in very large plants has been much neglected in this country. Better methods of domestic heating are greatly needed, and the abolition of the smoke nuisance demands urgent attention.

The report on "Electric Power Supply in Great Britain," prepared by the Coal Conservation Sub-Committee of the Ministry of Reconstruction, and a later report of the Board of Trade Committee appointed to consider the question of "Electric Power Supply from the National Standpoint," were referred to and discussed. Many people (the lecturer observed) regard the scheme in some of its aspects as of a highly Utopian character, but if it could be shown to be possible of realisation in its main elements, the issues involved are of such supreme importance to the whole nation, that it should receive the sanction and support of the entire community. No doubt, several important matters have been overlooked, notably the fact that

a very large amount of steam will always be required for industrial purposes, in heating, boiling, &c., altogether apart from power production. The report in question should be carefully considered and discussed by every technical society in the country, so that when any action dealing with the subject is proposed to Parliament public opinion might make itself felt in no unmistakable manner.

It should always be borne in mind that the main object is the utilisation of the nation's fuel supplies to the best all-round advantage. Not only should a supreme effort be made by industrial firms to reduce their losses in every possible way, but steps should be taken to set on foot any enquiry or research which will help forward the movement to promote economy in the production of power.

HUMIDITY OF THE ATMOSPHERE IN REGARD TO TEXTILES.

By BARKER NORTH, A.R.C.Sc. (Lond.).

After explaining by word and illustration methods of testing for vapour in the atmosphere, the matter of vapour pressure, and relative humidity, Mr. North said wool dried in a desiccator in the manner described became bone dry, and if again exposed to moist air took up moisture until a balance was obtained between the water vapour in the air and the water in the wool, the point of balance being dependent upon (1) the kind of material, (2) the temperature of the air, and (3) the relative humidity of the air. When this balance was obtained, the percentage of moisture in the material remained constant so long as the atmospheric conditions of temperature and humidity were maintained constant. Hartshorne, as described in a paper contributed to the American Society of Mechanical Engineers, had shown that, starting with two skeins of wool, one which had been exposed to a dry atmosphere, and the other to a moist one, it may take a very considerable time to bring the skeins together again—to the same condition, when a balance was maintained between the moisture in the wool and in the atmosphere. He had, however, also shown that this lagging effect may be made use of to give the true regain relationship for the particular atmospheric conditions, as after about 15 or 20 minutes the mean result of the conditions of the two skeins was the same as the final result obtained by exposing the material for a considerable time to similar conditions of temperature and humidity and until both skeins were in a balanced condition as regards percentage of moisture. Hartshorne's charts for worsted and cotton showed that the percentage regain was diminished by increase of temperature and increased by an increase in relative humidity. It must be noted that, assuming the average conditions of the atmosphere in England to be 60 deg. Fah., and 70 per cent relative humidity, the regain for worsted was obtained from the chart as 18 per cent, and in the case of cotton just under 9 per cent, figures which agreed very closely with the figures officially fixed. It was thus evident that in order to secure the most satisfactory results in the drying of wet material, or in the conditioning of dry wool, certain

points must be observed which were in accordance with the laws of humidity. In the drying of wet material in a confined space, the volume of the drying chamber, the quantity of vapour already in the air, and the quantity of water which may be taken up under certain conditions of temperature by the space must all be taken into account, but most important of all, means must be adopted of removing air saturated with water vapour and replacing it by unsaturated air, otherwise all drying would cease. The vapour pressure in the barometer tube showed that once a certain pressure was obtained at any particular temperature, evaporation ceased. In the conditioning of dry wool, it was obvious that a high percentage of moisture could only be got by employing air of high relative humidity. A balanced condition between the air and the wool was obtained with a relative humidity of 100 per cent, with a regain of 24·5 to 28 per cent, according to the temperature. With 70 per cent relative humidity, between 16 per cent and 17 per cent regain was obtained, according to the temperature, and so on. Remembering the relationship between the 2-gram sample of wool treated in the course of the lecture, and the quantity of water in the cubic foot of air at 60 deg. Fah. when saturated, that this quantity of water may be taken up by the wool to give 18 per cent regain, and further the large volume of air relatively to the volume of the wool, it demonstrated in a very striking way the large volume of air which was necessary in the conditioning process. As the absorption of the water from the air lowered the relative humidity, it was also evident how important it was to replenish the water vapour in the air, in conditioning, in order to maintain the relative humidity, which was one of the most important factors in the process.

MECHANICAL DOFFING DEVICES.

Mr. J. DUMVILLE, lecturer in combing and spinning, dealt with the subject of mechanical doffing. The lecturer said that the production of efficient doffing arrangements for the several types of spinning frames used would be of immense value to the worsted and allied trades. The frequency with which doffing of spinning frames is necessary, and its routine character, seemed to specially mark it out for mechanical treatment. Doffing by manual labour, however expert, involved considerable cost in labour, constant supervision, and loss of time and production by the system of doffing one bobbin at a time. The ideal which inventors had to aim at was to evolve a device which, when the diameter of the bobbin indicated that it was full and ready for doffing, would stop the frame and, simultaneously, by means of levers, cams, and wheels, remove the full bobbins and assemble empty ones in their place, and at the same time so sever and wrap in the end of yarn that it could not interfere with the winding-on during spinning. For the inventor of such a machine a great reward was assured. Some device less complete, however, would be of use at the present time. The flyer-frame seemed to have received most attention from inventors and machine makers,