Engineering in Steel Works and Collieries.

THE presidential address of Sir William Henry Ellis, delivered at the Institution of Civil Engineers on November 3, was devoted to a survey of the varied and difficult problems arising in steel works and collieries connected with the great development in mechanical engineering which has taken place during the last forty years. In the early part of this period, steel works engineering was in the hands of good practical men who could only with difficulty move with the times, owing to their lack of knowledge of the technical side of engineering. Low pressure steam was supplied to distant mill and machine shop engines with inevitable waste. Electricity probably did not exist in any of the large steel works. High-speed tool steel was unknown, except Mushet steel, used more for its power of dealing with unexpectedly hard material than as high-speed steel is now used. There was, therefore, a great opportunity for young engineers who had received a combined technical and practical training to share in the work of introducing improved machinery. Economic production was not then so important, and there was comparatively little foreign competition.

The introduction of much higher steam pressures with water-tube boilers, and the advent of electricity, have been the two factors of the greatest help to steel-works engineers. To illustrate the advance—thirty years ago a large machine shop, with its inefficient driving and steam generation and distribution, was converting 1·5 per cent. of the total energy of the coal into useful work. Now, by taking power from one of the latest and most efficient super power-stations in Great Britain, the shop can convert 17·38 per cent. of the thermal energy of the coal into useful work. This represents less than one-fifth of the energy available, and hence engineers cannot yet feel satisfied.

Developments in marine engineering caused the introduction of hollow rolling. Up to the time of the s.s. *Lusitania* turbine drums had been nearly all welded. Sir William was able to apply a process of punching and hollow rolling to the production of drums, in some cases more than thirty tons in weight. The process has revolutionised this important industry, and the results have been entirely satisfactory. What has always been wanted for this purpose has been a satisfactory ingot, cast hollow. At present Sir William and his colleagues are interested in experiments in this direction by means of centrifugal casting, this point being mentioned as an instance of the importance of the metallurgist and engineer co-operating in the closest possible way.

The physical properties of steel begin to change at temperatures at which steam is now used—750° F. and higher, and Sir William is carrying out a research on this point, with his metallurgical colleague Dr. W. H. Hatfield. The results of the series of tests being made will be useful to engineers who have to deal with the very high steam pressures employed. If still higher pressures with their corresponding temperatures are introduced, it may be necessary to use alloy steels, the physical properties of which are only affected at much higher temperatures.

No engineers are more definitely entrusted with the lives of their subordinates than mining engineers. Such engineers must possess an extremely varied knowledge, and it is very difficult for the mining engineer of a large colliery to be conversant with all the modern developments in mechanical engineering. Immense progress has been made in recent years in colliery engineering, but much remains to be done, and Sir William urges the desirability of the mining engineer having well-trained mechanical engineers on his staff. Such could render very great assistance to their chief.

Electricity has as yet been introduced into collieries only to a limited extent. No doubt electrical engineers may aid its use by further reducing the liability to sparking. Oil-immersed switches in closed boxes are a considerable safeguard, and the well-thought-out designs of main cables now in use appear to afford great security against risk of short-circuiting in cases of falls of roof. Electric haulage in the workings has largely replaced the practice of surface engines with haulage ropes in boxes down the shafts. Electric winding has been introduced, and is making considerable progress.

Reference was also made to the work of the British Engineering Standards Association, which has now 475 committees and 2300 members. Engineers have shown great public spirit in giving time and attention to this great work—entirely on an honorary basis. Engineers and steel firms throughout Great Britain have generously supported the work by contributions to the funds, but this is a severe tax on industry in the present state of things, and it is earnestly hoped that some measure of Government help may be forthcoming.

The Ignition of Gases.

MANY of the difficulties connected with the ignition of gases are still unfathomed, although the subject has been investigated in one way or another from the time of Davy's well-known researches connected with safety in mines. Measurements of the rate of combustion were first attempted by Bunsen, but it was left to Berthelot, to Le Chatelier, and to Dixon to lay down the methods by which the propagation of combustion in gases could be satisfactorily studied. A further impetus to such investigations came with the development of the internal combustion engine. The recent work of Bone, which indicates that nitrogen plays a considerable part in the process of combustion, is particularly interesting and links the subject with the fixation of nitrogen. It was apt, therefore, that a discussion on the subject should have taken place at the meeting of the British Association at Southampton between the Chemistry and the Engineering Sections.

Prof. H. B. Dixon opened the discussion with a historical survey of the subject. He described Berthelot's discovery of the detonation wave and Le Chatelier's experiments on the same subject at the same date. Le Chatelier discovered three stages of combustion; the stage of uniform propagation, developing into a vibratory type of combustion which precedes the last stage, the initiation of the detonation wave. Prof. Dixon illustrated his remarks by some of his beautiful photographs of the propagation of explosions in mixtures of oxygen with cyanogen, acetylene, and other gases. The explosion wave travels with uniform velocity at the speed at which sound would travel in the gas, taking into account its high temperature and state of compression due to the combustion. Experiments on the measurement of ignition temperatures, which he has recently carried out by two different methods, were described. Tizard and Pye have shown that the delay which