During the past 75 years there had been a criminal waste of fuel going on all over the world. The ordinary wasteful method of using coal was really stealing from posterity, and it would not be long before enlightened nations would prohibit the use for power purposes of any distillable fuel that was not in the form of oil. The transformation of coal into oil for use in internal combustion engines, and the reserving of petroleum residuals and other suitable oils for a like purpose, would be a move in the interests of economy, and would materially postpone the day when the world's fuel supply would be exhausted.

Discussion.

Mr. Sykes said he had very much pleasure in proposing a hearty vote of thanks to Mr. McEwin for the paper to which it had been their privilege to listen. He did not think a more unsuitable person could be found for the task he had now in hand, as for all practical purposes he had had little or no experience with oil fuel, and, consequently, any remarks he might make must be regarded as purely of a general nature, and which might readily occur to any engineer unversed in this subject. There were, however, one or two points about which he would like some further explanation.

He noticed, in one of the illustrations of a furnace which appeared on the screen, that the combustion took place all round the chamber, and he believed Mr. McEwin stated that the nozzles or feeders could be applied to a furnace fitted with fire-bars. He had always been under the impression that all the oxygen necessary for burning fuel was conveyed through the nozzle. He would, therefore,

like to ask in what manner the fire bars are kept sufficiently cool to prevent deterioration by the heat produced by the burners.

Some years ago he was connected with a coal-field in Swansea, South Wales, G.B., and he remembered trying an experiment there upon an ordinary Lancashire boiler with pure anthracite coal, which he understood was shown upon analysis to contain about 90 per cent. pure carbon. The results of that experiment were disastrous. We found that it was necessary to apply steam in order to keep down the temperatures sufficiently to prevent the bars from melting and adhering together.

Another point which the lecturer, in the course of his remarks, revealed to them with much forcibleness, was the enormous discrepancy between the thermal efficiency of oil fuel and coal fuel. At the present moment he had under consideration the design of a jacket which he desired to attain a temperature of something like 800 to 1000 degrees Fahr. It occured to him that he might be able to apply oil fuel. The other alternative was, of course, ordinary gas. Mr. McEwin's remarks had encouraged him to hope for success in connection with this matter.

The lecturer also stated he believed that a recent calculation made by Dr. Engler placed the world's oil resources at 5,000,000,000 tons, which he estimated would last about 100 years at the present rate of production. He would like to ask if there was any possibility of oil fuel being sufficiently reduced in price before the 100 years expires, so that intending consumers in New South Wales would be able to use it?

Mr. W. Sinclair said he had very much pleasure in seconding the motion put to the meeting by Mr. Sykes. Like that gentleman, he was not familiar with the subject of oil fuel, in all probability by reason of the fact that

different countries prefer different systems. For instance, in Victoria, the use of suction gas prevailed. In this State ordinary coal was principally used, and probably further on wood was burned.

He remembered reading a good many years ago that the first method of burning oil required the use of a hollow fire-bar, but I believe little or no success was achieved by it.

He had seen oil fuel applied in a sugar refinery in British Columbia which had been using coal for many years. Owing, however, to labour troubles, the authorities concerned were induced, despite the higher price of oil fuel, to convert their boilers to the use of oil burners. If he remembered rightly, they commenced to do so by putting jets in the back of the furnaces, and blew the incandescent gas towards the furnace bars, and then through a series of channels to the boilers. He thought they had a number of buckle-bottomed tubes; but, evidently, these were now things of the past. The combustion chamber in front of the boiler apparently surmounted that difficulty.

Later on he was on board a steamer owned by the Hawaiian-Californian Line, and a good deal of excitement was caused by the steamer bunkering oil fuel in California and going half-way across the Pacific and round to Baltimore and back again. He was impressed by the special design of the boilers. It was found that converting an ordinary steam boiler did not produce very good results, so they increased the furnaces enormously in diameter, reduced the combustion chambers, and had a somewhat larger tube area. That was how they obtained their proportions for atomising the oil in that vessel. There was no trouble about keeping steam up. They figured out how many revolutions they would require, and they obtained them. The only trouble they

appeared to experience was grit in the oil. They were using ordinary petroleum straight out of the ground. Evidently it required a great deal of filtering before it would produce satisfactory results.

He saw another method, which consisted of blowing a spray of oil on to a disc about the size of a half-crown piece, which disc acted centrifically on to an oil spray. He believed the Union Ironworks also adopted that idea.

In regard to the remarks which were made by the lecturer in reference to the application of oil directly into the cylinders, he did not think they had had much experience of that method in this country. There were one or two installations in which it obtained, and from these, he thought, we have learned the necessity for using absolutely reliable metal in all high-class engines, and despite the remarks about Asiatic workmen running these, he thought there was something to be said about the necessity for the employment of skilled labour in connection with the care of high-class machinery. Surely it was necessary that the attendants be painstaking to the utmost degree, and also possessed of sufficient intelligence to ascertain and rectify with a minimum of delay, any ordinary trouble which may occur.

Mr. A. Stobo said he was sure it had been with the utmost pleasure that they had listened to the perusal of the excellent paper made by the lecturer this evening, for it touched upon a subject with the importance of which one cannot fail to be seized. He was strongly impressed by the explanation of the method of blowing in the oil as fuel. It showed how much room there was for combustion in the furnace and the combustion chamber. He believed it explained to a certain extent why oil fuel will give better results than coal fuel.

An examination of the papers written by Williams and other gentlemen, some 80 years ago, revealed the fact that the matter of obtaining the proper combustion with coal had proved to be of extreme difficulty since the commencement. If only more room could be secured, better results could be achieved. It was in this connection that oil was productive of better results.

He would like Mr. McEwin to furnish them with some information about petroleum products generally. He would like particularly to know if the petroleum of the British Imperial Oil Co., which, he assumed, was produced in Borneo, was taken from oil wells. It was common knowledge that the word "petroleum" was derived from "petros" a rock, and "olium," meaning oil—rock oil. Was it a fact that the petroleum referred to was really founded on that definition?

Recently he installed a Diesel engine in a vessel which went to the Solomon Islands. It was a well-known fact that the majority of "steam" men were somewhat prejudiced against oil engines, and he must confess to a little prejudice on his own part; but he was pleased to be able to say that the engine referred to fulfilled all expectations. It was from Augsburg. It was, however, worthy of note that the price, both of oil engines and oil itself, was very high. We could buy oil in bulk with a specific gravity of .924 at 5d. per gallon. It was offered to us at 4½d. Immediately we had it put in cases it rose to 7½d. per gallon. We wanted something cheaper than the high-grade petrols at their present price. He believed that if the British Imperial Oil Co. could be persuaded to put the oil up in cheaper packages, it would, to a certain extent, counterbalance the high cost of the engines, and therefore more of it would be used. He must say that, in his opinion, the engines did not leave very much to be desired. He saw several of them on exhibition

at the Show, and he considered they were one of the leading features to be found. Another feature was the "Caterpillar," also possessed of an oil engine.

Mr. Sinclair referred to suction gas prevailing in Victoria as against coal in this State. Probably the difference in prices furnishes the reason sought for. The cost was the chief factor all over the world—everybody was looking at that question. Everyone appeared to want the cheapest and also the best at the same time. If only the price of oil could be reduced, it would be a good thing. He was sorry to learn that the oil reserves would only last another 100 years, because he was looking forward to using oil for a long time to come. In conclusion, he would say that he felt very much indebted to Mr. McEwin for the very interesting remarks he had made that evening.

Mr. A. W. Tourney-Hinde said it had been with the utmost satisfaction that he had listened to the extremely illuminating and descriptive paper read to them that evening. In addition to the remarks which had been made by the speakers who had preceded him, he would like to refer to the interesting comparison made by Mr. McEwin between thermal efficiency of oil-fed engines—if he might use the term—and internal combustion engines, and to ask him if he could furnish them with some idea of the relative commercial values of these in the countries where they were made—in some place where, bulk for bulk, the calorific value of the coal and the oil was approximately the same. He could then, upon such data, furnish them with some idea of the advantages which would accrue from equipping a ship with an internal oil-fired engine and a fired boiler. What he meant was this: He thought the basis assumed by Mr. McEwin was about 14,000 thermal units for coal and 22,000 for residual oil. Well, then, on some figure per gallon, and some price per ton, the

two things would be of equal value as heat units. Well, with a higher thermal efficiency due to the oil-burning or the internal combustion engine, could the lecturer give them some idea of the advantage that would be on the side of the oil, so that, in places where the difference in fuel values was to the disadvantage of oil or to the disadvantage of coal, one could come to a conclusion as to whether it would be better to go to the higher expenditure for oil as compared with coal?

There was one other phase of coal-burning which might make some difference in the value of coal as compared with oil fuels in that it was now possible to distil certain fuels and to remove the properties which were not of value as thermal units. Take, for instance, nitrogen, which could be converted into ammonia and sulphate of ammonia, and sold as a set-off, leaving only the gas which could be utilised. He thought these matters were likely to play a prominent part in connection with the use of heat for power purposes in the future.

Before he sat down he would like to express his gratitude for the privilege afforded by Mr. McEwin to all of them in listening to his very valuable and interesting paper.

The Vice-President then remarked that he thought Mr. McEwin had made it a very strong case for "Oil," and this fact made those of them whose sympathies are still with "Steam" feel somewhat sad. Indeed, he must acknowledge that, as he read paragraph after paragraph of the paper which had been read and discussed that evening, our old friend coal was having a very bad time, and that the counsel for the defence would find it a very difficult matter to "make good."

But the question of cost was of supreme importance the relative cost of the two fuels.

He used to understand that provided you could obtain coal at one-fifth of the price at which oil could be procured, then coal fuel was equally as good as oil as far as economy was concerned. The actual cost of a high-class steam plant and a Diesel oil plant must, he thought, be taken as being practically the same, and if these two relative values of five to one obtained, then the advantages of the oil remained more in the actual working of the plant than in any other place.

He would also like to ask Mr. McEwin if it was possible to dispense with the stoker on a locomotive, that was to say, was one driver enough in the case of an oil-driven locomotive?

Nor must they lose sight of the fact that coal was a very reliable fuel. We knew how to handle coal and how to handle a steam plant, but there were not so many people who know how to handle an oil plant with equal efficiency.

Proposed by Mr. Sykes, seconded by Mr. Sinclair, "That a very hearty vote of thanks be accorded to Mr. McEwin for his paper." Carried by acclamation.

Mr. McEwin, in reply to the above, said he thanked them for the very kind remarks which had been uttered by the various speakers in reference to his paper, the preparation of which he might say had proved of great additional value to himself, and he was quite sure that the benefit which he derived from its compilation must easily exceed the benefit secured by his hearers that evening.

In answer to Mr. Sykes re the fire-bars and how the air was supplied, he would say that in the case of one or two burners it was supplied through a central orifice—an Osborne and a Holborn—but in two cases air was supplied in other ways. In many instances where oil was burned over the fire bars, a quantity of broken fire-brick

was placed over the bars. He had never heard of the fire-bars being melted or softened by the use of the fuel. In some cases the fire-bars were left out altogether.

He regretted it was impossible for him to enlarge on this subject at this time. Indeed, he felt during the reading of the paper that he had pruned it too much. He was unable to deal with the various types of oil engines, and so on.

The most important omission, however, is that referred to by Mr. Tournay-Hinde—the comparative values of coal and oil. In the data to which he had access no reference was made to prices of coal and oil, and he was unable to obtain the information desired in the short space of time at his disposal.

As far as the rise in price of oil in other markets was concerned, he thought he made a reference at the end of the paper which largely explained it. It was a question of freight. It might be assumed by many that oil fuel was not a commercial proposition for use in steam boilers in this part of the world. But he thought it was. Perhaps in New South Wales this was not the case, but there were many ships trading to and from this port which burned oil fuel The price of oil at this port was largely made up of "freight." It cost about 66/- per ton, he thought, to bring it across the Atlantic at the present time. But, as he mentioned at the end of the paper, 70 tank steamers were being built to deal with the present requirements of the trade. Until the question of freight was satisfactorily arranged, there was no likelihood of the price of oil being altered. Steamers like the "Niagara," which were able to go direct to the source of supply, did not have to pay freight, and therefore oil was easily a commercial proposition for them, especially as they made so many savings in other ways. But oil had so many advantages of its own which did not obtain in coal, and these would, in all probability, enable it to be used in many places where

the price was high. He took, for instance, the high-powered American locomotives. The design was perfect. On trial they fulfilled all expectations, but when put into actual practice it was found that the human element was unreliable—the firemen could not withstand the tremendous strain. To many of these locomotives oil fuel had been applied, and the trouble had been successfully overcome. In similar cases to that, oil would have an advantage over coal which would compel its use, even at a very much higher price than coal.

Mr. Bragg referred to the matter of dispensing with the fireman or stoker on a locomotive. He had not heard of any instance of this being done, but the reason probably was that the stoker was required as a look-out man. One man was not sufficient to watch over things, especially in the case of a passenger train. In very large locomotives, where there had been two stokers, there was no doubt that one stoker would be dispensed with.

Mr. Sinclair made a reference to some special design of boiler. Broadly speaking, oil fuel could be burned in any type of boiler without any serious alteration. A good many of the oil steamers trading to Sydney had at various times returned to the use of coal, and the matter of conversion had taken place within a few hours. The Meyer system was particularly simple. In all cases the alteration could be made while the ship was in port discharging cargo, so there was no delay worthy of mention.

The reference made to Asiatic labour showed that the speaker did not appreciate the point. He did not mean that Asiatics were in charge of plants, or that they held positions of responsibility or where skill was required. He was only pointing out that the human element was not such an important one as in the case of a fireman on a locomotive.

In reference to the petroleum referred to by one of the speakers, he might say that it was obtained from wells bored in the earth to a distance of, perhaps, 3000 feet. In many cases the oil was forced up by pressure from below, in others pumped as required. But all the oil referred to was really rock oil—oil taken from the bowels of the earth in liquid form. He did not refer in his paper to crude oil, but to residual oil.

He believed that the continuous process of distillation had been largely used in Russia. The oil was distilled practically all from the same still. The various products had different boiling points, and different temperatures at which they vapourised, and it was, therefore, very easy to separate them. The crude petroleum was put into the still and heated, and at a very low temperature the petroleum ether—a very light spirit sometimes used in surgical work—came off, and was led through its own pipe to its own condenser. Through another pipe the spirit with the next highest boiling point was led, and so on to the naphtha, benzine, illuminating oils, lubricating oils, and finally, such products as gasoline and wax. The wax was usually left in the residual oil at the completion of the first stage of the refining process, and could be easily separated from it by reducing the residual oil to a very low temperature. The oils to which reference had been made that evening had a full range of products, and any particular product could be obtained in larger than the normal quantity by special refining. By re-refining the heavier oils, for example, larger quantities of benzine could be procured. That, of course, added very largely to the cost of the spirit put on the market.

In conclusion, he thanked them for the very kind manner in which his remarks had been received.