DISCUSSION.

Mr. J. S. Fitzmaurice, in opening the discussion, thanked Professor Selman for his kindness in affording our members an opportunity of witnessing the tests made with the Priestman Oil Engine at the Technical College. Judging from the tests made the engine appeared to run very steadily, although by no means quietly, for when indicating about 10 horse-power the noise was very objectionable, running lightly, the noise disappeared. The system adopted of regulating the air and gas together was very good, and should ensure steady running for variable loads. The method commonly adopted in gas engines at present in use in the colonies was to govern the gas only by means of a tappet connected by lever to the governor and operated by a cam in such a manner that when the speed of engine increased the tappet was thrown out of gear and no gas was admitted to the cylinder until the speed was reduced. For incandescent electric lighting purposes this method was manifestly wrong, and produced considerable irregularity in the working of the lamps.

One apparently weak point in the Priestman Oil Engine was the method of driving the governor by a small round belt about $\frac{5}{16}$ in. or $\frac{3}{8}$ in. in diameter. In any engine this system was objectionable, for the slightest slip in the belt threw all governing arrangements, however perfect otherwise, out of gear. Wherever possible the governor should be driven direct.

The author stated " that for isolated places, where ordinary fuel is difficult and expensive to procure, the oil engine is eminently suitable, &c." This to an extent was correct. The seven horse-power engine required about 1,000 gallons of water for keeping the cylinder at the proper temperature, consequently great trouble would be experienced if sufficient clean water was not available; even with the Sydney water the water jackets required thoroughly cleaning about every three months, and the sample of residue in bottle (produced) would give an idea of the amount and quality of mud deposited in jackets. Again, where internal clamping bolts are used, such as in the Otto, the circulating water had a very injurious effect, as could be seen by the bolt exhibited. Electric ignition was very good, and should prove economical when compared with slide valves, but if points were allowed to be bridged by carbon, however slight, so long as the resistance was less than the intervening space of air, the ignition would be very unreliable. He would like to know where the source of danger by tube ignition, referred to by the author, was. If any valves or electric devices were timed to give premature ignition there certainly would be danger, but experience showed that tube ignition was more easily managed and required less attention than slide valves, and was thoroughly reliable and safe.

From the tables published in the paper, one would certainly be led to believe that greater economy would be realized by using Russolene in preference to Royal Daylight Oil, for in Table 1 the mechanical efficiency was 82 per cent., and in Table 2 94·6 per cent., although in the latter more oil per h.p. was used. Surely there must have been some error in the observations.

The comparison made by the author between oil and steam engines was scarcely fair to the latter, inasmuch that he stated that one pound of oil was equivalent in calorific value to $1\frac{1}{4}$ lbs. of coal. In the *Proceedings of the Institution of Mechanical Engineers,* October, 1888, page 511, Mr. Jeremiah Head stated that oil had twice the heating power of coal, and he (the speaker) presumed English coal was referred to. In adopting oil for fuel the very essence of coal or shale was used, so that if oils were used for heating steam boilers the comparative consumption of oil per h.p. would be naturally reduced in the steam plant. Moreover, the price of oil would increase if it were universally used for land and marine engines. The price of oil quoted in the paper, viz.: 4d. per gallon, was absurd, when we had to pay 6d. per gallon duty on all oils imported to the Colony. The author stated that a much heavier and cheaper oil than the commercial kerosene could be used, but he (the speaker) believed the makers of the Priestman Oil Engine did not recommend the use of an oil above ·850 specific gravity on account of the trouble of the carbon and other deposits.

An indicator card taken during the trial worked out as follows: Indicated h.p., 10·5; brake h.p., 8·1; mechanical efficiency of ·77.

In testing a Griffen Gas Engine in 1888, Professor Kennedy found by using a $^1/_{10}$ spring that the indicated work spent in driving out the hot gases and drawing in the next charge made a reduction of 3·54 lbs. per square inch in the mean pressure during the working stroke, as calculated in the ordinary way from the indicator card.

Mr. W. D. Cruickshank considered that the results given in the table accompanying the paper where an inferior oil gave the highest mechanical efficiency must be an error.

As there were many young engineers present it might be as well to explain the meaning of the term "mechanical efficiency," and he would do so as applied to the steam engine. Given an engine having a stroke of 33 inches, working with steam at a pressure of 60 lbs. per square inch above atmospheric pressure, or in other words at an absolute pressure of 75 lbs. per square inch, and cut off at one-third of the stroke, mean effective pressure $52\frac{1}{2}$ lbs., What is the theoretical gain due to the expansion of the steam?

This could very readily be calculated by the following formula:—

$$\frac{\text{Mean pressure in lbs.} \times \text{stroke in inches.}}{\text{Gross pressure in lbs.} \times \text{cut off} + \text{clearance.}}$$

This applied to the above example gave the following result:—

$$\frac{52{\cdot}5 \times 33}{75 \times 11 + {\cdot}7} = 1{\cdot}97.$$

Thus by cutting off the steam at one third of the piston's stroke its mechanical efficiency was nearly double of what it would be if the steam were not used expansively.

The author had much underrated the efficiency of petroleum as compared with coal, as Mr. Urquhart, an English engineer, in Russia—where it had been adopted as fuel for locomotives, steamers, mills, and ironworks to a very great extent—in one of the best papers that had yet been written on the subject, stated that 50 tons of refuse oil was equal to 100 tons of best English coal. Since its introduction the cost for fuel per locomotive per 1,000 axle miles was 8s., while with coal the cost had been 17s. The working pressure of these locomotives was 125 lbs. per square inch, and the evaporative efficiency of 1 lb. of oil was found to be 14 lbs. of water, the theoretical value was 17·1 lb., the efficiency thus being 82 per cent.

With regard to the cost of petroleum consumed by the "Priestman," he did not think it fair to compare it with steam engines, as coal was about one-twelvth of the cost of the oil.

The President stated that he considered that the petroleum engine possessed many advantages, the principal among them being that it could be used for intermittent work without waste, and was very suitable for country places where gas was not available.

Professor Selman, in reply to the various remarks, said that his experience with different types of engines at the Paris Exhibition had convinced him that electric ignition of the charge was to be preferred to any other system. The method of governing adopted in the Priestman engine was without doubt one of its weakest points.

Exception had been taken to the low estimate he gave of the relative values of petroleum as compared with coal, but Professor Unwin had lately completed an elaborate series of experiments and found that $1\frac{1}{4}$ lbs. of coal was equal to 1 lb. of petroleum.
