burns, increasing in volume and driving the piston down. This, therefore, constitutes the power stroke of the cycle. It will be seen that no explosion takes place in the true sense of the word, and this type of oil engine, therefore, works much more quietly than any other type of internal combustion engine. On the fourth stroke the burnt gases are exhausted into the atmosphere, and the cycle is then repeated.

In this cycle there are, of course, two revolutions of the crankshaft for one working stroke.

In the two-cycle type of engine there is only one revolution for each working stroke. A special scavenging pump is also required for the removal of the exhaust gases, and for filling the cylinder with fresh air. On the first portion of the ingoing stroke of the piston the exhaust gases are scavenged out of the cylinder and replaced with fresh air; on the second portion of the same stroke the air is compressed. At the commencement of the second stroke the fuel oil is injected and ignited, thus constituting the working stroke; near the end of this second stroke the exhaust gases are allowed to escape, and then a fresh cycle commences.

Practical Considerations.—In the writer's opinion two of the most important points to be borne in mind in choosing a Diesel engine are to obtain as low a speed and as low a mean effective pressure (m.e.p.) as possible. The cylinder heads and pistons are subjected to such great pressures and temperatures that any reduction of these, while still obtaining the same power, is most beneficial. The continual heating and cooling induces fatigue of the metal, and the more rapid these alternations are the quicker the fatigue. A slow speed is therefore of great value in reducing the trouble often met with in high-speed oil engines of cracked heads and pistons.

The m.e.p. is obtained as follows, the actual dimensions of the engines installed being taken:—

A mechanical efficiency of 75 per cent. is usually assumed; therefore a b.h.p. of 50 is equivalent to an i.h.p. of 66⅔.

Diameter of cylinder, 13 in.
Area of piston, 132.73 sq. in.
Stroke, 20 in.
Number of revolutions per minute, 210.

Then $\frac{\text{PLAN}}{2} = 66\frac{2}{3}$.

Therefore $\frac{P \times 1.66 \times 132.73 \times 210}{2 \times 33{,}000} = 66\frac{2}{3}$.

Therefore P = 94¾ lb. per sq. in. = M.E.P.

The largest maker of Diesels on the Continent quoted for an engine of this size, having a speed of 195 r.p.m., with an m.e.p. of 96.1, while that quoted by probably the largest maker in England had a speed of 250 r.p.m., with a m.e.p. of 102½.

A further point requiring attention when installing Diesels is that great care is necessary in providing a sufficiently firm and massive foundation for the engine, so as to prevent trouble from vibration. A peculiarity of this vibration seems to be that it is not very noticeable in the engine-house itself, but is more pronounced some distance away. Trouble has arisen in various towns from this cause, and an injunction has been obtained against a neighboring council at the instance of an aggrieved householder living near a Diesel engine station.

In the majority of stations nothing more appears to be done than to provide a massive foundation of rich concrete carried down on to a solid bearing. In one or two instances a cushion of a few inches of sand has been interposed between the base of the concrete and the substratum. A space has also in some cases been left round the sides and ends of the concrete so that no vibration should be transmitted to the adjoining earth. Several patent methods of combating this trouble are also in vogue, comprising chiefly the use of cork layers to surround the foundation concrete.

In the writer's case a plain 5 to 1 concrete foundation was used, carried down to a depth of 7 ft. on to a solid chalk foundation, and no trouble has yet been experienced.

Nuisance is also occasionally caused by noise and fumes from the exhaust, and noise from the air-inlet pipe. A quiet exhaust can, however, generally be obtained by providing an underground baffle pit, from the end of which the vertical exhaust pipe is carried up to the roof of the building, and capped with a cast-iron silencer. A smoky exhaust should never occur if the valves are in correct adjustment, except possibly for a few moments at starting.

The air inlet pipe requires silencing, and this is usually done by closing the end of the pipe, and providing a series of long, narrow slits in lieu of the open end. If the air-inlet pipe is carried outside into the open, a quieter engine-house is the result, and the air obtained is certainly no less suitable for combustion purposes than that inside. On the other hand, in a confined engine-house the ventilation obtained by drawing air from inside the engine-house might be an advantage.

In actual running special care is required to see that the lubrication of all parts is adequate. Failure in this direction has been the cause in many cases of melting of the white metal of the bottom bearings, and in some cases this has been followed by fracture of the crankshaft—an expensive item to replace.

Other results often due to faulty lubrication are seized and cracked pistons, though the latter more often is caused by running the engine for long periods on overload and at high speeds. Many engineers on this account hesitate to put their engines for long runs on more than 90 per cent. of their rated capacity, and if this is necessary it should be taken into account in the comparison of capital costs.

Arrangement of Engines.—The general arrangement of Diesel engines is that of having one, two, three or four cylinders in a line, the power of these cylinders varying as desired. Few English makers go beyond 125 h.p. per cylinder.

The cylinders are carried in the usual "A" frame, which is in its turn bolted on to the bed-plate; the latter is secured by 2-in. holding-down bolts, going 5 ft. down into the concrete foundation, finishing with 9-in. plates, the whole as usual being grouted up with cement.

On top of the cylinders are bolted the cylinder heads, on which are fitted the fuel valve in the centre, with the starting valve in front, and the exhaust and air inlet valves on either side. These valves are actuated by three outside levers, worked from a camshaft supported on the "A" frame; in most cases the valves are driven direct from the camshaft without the intervention of levers, but it is claimed that the former has an advantage by simplifying the casting of the cylinder heads and "A" frames in doing away with the projections to carry the camshaft bearings; also that the starting gear can be more easily operated from the ground, and again that it makes it possible to enclose the whole of the cams and rollers in an oil bath, so reducing wear and noise.

The camshaft is operated from the crankshaft by a vertical driving shaft, fitted with skew and bevel gearing. The same shaft also drives the governor, which controls the speed of the engine in a very sensitive manner. Each