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THE APPLICATION OF DIESEL ENGINES TO LAND AND MARINE WORK.

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Introductory.—Within the last decade no prime mover has provoked so much comment as the Diesel engine, and as within the last two years, almost daily reference has been made in regard to its development, it may be of interest to make some particular reference to its early history.

The earliest known internal combustion engine was invented and made by a French Abbé in the year 1682. This engine utilized the energy produced by the explosion of an inflammable powder, but difficulty was experienced in controlling the power. About two hundred years later Rudolf Diesel, a German scientist, after many years of study and experiments on different types of heat engines, formed the opinion that very little improvement in their heat efficiency could result until the principles of working were modified.

Herr Diesel, in order to demonstrate his theories, decided to construct a new type of heat engine to utilize the maximum amount of heat from the fuel used.

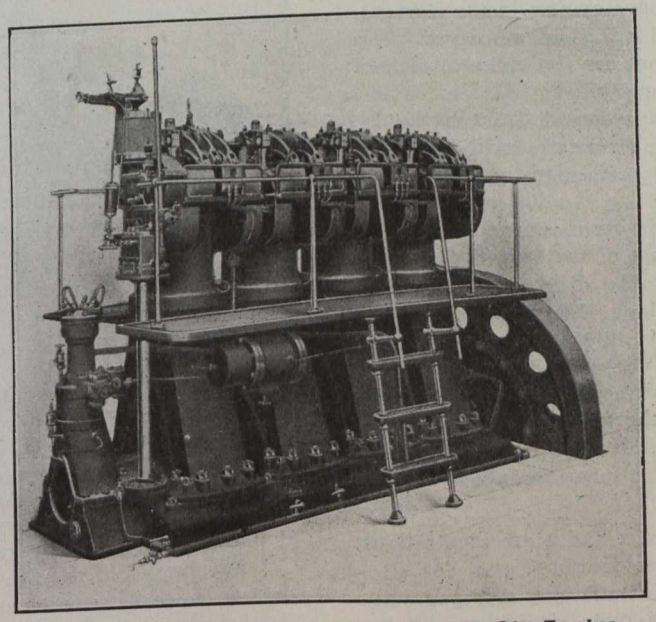

Fig. 1.—Four-Cylinder 200-h.p. Diesel Oil Engine.

In this engine only pure air is drawn into the cylinder and compressed, then the oil fuel is injected into this compressed air in the form of a fine spray and burns gradually as long as the injection is maintained. During the whole cycle the pressure in the cylinder does not rise above the compression pressure, unlike the ordinary gas engine where the combustible charge is drawn into the cylinder, is ignited and burned instantaneously or exploded.

In 1897, after four years of difficult experimental work, Dr. Diesel completed the construction of the first commercially successful motor in the Augsburg Works, and it was announced by the numerous engineering and scientific committees and deputations from various coutries, who tested the machine, that a higher heat efficiency was attained by it than by any other known heat engine. As a result of subsequent experience in practice, and the gradual improvement in the manufacture, still better results have been obtained and at the present time the thermal efficiency the motor attains is up to about 48 per cent., and the effective efficiency in some cases up to 35 per cent.

The results of this first motor were considered so satisfactory that a large number of engineering firms obtained licenses to build. At the beginning of 1901 twenty-five firms on the Continent, one in the United States, and one in Great Britain were costructing Diesel engines.

General Description.—The engines work on the four- and two-stroke cycle and run according to requirements at low or high speed, and are made in vertical or horizontal types.

Four- (Stroke) Cycle Engines.—(1) In the first downward stroke of the piston air is sucked into the engine cylinder direct from the atmosphere through the main air inlet valve on the top of the cylinder. At the end of this stroke the cylinder is full of pure air at practically atmospheric pressure, ready for the compression stroke.

(2) In the next upward stroke the air is compressed to the required pressure, usually about 500 lbs. per sq. inch, thereby having a temperature of about 1,000 deg. Fahr., all the valves, of course, being closed during this action. As the compression is very approximately adiabatic nearly all the work in it is returned.

(3) During the early portion of the third and working stroke the fuel oil is injected into the cylinder above the piston by a blast of air at a higher pressure than that in the cylinder (about 800 lbs. per sq. in.) through a special form of needle spray valve. Combustion takes place during this period as the temperature of the compressed air in the cylinder is above the burning point of the oil fuel. After cut-off, when the fuel inlet valve closes, combustion continues for a short period, expansion then occurs and work is done on the piston for the rest of the stroke. Just before the piston reaches the end of its stroke the exhaust valve begins to open.

(4) In the final stroke the exhaust valve remains open and the burnt gases are expelled from the cylinder into the exhaust pipe, leaving the cylinder ready to receive a further charge of gas on the next down stroke of the piston, when the cycle of operations begin once more. Fig. 2 shows an indicator card of an actual Diesel engine of this type.