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DIESEL ENGINE

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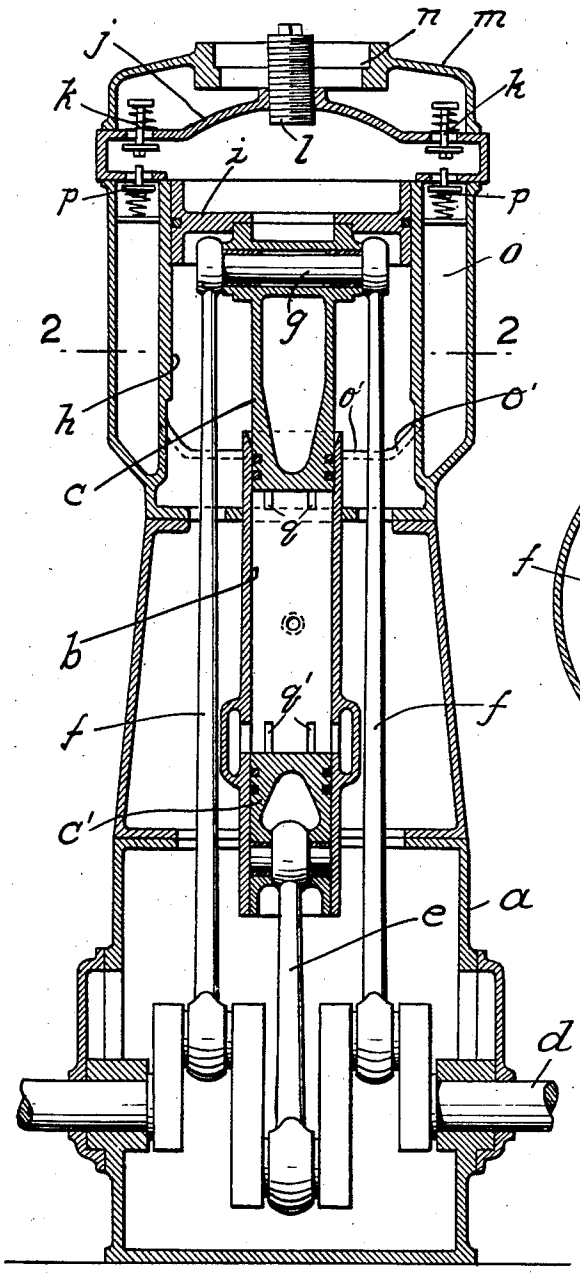


FIG. 1.

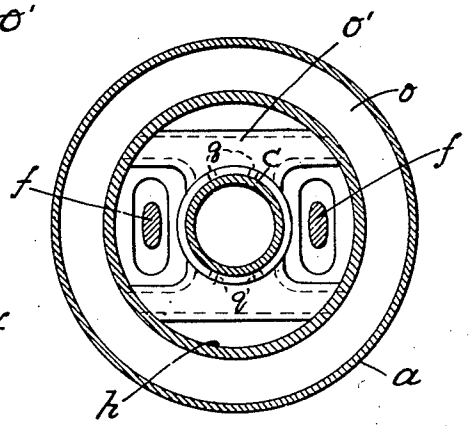


FIG. 2.

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DIESEL ENGINE

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1 Claim. (Cl. 123—51)

This invention relates to an improvement in internal combustion engines and more particularly to Diesel engines of the opposed piston type with reference to which this invention will be described.

Heretofore Diesel engines of the opposed piston type have been provided with scavenging pumps arranged beyond the outer end of the working cylinder and driven by direct connection of the scavenging pump piston with the outer working piston.

In such engines the scavenging pump cylinder has been of necessity of such dimensions as to embrace the side rods by which the outer piston is connected to the crank shaft and the piston is connected directly to the outer piston and has the same length of stroke as the outer piston.

In the early development of such engines the scavenging air pump cylinder was made circular and of a diameter to embrace the side rods. Such a construction is shown by the U. S. patent to Mader No. 1,629,878. However, variously and more particularly in slow speed engines, it was found that the cylindrical scavenging air pump developed an excess volume of air and at an excess pressure over that required for effective scavenging of the working cylinder.

The development of an excess volume of air at excess pressure, as with the circular scavenging pump cylinder, results in waste of air and consequently in loss of power, and such was recognized and avoided by the provision of a scavenging air pump cylinder of non-cylindrical cross section and of sufficient extent on one dimension to embrace the side rods connected to the outer working piston. Such a construction is shown by the U. S. patent to Junkers No. 1,679,976, which recognizes the defect in the circular type of scavenging air cylinder. However, the non-cylindrical type of cylinder, including that of the Junkers patent, is quite unsatisfactory for practical reasons in that it is practically impossible to maintain a fit between the piston and cylinder which will prevent the passage of lubricating oil into the pumped air with consequent wastage.

Now in accordance with this invention, there is provided a structure of the type under consideration in which wastage of scavenging air and hence reduction in the effective horsepower of the engine is eliminated and, at the same time, the practical advantages of the circular scavenging air cylinder are retained.

More particularly, the structure in accordance with this invention comprises a scavenging pump of the circular cylinder type positioned adjacent the outer end of the working cylinder of an opposed piston engine and designed, with consideration for a volumetric capacity in excess of that necessary for scavenging the working cylinder, to have a ratio of compression such as to give a terminal or maximum pressure not substantially in excess of the pressure desired for scavenging.

In the structure in accordance with this invention the scavenging air pump cylinder, circular in cross section and of a diameter to embrace the side rods, is arranged adjacent to the outer end of the working cylinder and the scavenging air pump piston is directly connected to and adapted to be driven by the outer working piston.

The diameter of the pump cylinder is fixed at such as will enable it to embrace the side rods and the stroke of the pump piston is fixed by that of the working piston to which it is attached. The ratio of compression to give the proper terminal pressure is fixed by adjustment of the clearance of the piston in upper dead center position.

The pump will have a volumetric capacity in excess of the requirement for scavenging the working cylinder, but the terminal pressure developed by the pump will be that required in the working cylinder plus such excess as will be necessary to overcome friction and drop in pressure in the scavenging air receiver. As a result, the velocity of the air through the scavenging air ports will be such as to admit to the working cylinder only the requisite amount of air at the requisite pressure and the excess volume of air compressed by the pump will remain in and be reexpanded in the pump on its intake stroke. Thus, despite the compression of an excess volume of air, waste of air will be avoided and the excess will be reexpanded and the work involved in its compression largely recovered.

Having now indicated in a general way the nature and purpose of this invention, I will proceed to a description of a practical embodiment thereof with reference to the accompanying drawing, in which:

Figure 1 is a sectional view of an opposed piston engine of the Diesel type and embodying this invention.

Figure 2 is a cross sectional view on line 2—2, Figure 1.

In the drawing *a* indicates the engine frame from which is supported a working cylinder *b*, within which are an outer working piston *c* and an inner working piston *c'*. The inner piston *c'* is connected to a crank shaft *d*, supported from the frame, by a connecting rod *e* and the outer piston *c* is connected to the crank shaft by means

of a pin *g* and side rods *f*, *f*. Adjacent to the outer end of the working cylinder *b* is mounted a circular scavenging air cylinder *h* of a diameter to embrace the side rods *f*, *f* and within which is a piston directly connected to the outer end of the outer working piston *c*. The cylinder *h* is closed by means of a head *j* in which are arranged a pair of inlet ports controlled by valves *k*, *k*. The cylinder head is provided with a threaded aperture in which is threaded a tube *l* closed at its outer end. Beyond the head is a cover *m*, provided with a large opening *n* for the ingress of air and adapted to be screened.

Embracing the scavenging air cylinder *h* is an air receiver *o* in communication with the cylinder through ports controlled by valves *p*, *p* and in communication with the working cylinder through a passage *o'* and scavenging air ports *q*, *q*, which, as is usual, are controlled by the working pistons *c*, *c'*, as are exhaust ports *q'*, *q'*.

The head *i* of the scavenging air pump cylinder is designed to provide a lineal clearance for the piston such that the ratio of compression in the cylinder will be such as to give a pressure exceeding that desired in the working cylinder for scaveninging only by the pressure loss from friction in passing from the scavenger pump cylinder to the working cylinder and by the drop in pressure in the receiver. The head *i* may be designed with approximate correctness and accuracy attained by enlargement or restriction of the compression space by adjustment of the threaded tube *l*.

The operation of the engine and scavenging air pump described will be obvious, it being appreciated that air compressed in the scavenging air cylinder in excess of that used for scavenging will be reexpanded, since under the pressure conditions existing no substantial excess of air will pass into the working cylinder.

As a consequence of this invention, as will now be obvious, the waste of scavenging air is avoided, work done in the compression of an excess volume of air is largely recovered and, at the same time, all the practical advantages of the circular type scavenging air pump cylinder are retained.

What I claim and desire to protect by Letters Patent is:

In an internal combustion engine a working cylinder, opposed working pistons in said cylinder, a crank shaft, side rods connecting the outer working piston to the crank shaft, a scavenging air pump comprising a cylinder circular in cross section and of a diameter to embrace said side rods positioned adjacent to the outer end of said working cylinder, and a piston in said scavenging air cylinder connected to and adapted to be operated by the outer working piston, said scavenging air pump having a volumetric capacity in excess of the requirements of air for scavenging the working cylinder and having a ratio of compression such as to provide air for scavenging the working cylinder at a terminal pressure not substantially in excess of that required for scavenging the working cylinder without passage through the working cylinder of an excess of air.

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