

Oct. 7, 1930.

R. GAUPP  
TWO-STROKE CYCLE INTERNAL COMBUSTION ENGINE  
EQUIPPED WITH SCAVENGING PUMP ANNEX  
Filed Dec. 12, 1928

1,777,841

2 Sheets-Sheet 1

Fig. 1.

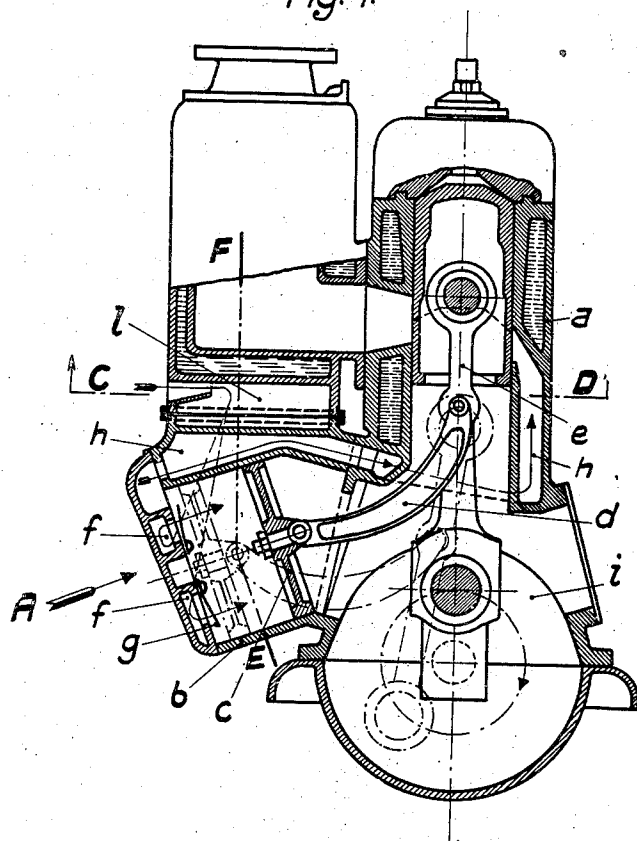


Fig. 2.

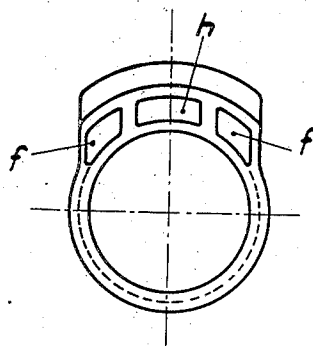


Fig. 4.

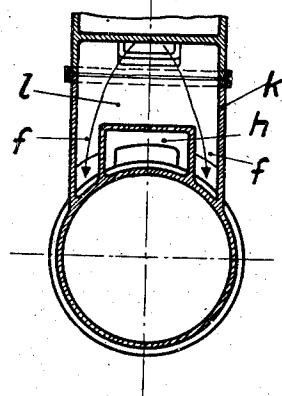
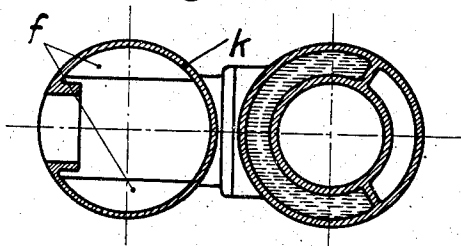


Fig. 3.



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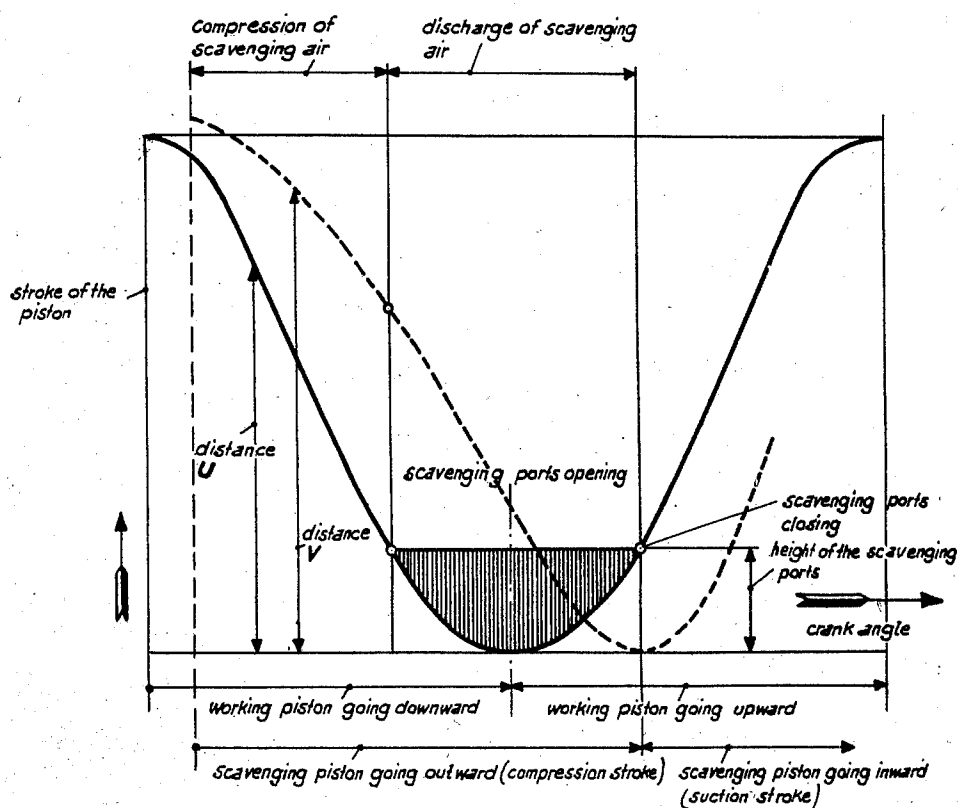
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Fig. 5.



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## UNITED STATES PATENT OFFICE

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TWO-STROKE-CYCLE INTERNAL-COMBUSTION ENGINE EQUIPPED WITH SCAVENGING-PUMP ANNEX

Application filed December 12, 1928, Serial No. 325,517, and in Germany December 17, 1927.

My invention, which relates to internal combustion engines, and has among its objects the driving and positioning of the scavenging pump and associated parts in an improved manner, will be best understood from the following description when read in the light of the accompanying drawings of an embodiment of the invention.

The drawings illustrate one embodiment of an engine constructed according to the invention.

In the drawings:—

Fig. 1 is a longitudinal axial section of the engine with parts in elevation;

Fig. 2 is a view of the pump cylinder, with the cylinder head removed, looking at the cylinder in the direction of the arrow A;

Fig. 3 is a section on the line C—D of Fig. 1;

Fig. 4 is a section on the line F—E of Fig. 1; and

Fig. 5 is a diagram showing the relation between the movements of the air pump piston and working piston and the events and periods of the cycles of each.

Referring to the drawing, *a* is the cylinder block of a vertical two stroke cycle Diesel engine. Attached to said cylinder block is the cylinder block *b* of the scavenging pump, the piston *c* of the latter being joined with the main-connecting rod *e* by means of the connecting rod *d*. The scavenging air is drawn in through the partially visible channels *f* and the suction valves *g* and forced through the channel *h* to the scavenging ports of the working cylinder. The crank case *i* has no connection with the scavenging ports. The suction chamber *l* is formed by the wall *k*, placed between exhaust pot and the air pump cylinder. The arrows indicate the courses of the inflowing and discharged air. The arrangement of the air conduits associated with the pump in the present embodiment of the invention is shown in Figs. 2 to 4. It will be observed that this arrangement does not increase the width of the pump cylinder block to above that required to accommodate the pump piston.

It will be observed that by arranging the scavenging pump with relation to the work-

ing cylinder and crank shaft as above described, and driving it in the manner above described, the height of the engine measured from the axis of the crank shaft to the top of the working cylinder is reduced to a minimum, this result being accentuated by connecting the scavenging pump piston to the connecting rod between the ends of the latter and further accentuated by bending the connecting link toward the crank shaft. Further, the arrangement permits the placing of the expansion chamber *l* between the exhaust pot and pump cylinder block *b*, which provides compactness and ample space for the expansion chamber sufficient to permit effective muffling.

The displacement of the scavenging and working pistons for different positions of the crank shaft is shown diagrammatically in Fig. 5. In this figure the abscissas denote the different angles of the crank shaft, while the ordinates denote the volume displaced by the working and scavenging pistons, the full line curve representing the relations for the working piston and the dotted line curve the relations for the scavenging piston.

Referring to the diagram, it will be noted that the scavenging ports begin to open when the pump piston has finished part of its inward stroke, thus scavenging air under pressure is immediately available when the scavenging ports open. Further, it will be noted that the pump piston reaches its inner dead center, that is to say, the end of its compression stroke, just as the scavenging ports close or begin to close, and consequently scavenging air is discharged into the working cylinder during all the time the scavenging ports are open.

It will be understood that wide deviations may be made from the embodiment of the invention herein described without departing from the spirit of the invention.

What I claim is:

1. A single acting non-reversible internal combustion engine having, in combination, an engine cylinder having an exhaust port and a scavenging port in the wall thereof, an engine piston for controlling said ports, an engine crank-shaft having an engine crank,

a connecting rod connecting said engine piston and engine crank, a scavenging pump having a pump cylinder and pump piston, said pump cylinder being at that side of said engine cylinder which is occupied by said connecting rod when said engine piston makes its compression stroke and being at an obtuse angle to said engine cylinder, said pump being single acting with its working chamber at the side of said pump piston remote from said engine cylinder, a link bent toward the crank shaft connecting said connecting rod at an intermediate portion of its length to said pump piston for reciprocating the latter, and ports and passages connecting the working chamber of said pump to said scavenging port for delivering fresh air thereto.

2. A single acting non-reversible internal combustion engine having, in combination, an engine cylinder having an exhaust port and a scavenging port in the wall thereof, an engine piston for controlling said ports, an engine crank shaft having an engine crank, a connecting rod connecting said engine piston and engine crank, a scavenging pump having a pump cylinder and pump piston, said pump cylinder being at that side of said engine cylinder which is occupied by said connecting rod when said engine piston makes its compression stroke and being at an obtuse angle to said engine cylinder, said pump being single acting with its working chamber at the side of said pump piston remote from said engine cylinder, a link connecting said connecting rod at an intermediate portion of its length to said pump piston for reciprocating the latter, an exhaust port at the side of the engine cylinder above said scavenging pump, and an expansion chamber for the intake of said pump between said port and pump.

3. A single acting non-reversible internal combustion engine having, in combination, an engine cylinder having an exhaust port and a scavenging port in the wall thereof, an engine piston for controlling said ports, an engine crank shaft having an engine crank, a connecting rod connecting said engine piston and engine crank, a scavenging pump having a pump cylinder and pump piston, said pump cylinder being at that side of said engine cylinder which is occupied by said connecting rod when said engine piston makes its compression stroke and being at an obtuse angle to said engine cylinder, the axial line of said pump cylinder extending through the space between said crank shaft and said piston, and a link connecting said connecting rod at a point materially removed from each end thereof to said pump piston for reciprocating the latter.

4. A single acting non-reversible internal combustion engine having, in combination,

an engine cylinder having an exhaust port and a scavenging port in the wall thereof, an engine piston for controlling said ports, an engine crank shaft having an engine crank, a connecting rod connecting said engine piston and engine crank, a scavenging pump having a pump cylinder and pump piston, said pump cylinder being at that side of said engine cylinder which is occupied by said connecting rod when said engine piston makes its compression stroke and being at an obtuse angle to said engine cylinder, the axial line of said pump cylinder extending through the space between said crank shaft and said piston, and a link bent toward the crank shaft connecting said connecting rod at a point materially removed from each end thereof to said pump piston for reciprocating the latter.

5. A single acting non-reversible internal combustion engine having, in combination, an engine cylinder having an exhaust port and a scavenging port in the wall thereof, an engine piston for controlling said ports, an engine crank shaft having an engine crank, a connecting rod connecting said engine piston and engine crank, a scavenging pump having a pump cylinder and pump piston, said pump cylinder being at that side of said engine cylinder which is occupied by said connecting rod when said engine piston makes its compression stroke and being at an obtuse angle to said engine cylinder, said pump being single acting with its working chamber at the side of said pump piston remote from said engine cylinder, and a link bent toward said crank shaft connecting said connecting rod at an intermediate portion of its length to said pump piston for reciprocating the latter.

In testimony whereof, I have signed my name to this specification.

RUDOLF GAUPP.