Oct. 15, 1940. H. LIEBERHERR 2,218,202

TWO-CYCLE INTERNAL COMBUSTION ENGINE

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Fig. 1

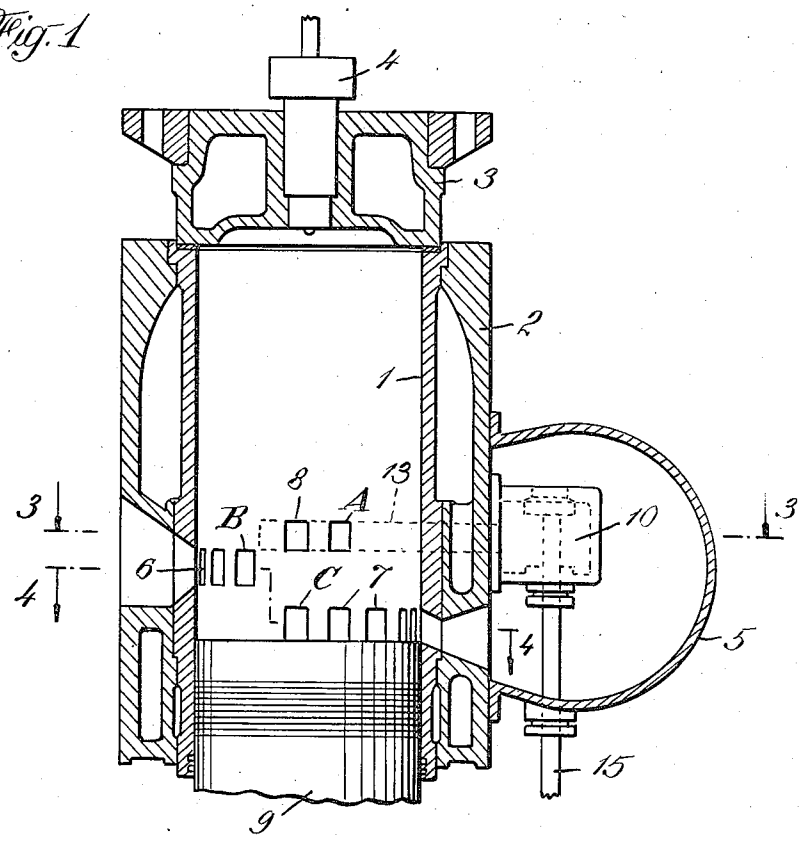
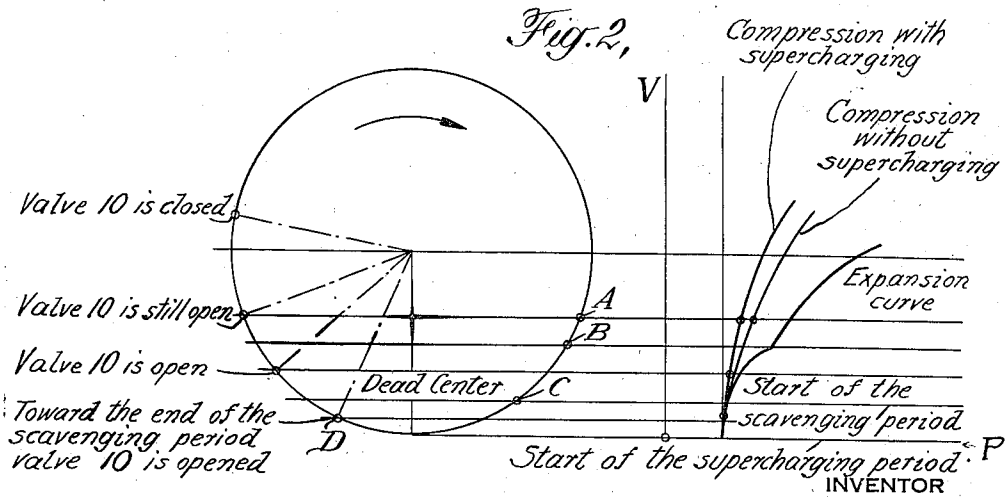


Fig. 2,



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Fig. 3,

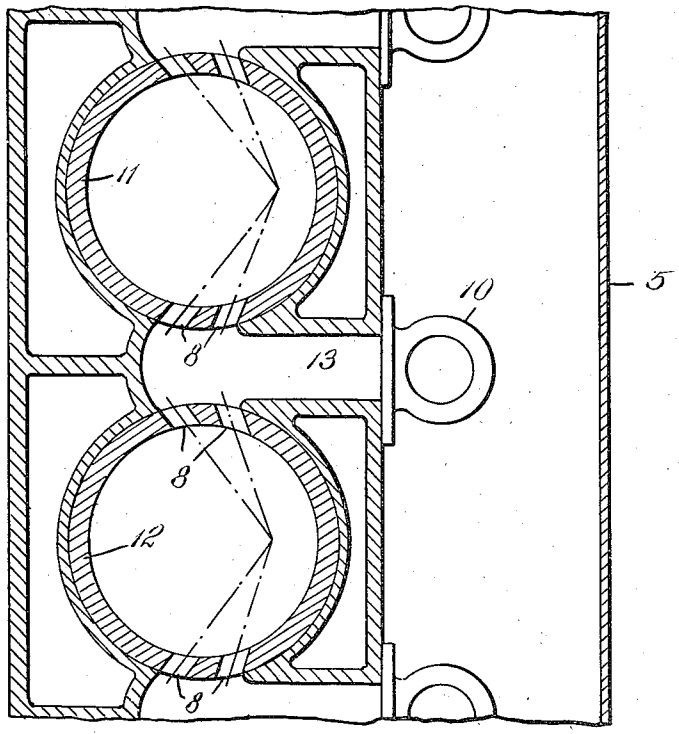
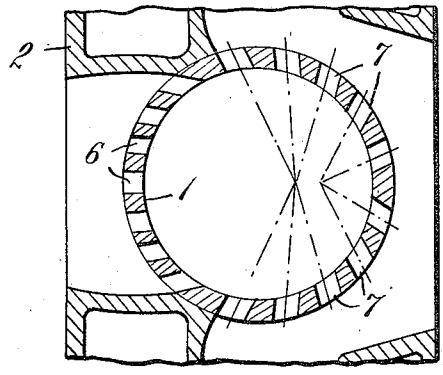


Fig. 4,



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UNITED STATES PATENT OFFICE

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TWO-CYCLE INTERNAL-COMBUSTION ENGINE

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Application June 17, 1938, Serial No. 214,263
In Switzerland June 19, 1937

7 Claims. (Cl. 123—65)

The invention relates to a two-cycle internal-combustion engine, in which the scavenging-air, the charging-air, and the supercharging-air are admitted into the working cylinder through ports in the cylinder. In the engine of the invention both the scavenging and charging-air are admitted into the working cylinder through ports which permit the flow of gas thereto only after pressure equalization has taken place in the working cylinder, whereas the supercharging-air is admitted into the working cylinder under separate control through ports oppositely disposed in the axial direction of the engine, and extending higher than the exhaust ports and corresponding solely to the amount of supercharging-air admitted. It is known to arrange supercharging air ports throughout the entire cylinder periphery occupied by the exhaust ports. The disadvantage of this arrangement consists in that at the moment where the downwardly moving piston exposes the supercharging air admission ports, the load on one side of the piston is removed causing it to knock in a harmful manner. In the engine of the invention the lateral thrusts on the working piston caused by the combustion gases flowing into the chambers situated rearwardly of the supercharging-air admission ports are mutually compensated.

The accompanying drawings illustrate diagrammatically apparatus in accordance with the invention, in which

Fig. 1 is a longitudinal view, partly in section, of the working-cylinder portion of an internal-combustion engine;

Fig. 2 is a crank-shaft diagram of the engine;

Fig. 3 is a cross-section taken along the line 3—3 of Fig. 1, and

Fig. 4 is a cross-section taken along the line 4—4 of Fig. 1.

In the apparatus illustrated in the drawings, the cylinder 1 is provided with a jacket 2 and a cylinder head 3 in which a fuel-admission valve 4 is mounted. Connected at the air-admission side of the engine is a conduit 5 for the supply of scavenging-air, charging-air and supercharging-air. The exhaust ports 6 and an exhaust conduit (not shown) are connected on the opposite side of the cylinder. The scavenging and charging-air flow directly into the working cylinder through ports 7 only after pressure equalization has taken place in the working cylinder, whereas the supercharging-air is admitted into the cylinder 1 through ports 8, the air supply to which is separately controlled. The supercharging-air ports are preferably arranged on opposite sides of the cylinder and may be angularly disposed to direct the air towards one side of the cylinder. The piston 9 is shown in the lower dead-point position.

As can be seen from the crank diagram (Fig. 2), the supercharging-air admission ports 8 (Fig. 1) are first uncovered by the piston as it moves downwardly. Then the exhaust ports 6 (Fig. 1) are opened, and the combustion gases make their exit through ports 6. Upon completion of the pressure equalization the scavenging ports 7 (Fig. 1) open, as a result of which scavenging and charging take place in the working cylinder.

As shown in Fig. 3, the supercharging-air is admitted under control to the ports 8 through a charging valve 10. This valve may be operated in timed relation with the piston in any suitable manner. The advantage of this arrangement is that the waste gases flowing beyond the supercharging-air ports do not exert unilateral pressure on the piston of the adjacent cylinder. For each pair of cylinders 11 and 12, a single feed channel or conduit 13 may be provided for the supercharging air and this may be suitably connected, for example, through the valve 10 to the air conduit 5. The lateral thrusts exerted on the working piston and caused by the combustion gases flowing into the spaces situated behind the supercharging-air ports 8 are compensated by the oppositely disposed ports.

As shown in Fig. 4, the exhaust ports 6 and the admission ports 7 are oppositely arranged, and as shown in Fig. 1, are offset relatively to each other in different horizontal planes, in such a manner that when the admission ports 7 open, pressure equalization has occurred in cylinder 1. For the purpose of preventing the harmful results of vibrations in the exhaust conduit, on the scavenging operation, and for lessening the length of the web for the purpose of preventing the lining from warping, the exhaust ports 6 are located in the cylinder in such position that the lower edges thereof are at least 8 percent of the length of the stroke above the lower dead-end position of the piston head.

In order to further improve a two-cycle internal-combustion engine in which the exhaust ports are formed in a cylindrical band which is outside the band in which the scavenging air or supercharging-air admission ports are situated, the ports may be arranged in such a manner as to occupy at the most one half of the periphery of the cylinder so as to leave uninterrupted the

means for guiding the piston springs on the other half of the periphery.

I claim:

1. In a two-cycle internal-combustion engine having arranged in its cylinder exhaust ports, ports for the admission of scavenging-air, charging-air and supercharging-air, the improvement in which the ports for the admission of supercharging-air are arranged in two groups which are in diametrically opposite sides of the cylinder and located above the exhaust-ports and the scavenging-air ports are below the exhaust ports, whereby the scavenging-air and charging-air may enter the cylinder when pressure equalization has been effected, and valve means are provided for controlling the admission of supercharging-air in timed relation with the piston, whereby the supercharging-air may enter the cylinder at a predetermined time after pressure equalization has resulted.

2. A two-stroke internal-combustion engine which comprises a cylinder, ports in the cylinder for the admission of scavenging-air and charging-air, exhaust ports in the cylinder above the scavenging-air ports and below the supercharging-air ports, said supercharging-air ports being in two groups, each of which is disposed oppositely in the cylinder, conduit means for supplying air under a suitable working pressure to the ports for the admission of scavenging-air and charging-air, separate conduit means supplying air under pressure to the supercharging-air ports, and valve means controlling the flow of air through the last mentioned conduit to the supercharging-air ports in timed relation with the piston.

3. In a two-cycle internal-combustion engine in which the scavenging-air, the charging-air and the supercharging-air enter the working cylinder through ports, the improvement in which the scavenging-air and the charging-air are introduced into the working cylinder through non-controlled ports which open only after pressure equalization has taken place in the working cylinder, while all the supercharging air enters the working cylinder through controlled ports, oppositely disposed, extending higher than the exhaust ports and corresponding solely to the amount of supercharging-air admitted, in order to compensate the lateral pressures on the working piston resulting from the flowing of the combustion gases into the spaces or chambers lying behind the supercharging ports.

4. A two-cycle internal-combustion engine according to claim 3 consisting of at least two cylinders, and a common supply channel arranged at least partly between and in direct contact with the adjacent cylinders for introducing supercharging-air into the supercharging-air ports of the two cylinders.

5. A two-cycle internal-combustion engine according to claim 3, in which the supercharging openings are disposed angularly in order to direct the air against the cylinder wall.

6. A two-cycle internal-combustion engine according to claim 3, in which the exhaust ports are arranged above the scavenging ports and below the supercharging ports.

7. In a two-cycle internal-combustion engine having arranged in its cylinder exhaust ports, ports for the admission of scavenging-air, charging-air, and supercharging-air, the improvement in which the exhaust ports are arranged on one side of the cylinder and entirely above the scavenging-air ports a plurality of which are diametrically opposite the exhaust ports, a plurality of supercharging-air ports in the cylinder located above the exhaust ports, said supercharging-air ports being so located in the cylinder that a number of the port openings are in diametrically opposite sides of the cylinder, and valve means operated in timed relation with the piston for controlling the admission of supercharging-air into the supercharging-air ports.

HANS LIEBERHERR.