S. WIEBE.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED OCT. 2, 1905.

966,972.

Patented Aug. 9, 1910.

2 SHEETS—SHEET 1.

Fig. 2,

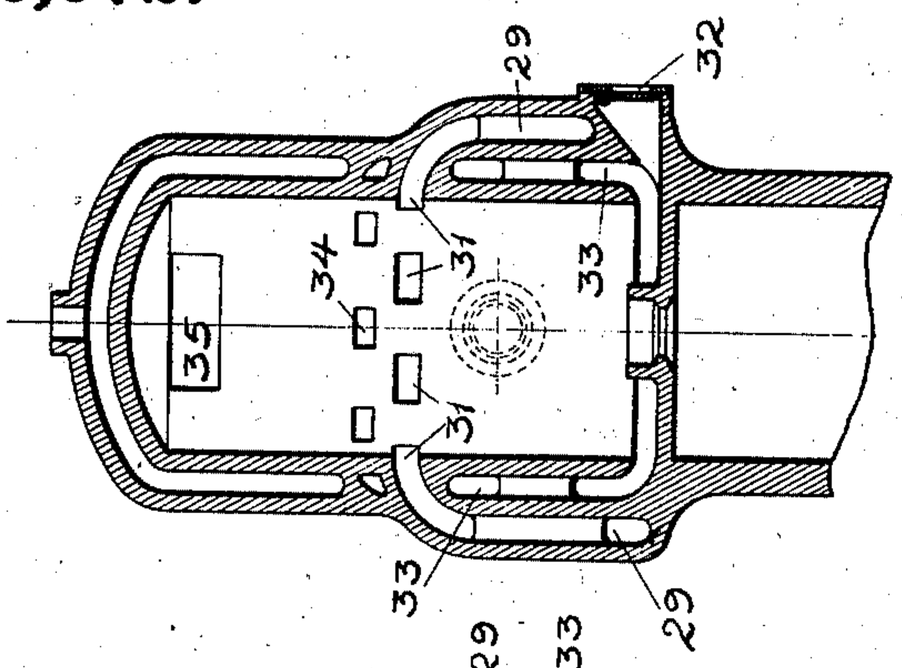

Fig. 1,

WITNESSES:

Jno. C. Purdy

L. L. Andrews Jr.

INVENTOR

Sigurd Wiebe

BY

Church Raymond Wheeler

ATTORNEYS

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Fig. 3.

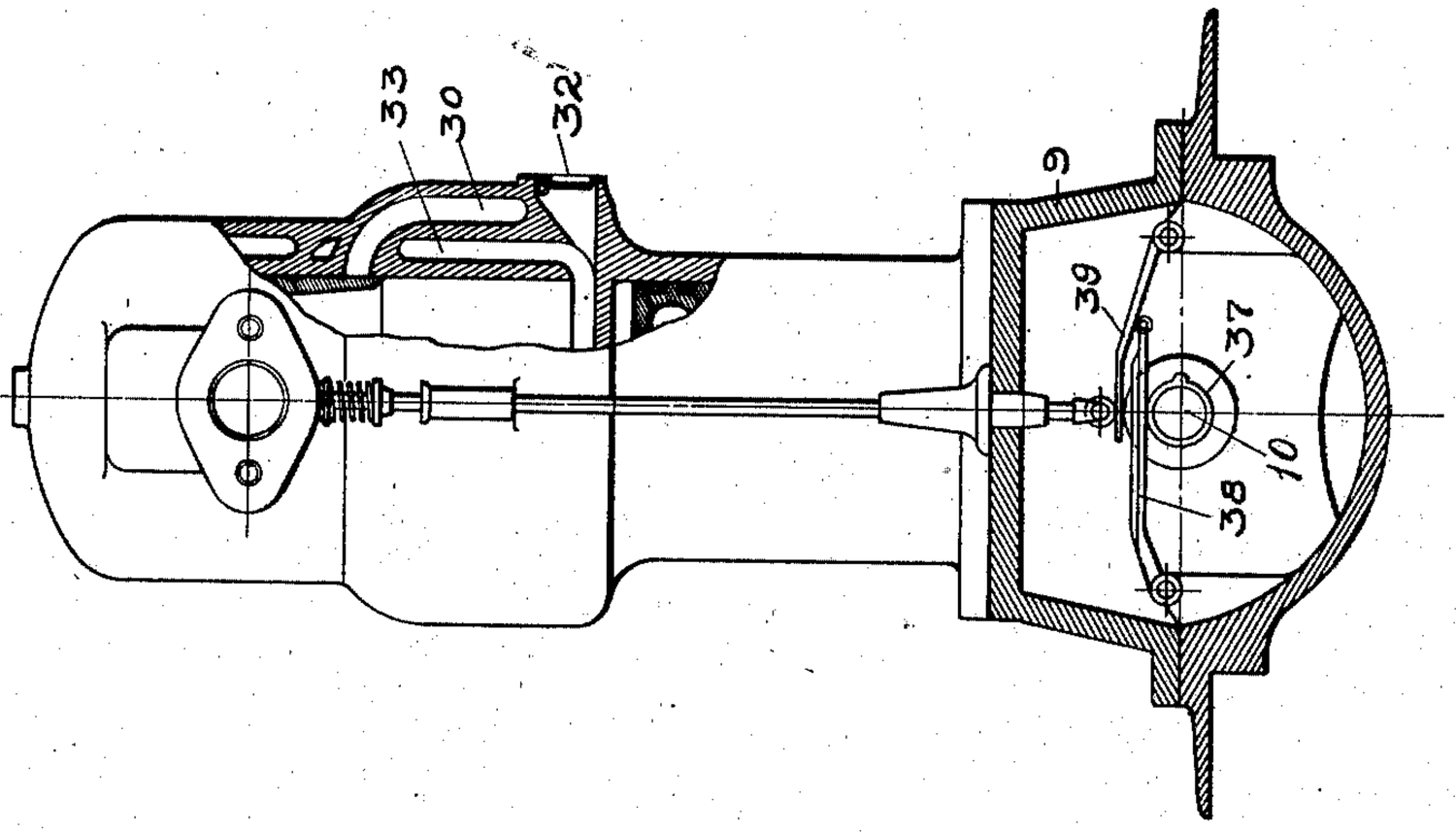
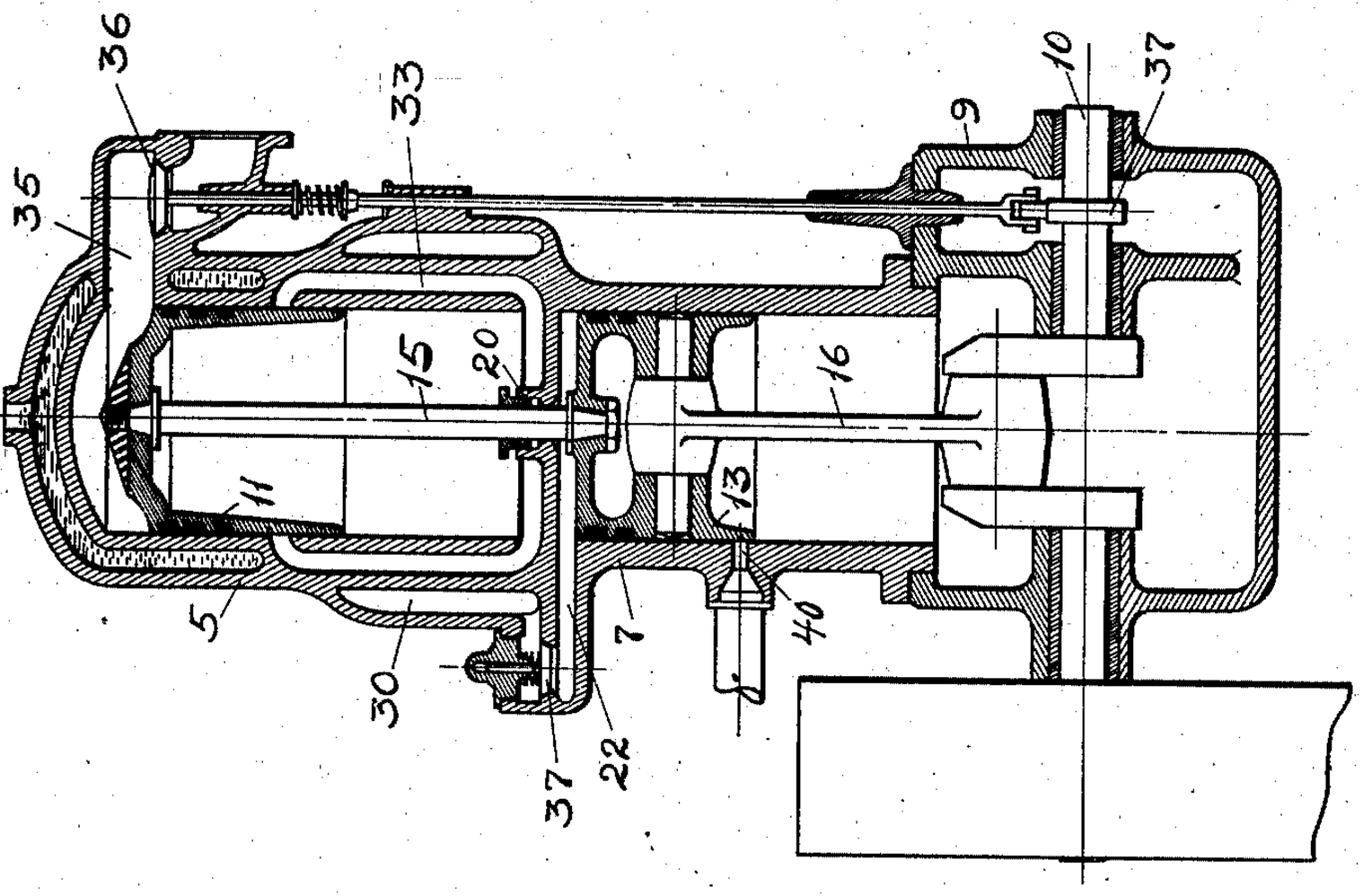


Fig. 4.



WITNESSES:

Jno. C. Purdy

L. L. Andrews Jr.

INVENTOR

Sigurd Wiebe

BY

Chapin Hayford Noble

HIS ATTORNEYS

UNITED STATES PATENT OFFICE.

SIGURD WIEBE, OF NEW YORK, N. Y., ASSIGNOR OF ONE-HALF TO JOHN C. QUINN, OF PHILADELPHIA, PENNSYLVANIA.

INTERNAL-COMBUSTION ENGINE.

966,972. Specification of Letters Patent. Patented Aug. 9, 1910.

Application filed October 2, 1905. Serial No. 280,888.

To all whom it may concern:

Be it known that I, SIGURD WIEBE, a subject of the Crown of Sweden, and resident of the city, county, and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to internal combustion engines, and particularly to internal combustion engines of the two-cycle type, in which each stroke of the working piston in one direction is a power stroke. In this type of engine, one of the greatest difficulties is the thorough scouring of the cylinder to get rid of the burned gases, after they have been employed in a power stroke. For this purpose, I employ atmospheric air under slight pressure, which I introduce into the cylinder after the gases have done their work and the discharge has been opened therefor, so as to thoroughly clean out the cylinder before I admit a fresh charge of gaseous mixture. For introducing the fresh charge quickly and positively, I employ a secondary cylinder and piston, using the opposite side of the working piston for the slight compression of air employed for scouring purposes.

My invention also consists in certain novel details of construction and combination of parts, as will hereinafter be more fully pointed out.

I will now proceed to describe an internal combustion engine embodying my invention, and will then point out the novel features in claims.

In the drawings—Figure 1 is a view in central vertical longitudinal section of a two-cylinder engine embodying my invention. Fig. 2 is a detail view in central transverse section through one of the cylinders, at right angles to the point of view of Fig. 1. Fig. 3 is an end view of the engine, with certain parts broken away, to more clearly illustrate other parts. Fig. 4 is a view in central vertical longitudinal section through a single cylinder engine embodying my invention.

The engine illustrated comprises two vertical working cylinders 5 and 6, with charging cylinders 7 and 8 arranged longitudinally beneath same. These cylinders 5 6 7 and 8 are supported by a crank casing 9, which carries and incloses the crank shaft 10. Reciprocating pistons 11 and 12 are suitably mounted in the cylinders 5 and 6, and corresponding pistons 13 and 14 are mounted to reciprocate in the cylinders 7 and 8. The pistons 11 and 13 are connected together by a piston rod 15, and with the crank shaft 10, by means of a pitman or connecting rod 16, while the pistons 12 and 14 are similarly connected together by means of a piston rod 17, and to the crank shaft 10 by means of a connecting rod 18. The lower ends of the cylinders 5 and 6 are closed by means of a lower head 19, the piston rods 15 and 17 passing through suitable packing boxes 20 in the said heads. The lower ends of the cylinders 7 and 8 are open.

21 designates an inlet for explosives gases, said inlet 21 being connected with a carbureter, or with other source of gas supply, and passages 22 and 23 respectively lead from the said inlet 21 to the interior of cylinders 7 and 8. Inlet valves 24 and 25 control the passages 22 and 23, and are operated by means of cams 25 26 upon the crank shaft 10. The passages 22 and 23 also lead through cross-over conduits 27 and 28 respectively, to annular chambers 29 and 30 formed around the cylinders 5 and 6. These chambers communicate through ports 31 to the interior of the cylinders 5 and 6, such ports being just uncovered by the pistons 11 and 12, when in their lowest positions. Air is admitted to the said cylinders through an air inlet 32 to beneath the working pistons, and to annular chambers 33 arranged around the cylinders, the chambers in the present instance being located between the annular chambers 30 and the cylinders 5 and 6. These annular chambers, of which there is one for each cylinder, communicate through ports 34 with the cylinders 5 and 6 at points just above the ports 31, and are hence uncovered by the pistons 11 and 12 in their downward movement a little ahead of the uncovering of the said ports 31. The exhaust ports 35 of the said cylinders 5 and 6 are arranged at substantially the upper end of the said cylinders, the said exhaust ports being controlled by means of exhaust valves 36. The exhaust valves are operated through certain levers, rods, etc., by cams 37 upon the main shaft, as will be readily un-

derstood. In Fig. 3 I have shown compound levers 38 and 39 between one of the cams 37 and its follower, in order to insure a rapid and extensive movement of the exhaust valve. The precise construction or arrangement of these parts, however, is immaterial, and forms, *per se*, no part of my present invention.

The operation of the engine is as follows: With the engine in the position shown in Fig. 1, a power stroke is about to be made in cylinder 5, while the piston in cylinder 6 has completed its power stroke, and exhaust has taken place, and during its forward movement a new charge will be compressed. During the downward power stroke of pistons 11 and 13 in cylinders 5 and 7, air, which is contained beneath the piston 11 and in the chamber 33 in communication therewith, will be slightly compressed, and gas will be drawn into the cylinder 7 past the inlet valve 24, which is shown as having been opened by its cam 25 for this purpose. The charge thus drawn into the cylinder 7 will be finally delivered through the cross-over conduit 27 into the chamber 29 of the cylinder 6 upon the return movement of the piston 13. Just before the piston 11 uncovers the ports 34, its exhaust valve 36 will be opened, permitting the spent gases to exhaust down to atmospheric pressure. Continued movement of the piston will uncover the air inlet ports 34, allowing air, which has been compressed to a slight degree beneath the piston and in the chamber 33, to rush into the cylinder, expelling the remaining inert gases and thoroughly scouring the same. In its final downward movement, the piston will uncover the ports 31, so as to admit a fresh charge of gas under pressure from within the chamber 30 and which was delivered by the piston 14 in its upward movement. During the downward movement of the pistons 11 and 13, the pistons 12 and 14 have been moving upward, with the following results: Gas, which had been drawn into the cylinder 8 by the prior downward movement of its piston 14 (as above described, with reference to the downward movement of the piston 13 in the cylinder 7) will be forced through the passage 23 and cross-over conduit 28 into the chamber 30, ready to be taken in at the moment the piston 11 uncovers the ports 31, as above set forth. The piston 12, in its upward movement, first closes the ports 31 (the charge having previously entered therethrough into the cylinder 6), and then closes the ports 34. The exhaust valve 36 will have been closed by this time, and continued movement of the piston will compress the charge in the cylinder 6, ready for the following power stroke. The engine being of the two-cycle type, every down stroke of each piston 11 and 12 is a power stroke, and each up stroke of each said piston is a compression stroke. In the arrangement shown in Fig. 1, the upstroke of each of said pistons 7 and 8 compresses a charge, the former for the cylinder 6 and the latter for the cylinder 5, while at each down stroke a new charge is drawn in. In Fig. 4 I have shown the lower piston as arranged to charge the cylinder immediately above it, the only difference being that in such case a check valve 37 is provided in the passage 22 leading from the lower cylinder 7 to the annular chamber 30, surrounding the upper cylinder 5. This is necessary, because the lower piston 13 will be moving in a direction to charge the upper cylinder during the time the piston 11 in the upper cylinder is compressing a previous charge, and prior to its power stroke. This arrangement may be employed for a multi-cylinder engine, but is adapted also for a single cylinder engine, which class of engine is shown in Fig. 4. When the check valve 37 is employed, a mechanically operated inlet valve may be dispensed with, the piston 13 creating a vacuum in the cylinder 7 upon its downward movement, whereby gas will rush in through a port or passage 40 connecting with gas supply, and uncovered at about the completion of the downward stroke of the said piston 13.

What I claim is:

1. In an internal combustion engine, the combination with a working cylinder provided with two annular chambers concentric therewith, and with separate inlets from said chambers to the interior of said cylinder, the one arranged above the other, of a piston in said cylinder, arranged in its stroke to uncover said inlets, one of said chambers communicating with the said cylinder at the rear of said piston, and having an air inlet, a charging cylinder and piston communicating with the other of said chambers, and a mechanically controlled exhaust for the working cylinder.

2. In an internal combustion engine, the combination with a plurality of working cylinders and a plurality of charging cylinders, said working and charging cylinders arranged in pairs, one in line with the other, working pistons in said working cylinders, charging pistons in said charging cylinders connected with said working pistons, passages connecting the rear ends of said working cylinders with the forward ends thereof, and having air inlets, and passages connecting the charging cylinder beneath each working cylinder with another working cylinder, the admission from said passages to the said working cylinders being arranged to be uncovered by said working pistons in their forward or working movements, the former in advance of the latter, and exhaust passages for the working cylinders, arranged to be opened before either of the aforesaid pas-

sages are uncovered, and to be closed before either of the aforementioned passages are covered.

3. In an internal combustion engine, the combination with a plurality of working cylinders and a plurality of charging cylinders, said working and charging cylinders arranged in pairs, one in line with the other, working pistons in said working cylinders, charging pistons in said charging cylinders connected with said working pistons, passages connecting the rear ends of said working cylinders with the forward ends thereof, and having air inlets, and passages connecting the charging cylinder beneath each working cylinder with another working cylinder, the admission from said passages to the said working cylinders being arranged to be uncovered by said working pistons in their forward or working movements, the former in advance of the latter, and mechanically operated exhaust valves controlling exhaust from the front ends of the said working cylinders, and arranged to be opened before either of the aforesaid passages are uncovered.

4. In an internal combustion engine, the combination with a plurality of working cylinders and a plurality of charging cylinders, said working and charging cylinders arranged in pairs, one in line with the other, working pistons in said working cylinders, charging pistons in said charging cylinders connected with said working pistons, passages connecting the rear ends of said working cylinders with the forward ends thereof, and having air inlets, and passages connecting the charging cylinder beneath each working cylinder with another working cylinder, the admission from said passages to the said working cylinders being arranged to be uncovered by said working pistons in their forward or working movements, the former in advance of the latter, exhaust passages for the working cylinders, arranged to be opened before either of the aforesaid passages are uncovered, and mechanically operated inlet valves for the said charging cylinders.

5. In an internal combustion engine, the combination with a plurality of working cylinders and a plurality of charging cylinders, said working and charging cylinders arranged in pairs, one in line with the other, working pistons in said working cylinders, charging pistons in said charging cylinders connected with said working pistons, passages connecting the rear ends of said working cylinders with the forward ends thereof, and having air inlets, and passages connecting the charging cylinder beneath each working cylinder with another working cylinder, the admission from said passages to the said working cylinders being arranged to be uncovered by said working pistons in their forward or working movements, the former in advance of the latter, mechanically operated inlet valves for the said charging cylinders, and mechanically operated exhaust valves controlling exhaust from the front ends of said working cylinders, and arranged to be opened before either of the aforesaid passages are uncovered.

SIGURD WIEBE.

Witnesses:
D. HOWARD HAYWOOD,
JNO. C. QUINN.