T. L. CARBONE AND P. METZLER.

TWO-STROKE CYCLE INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 23, 1919. RENEWED NOV. 3, 1920.

1,361,680. Patented Dec. 7, 1920.

2 SHEETS—SHEET 1.

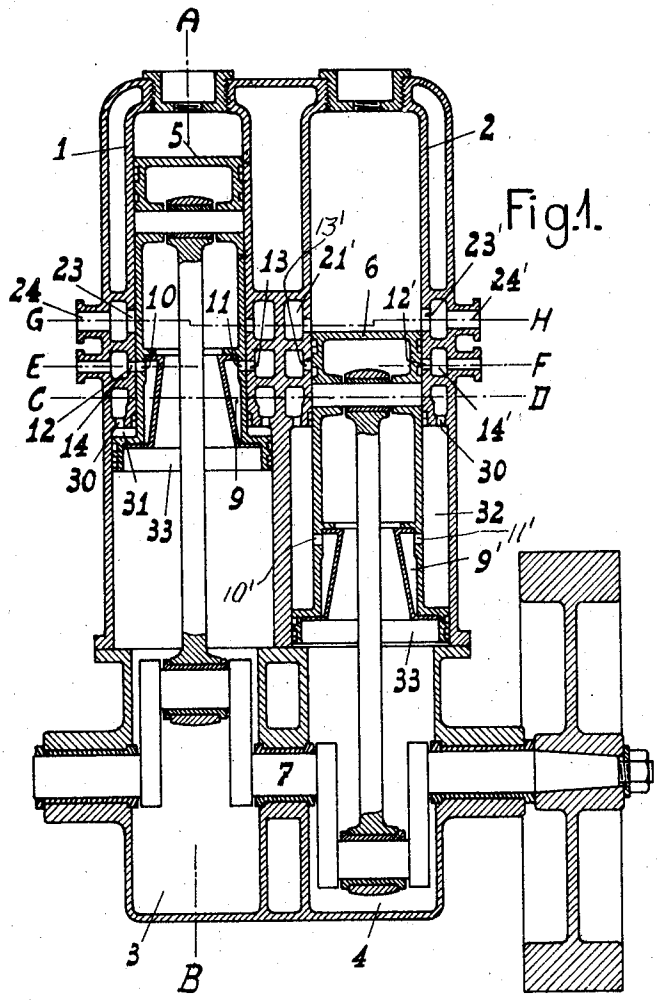


Fig.1.

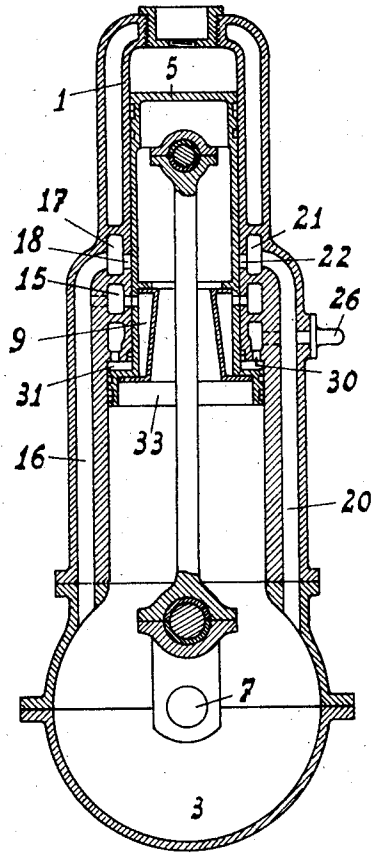


Fig.2.

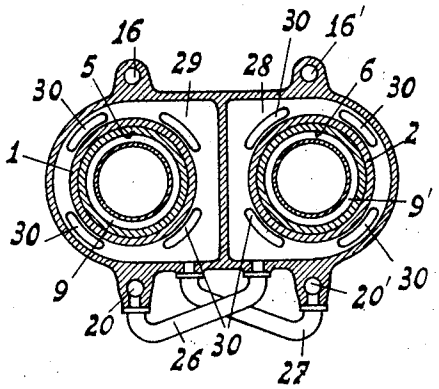


Fig.3.

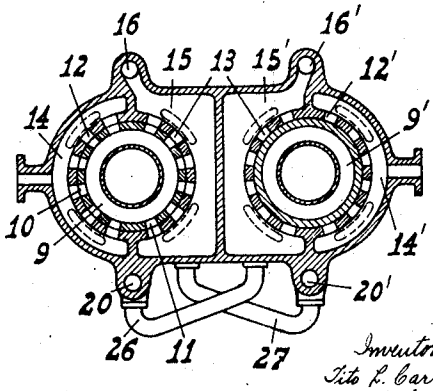


Fig.4.

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2 SHEETS—SHEET 2.

Fig.6.

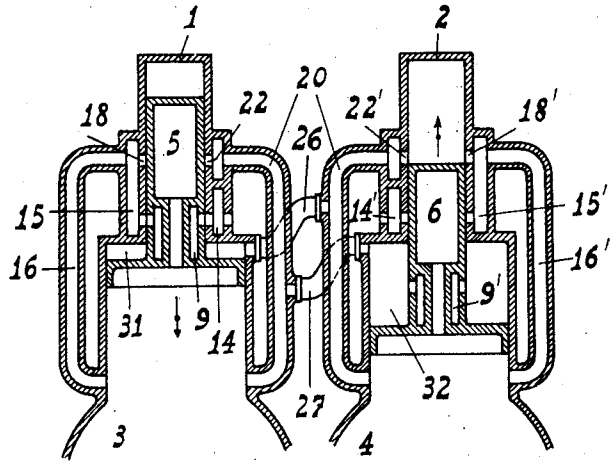


Fig.7.

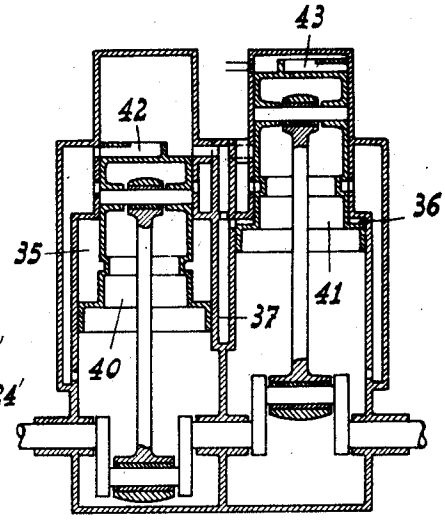
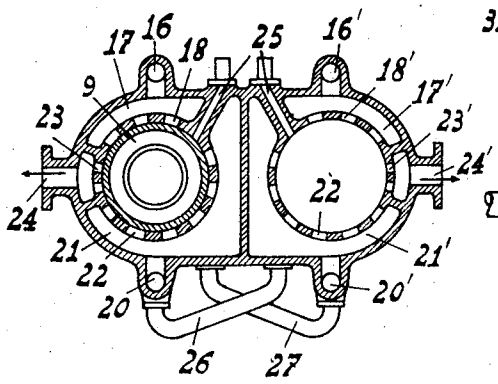


Fig.5.



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UNITED STATES PATENT OFFICE.

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TWO-STROKE-CYCLE INTERNAL-COMBUSTION ENGINE.

1,361,680. Specification of Letters Patent. Patented Dec. 7, 1920.

Application filed December 23, 1919, Serial No. 347,014. Renewed November 3, 1920. Serial No. 421,598.

To all whom it may concern:

Be it known that we, TITO LIVIO CARBONE and PAUL METZLER, residing at Zurich, Löwenstrasse No. 1 and Apollostrasse No. 5, respectively, Switzerland, have invented certain new and useful Improvements in Two-Stroke-Cycle Internal-Combustion Engines, of which the following is a specification.

The present invention relates to a new and improved two-stroke-cycle internal combustion engine of the type in which the air to scavenge the cylinder is compressed by the piston in the crank case of the engine.

The invention has for its broad objects to provide an engine which shall yield the highest desirable results in operation and we attain this object by the provision of means to increase the amount of air available for scavenging purposes and by the provision of means to raise and equalize the pressure of the air as far as possible and with the most simple means.

We attain these and other objects as hereinafter specified by means of the engine hereinafter described and particularly set forth in the claims appended hereto.

In order that our invention may be clearly understood we have illustrated the same in the accompanying drawings in a diagrammatical manner.

In the drawings—

Figure 1 shows an engine in sectional elevation;

Fig. 2 is a section taken on line A—B of Fig. 1;

Figs. 3, 4 and 5 are sections taken on the lines C—D, E—F, and G—H of Fig. 1;

Fig. 6 illustrates in a diagrammatical manner the coöperation of the two cylinders;

Fig. 7 shows in a diagrammatical manner a second form of the invention.

The engine shown in Figs. 1 to 6 comprises two cylinders 1, 2 and two crank cases 3, 4 said crank cases being tightly closed against each other and against the atmosphere. In each of the cylinders 1, 2 there is a two stepped piston 5, 6 respectively; the pistons are connected to a common crank shaft 7, the cranks being set at 180° to each other. Each piston 5, 6 is provided with an annular chamber 9 and 9′ respectively and with a row of holes 10, 11 and 10′ and 11′ respectively communicating with said chamber 9 and 9′ and with rows of ports 12, 13 and 12′, 13′ arranged in the walls of the cylinders 1, 2. The openings 12 and 12′ lead to chambers 14 and 14′ respectively communicating with the atmosphere. The openings 13 and 13′ lead to chambers 15 and 15′ respectively connected by conduits 16 and 16′ to the crank-cases 3 or 4 respectively. If piston 5 or 6 has reached its upper dead point position the openings 10 and 12 or 10′ and 12′ and 11 and 13, or 11′ and 13′ coincide and air passes through the chambers 14, 9, 15 or 14′, 9′, 15′ and through the conduit 16 or 16′ to the crank case 3 or 4. The conduits 16 and 16′ lead moreover to chambers 17 and 17′ the inner wall of which being provided with a row of inlet ports 18 and 18′ respectively through which air enters the cylinder 1 or 2. From each crank case 3, 4 a second conduit 20 and 20′ respectively leads upward to a chamber 21 or 21′ of the corresponding cylinder 1, 2 from whence the air passes through inlet ports 22 and 22′ into the cylinder 1, 2. The gases of combustion escape through exhaust ports 23, 24 and 23′, 24′. The fuel is introduced through a passage 25 in the well known manner into the combustion chamber. Each conduit 20 or 20′ of one cylinder 1 or 3 is connected by means of a branch pipe 26, 27 with a chamber 28, 29 of the other cylinder and the chambers 28, 29 communicate by means of slots 30 with the annular spaces 31, 32 between the larger portions 33 of the pistons 5, 6 and the shoulders of the cylinders.

In the position of the pistons 5, 6 as shown in the drawings fresh air passes from the atmosphere through the chambers 9 and 15 and through channel 16 into the crank case 3. From the crank-case 3 the air rushes through the slots 30 into the annular space 32 of the other cylinder. The piston 6 in its lowest position opens first the slots 23. High pressure exhaust escapes and reaches atmosphere pressure instantly. After this the slots 18 and 22 are opened and air enters for cleaning the cylinder. If now piston 5 descends and piston 6 ascends the ports 11, 12 of cylinder 1 are closed and the air within the crank case 3 is compressed. The compressed air passes in the chamber 17 and 21 and as soon as the piston 5 frees the ports 18, 22, 23 the compressed air passes through the ports 18, 22 into the cylinder 1 driving the gases out of the cylinder 1 through the

openings 23. While piston 5 descends piston 6 ascends and the head 33 thereof compresses air in said annular space 32. The compressed air passes through the slots 30 and pipe 26 into the conduit 20 from whence it passes into the chamber 21 and cylinder 1. To scavenge cylinder 1 there is not only that air available which is displaced by the descending piston 5 but also that air which is forced out of the annular space 32 of cylinder 2. A great amount of air at a great pressure is thereby gained insuring a perfect washing out of the cylinder 1. What is described above with reference to cylinder 1 will also hold good for cylinder 2, in which case the cylinder 2. As each cylinder is perfectly cleaned of the gases of combustion by a strong current of compressed air a perfect combustion of the fuel introduced in the cylinders and thereby a high efficiency is attained.

The engine shown in Fig. 7 in a diagrammatical manner differs in that the compressed air from the annular spaces 35, 36 passes into receivers 37 communicating with the adjacent cylinder. The pistons 40, 41 are provided with channels 42, 43 which guide the air coming from the crankcases through the channels 44, in the center of the cylinder. A stream of compressed air passes in the axis of the cylinder and a second current of air of still higher pressure enters from said receivers 37. It is preferable to let the air of higher pressure enter first.

We do not wish to confine ourselves to details of construction as they may be modified without departing from the spirit of the invention.

Having described our invention what we claim as new and desire to secure by Letters Patent is:

1. A two-stroke-cycle-internal combustion engine having two cylinders, a closed crank case to each of said cylinders, a two stepped piston in each of said cylinders, the pistons being connected to cranks of the shaft set 180° to each other, a fuel inlet in each of said cylinders, ignition devices in each of said cylinders, conduits leading from the atmosphere to the crank cases through chambers forming part of the pistons, a conduit leading from each of the said crank cases to air inlet ports of the cylinder, a second conduit leading from said crank case to air inlets of the cylinder, said last named conduit communicating with an air compression chamber of the second cylinder adapted to supply air under high pressure.

2. A two-stroke-cycle-internal combustion engine having two cylinders, a closed crank case to each of said cylinders, a two stepped piston in each of said cylinders, the pistons being connected to cranks of a shaft set 180° to each other, a fuel inlet in each of said cylinders, ignition devices in each of said cylinders, conduits leading from the atmosphere to the crank cases through chambers forming part of the pistons, a conduit leading from the said crank case to air inlet ports of the cylinder, a second conduit leading from each of said crank cases to air inlets of the cylinder, said last named conduit communicating with an air compression chamber of the second cylinder in which the enlarged head of the piston works, the ports in the cylinders being controlled by the pistons, the air inlets being arranged to allow first the entrance of the higher compressed air.

3. A two-stroke-cycle-internal combustion engine having two cylinders, a closed crank case to each of said cylinders, a two stepped piston in each of said cylinders, the pistons being connected to cranks of a shaft set 180° to each other, a fuel inlet in each of said cylinders, ignition devices in each of said cylinders, conduits leading from the atmosphere to the crank cases through chambers forming part of the pistons, a conduit leading from each of the said crank cases to air inlet ports of the cylinder, a second conduit leading from said crank cases to air inlets of the cylinder, said last named conduit communicating with an air compression chamber of the second cylinder adapted to supply air under high pressure, said chamber being connected to a receiver from which supplemental air under high pressure is fed to the cylinders, substantially as described.

In testimony whereof we affix our signatures.

TITO L. CARBONE.
PAUL METZLER.