Oct. 23, 1928. 1,688,767

C. WEBB

INTERNAL COMBUSTION ENGINE

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Fig. 1.

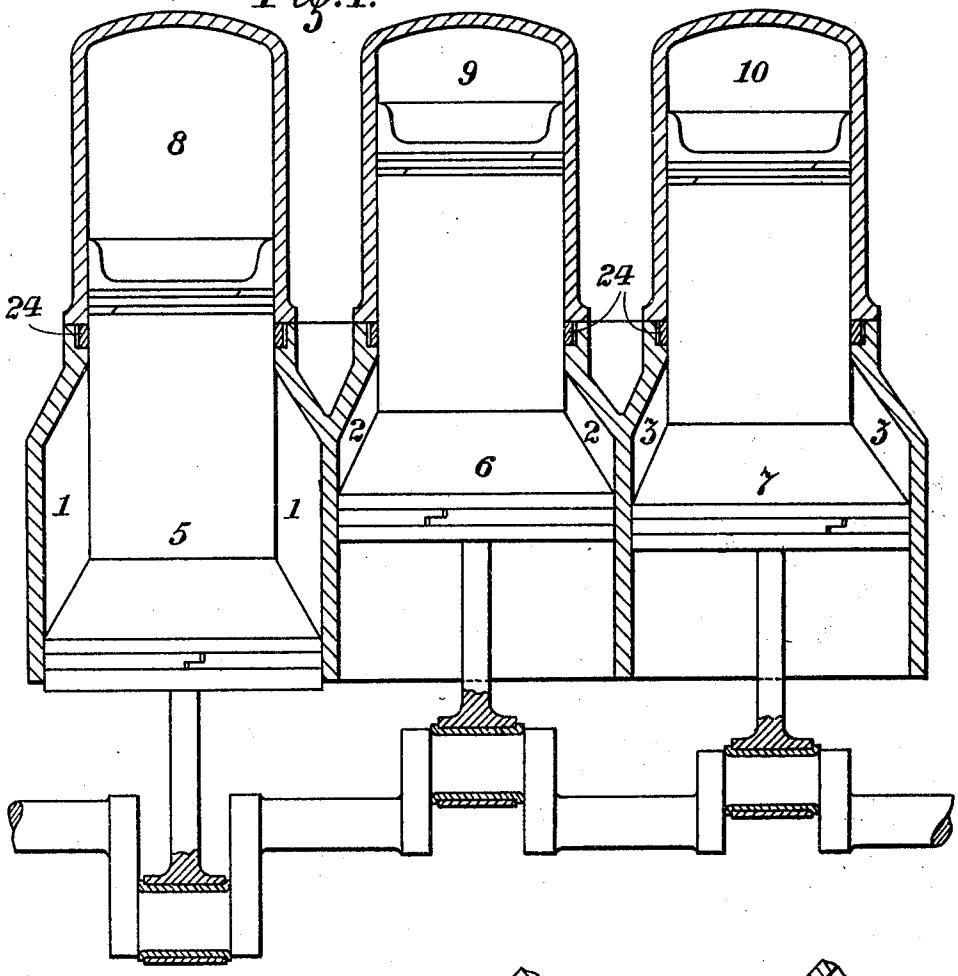


Fig. 7.

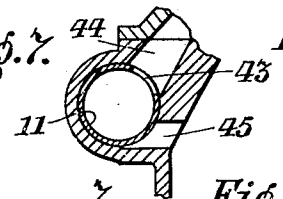


Fig. 8.

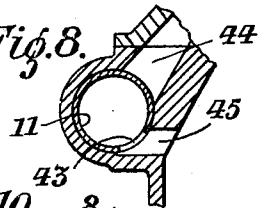


Fig. 9.

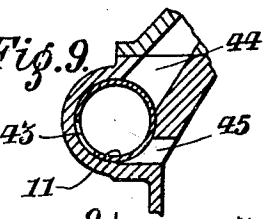
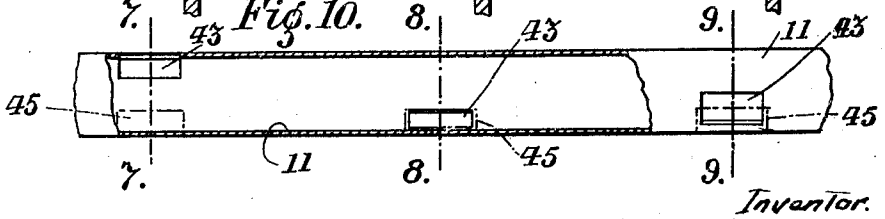


Fig. 10.



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By Jno Louis Atty.

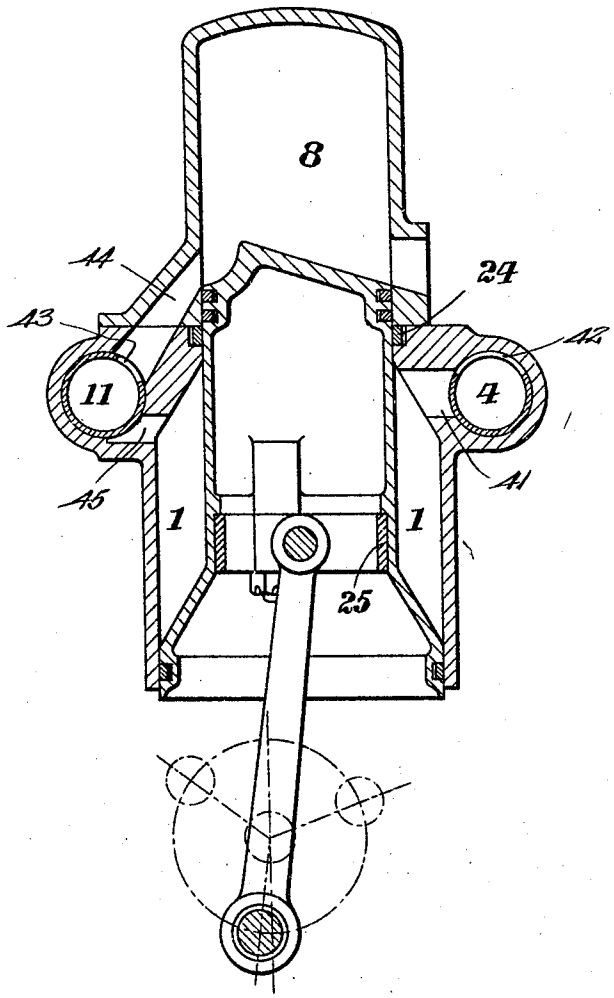
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INTERNAL COMBUSTION ENGINE

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Fig. 2.



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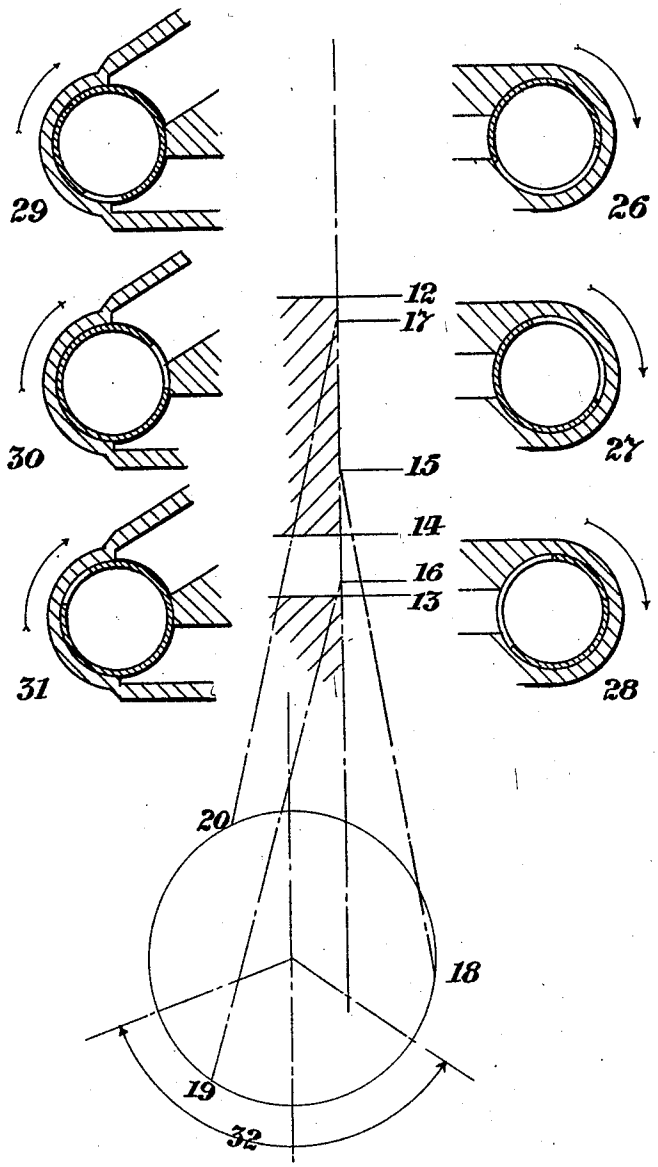
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INTERNAL COMBUSTION ENGINE

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Fig. 3.



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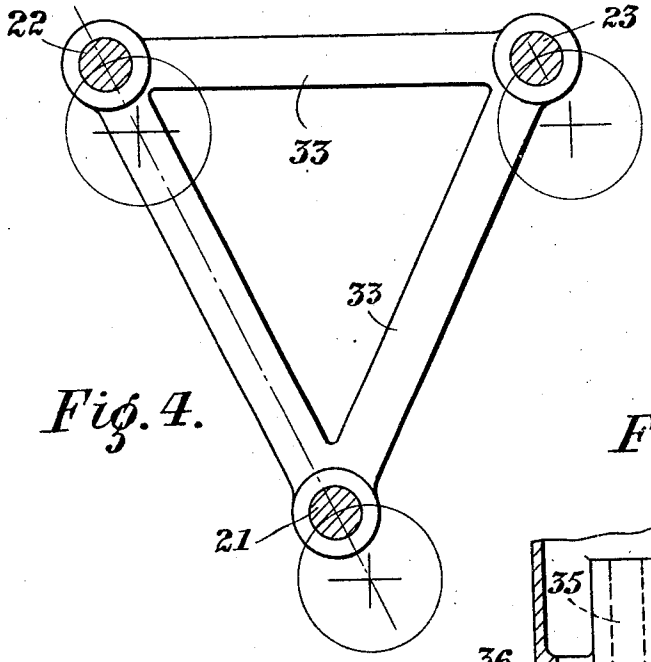


Fig. 4.

Fig. 5.

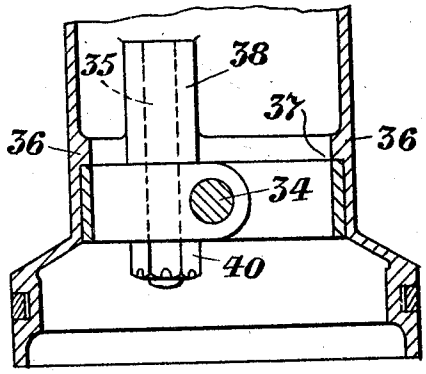
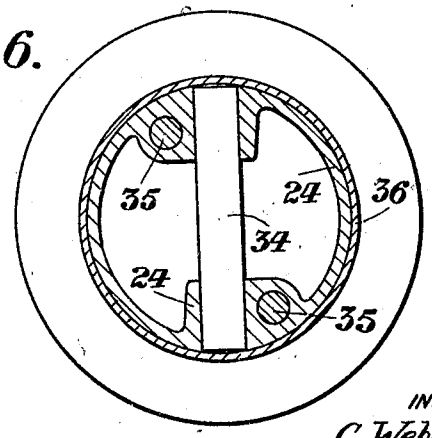


Fig. 6.



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UNITED STATES PATENT OFFICE.

CECIL WEBB, OF LISBURN, IRELAND.

INTERNAL-COMBUSTION ENGINE.

Application filed June 12, 1922, Serial No. 567,851, and in Great Britain June 24, 1921.

This invention relates to internal combustion engines of the two stroke cycle type in which three or multiples of three compound cylinders are fitted each with a differential piston acting on a common crank shaft with a distribution of about 120° around the crank circle, and in which the larger diameter of each cylinder and piston acts as a pump to deliver a gaseous combustible mixture to the smaller diameter of an adjacent cylinder in which it is compressed, ignited and expanded.

Fig. 1 shows a longitudinal section of such an engine.

Fig. 2 shows a cross section through one compound cylinder.

Fig. 3 shows the relative movements of pistons, cranks and rotary valves.

Fig. 4 shows a link used to transmit the rotary motion of the crankshaft to the valves.

Figs. 5 and 6 show a system of piston construction desirable for this type of engine.

Figs. 7, 8 and 9 are sections through the transfer valve at each cylinder respectively, and

Fig. 10 is a longitudinal vertical section of the said transfer valve.

Referring to Figs. 1 and 2, each cylinder has an annular pumping chamber 1, 2 or 3 and a working chamber 8, 9 or 10, provided with differential pistons 5, 6 or 7, respectively.

The cylinders are arranged in groups of three and along one side of each group is an inlet valve housing within which is located a rotary inlet valve 4, comprising a tube provided with three slots 42 disposed at 120° to each other and spaced apart axially to correspond with each cylinder. Three inlet passages 41 connect the inlet valve housing to the three pumping chambers 1, 2, 3. Each of the slots 42 in the tube is adapted to register periodically with one of the inlet passages 41 when the corresponding piston is descending, to cause a charge to be induced into the corresponding pumping chamber, the live gas being supplied along the interior of the rotating tube.

At the other side of the group of cylinders, a second valve housing contains a rotary transfer valve 11 having three slots 43 in it arranged somewhat similarly to those in the inlet valve. Three sets, of two passages each, extend from this valve housing, one set, of which only one passage 44 is shown in Fig. 2, leading to the working chambers 8, 9, 10, respectively and the other set, of which only one passage 45 is shown, leading to the pumping chambers 1, 2, 3, respectively.

The tube 11 is caused to rotate so that when one of the slots 43 therein is registering with the passage 45 to one pumping chamber, another of the slots 43 is registering with the passage 44 to an adjacent working chamber, the third slot being closed, and so on. Thus, in the example under consideration the charge induced into the pumping chamber 2 is transferred axially along the tube 11 to working chamber 8 (see Fig. 10); the charge induced into the pumping chamber 1 to working chamber 10 and the charge induced into pumping chamber 3 to working chamber 9, in the desired sequence, as the corresponding piston rises.

As the slots in the tube are arranged at 120° around it this transfer occurs thrice per revolution of the crank shaft.

It should be noted that the flow of gas from the transfer valve to the working chambers is controlled not only by the movement of the said valve but also by the movement of the pistons.

Referring to Fig. 3, the stroke of an engine piston is indicated from 12 to 13; the height of transfer and exhaust ports from 13 to 14; the position of the piston tops are shown as 15, 16, 17, corresponding to the crank pin positions 18, 19, 20. The centre line of the cylinders is shown offset from the centre line of the crank circle, as this gives an advantage not only as regards reducing pressure on the cylinder walls during the power stroke but in delaying the action of the piston in closing the transfer and exhaust ports.

On the same diagram, Fig. 3, three sections of the rotary inlet valve are shown. Section 26 corresponding to the piston position 17; section 27 corresponding to the piston position 16; section 28 corresponding to the piston position 15.

On the same diagram, Fig. 3, three sections of the rotary transfer valve are shown. Section 29 corresponding to piston position 17; section 30 corresponding to piston position 16; section 31 corresponding to piston position 15. The angle described by the crank whilst the exhaust ports are open is indicated at 32, Fig. 3.

A comparison of these relative movements of pistons, cranks and valves will reveal how the flow of gas is controlled into the annular pumps and thence into the combustion cylinders in the desired manner and sequence.

The relative proportions of ports may be varied according as to whether it is desirable to have a high speed engine, or a slow speed engine, and the action of the valves may be advanced or retarded also for the like purpose.

The rotary motion of the crankshaft may be transmitted to the valves by any suitable means such as geared spur wheels, or by the action of a chain running over sprocket wheels, but in order to obtain an especially satisfactory and silent motion the link motion shown in Fig. 4 has been devised.

Referring to Fig. 4, 21 is a crankpin on the main crank shaft, 22 and 23 are crank pins at the ends of the rotary valves. The circles described by these crank pins are indicated. The pins are connected to each other by a link or rod 33 which receives the rotary motion of the pin 21 and transmits it to pin 22 and pin 23.

It will be seen that in the position shown pin 21 and pin 22 are on dead centres with respect to each other, and in this position an ordinary link would result in a lag or delay of pin 22 which would be greatly increased by wear and slackness in the bearings. But pin 23 is in an advantageous position for receiving motion from pin 21 and as the link connects pin 23 to pin 22 the motion continues smooth and uniform for all positions.

Other points on the link may be used for giving a rotary motion to such adjuncts to the engine as an oil pump, water pump, or electric dynamo.

For the purpose of accurate adjustment of valve timing the pins 22 and 23 may be carried on an adjustable member at the end of each valve. Eccentrics may be used instead of crank pins in this link.

In order that the flow of gas outlined above shall take place without loss rings are made to contract on the pistons preventing leakage of gas between the walls of the cylinders and pistons when the pistons are forcing gas from the pumps through the transfer valve (see 24, Figs. 1 and 2).

It has also been found that when the ends of the gudgeon pins are supported in and penetrate through the walls of the pistons in the usual way there is a leakage of gas at the moment when the ends of the gudgeon pins are passing through the contracting rings. To avoid this loss, as well as to form a good construction the gudgeon pins 34 are carried in rings 24 which are held in position against a shoulder 37 inside the pistons by studs 35 and nuts 40 as shown in Fig. 5 and Fig. 2, 25. Two bosses 38 are formed on inside of piston to carry the studs.

Having now fully described my invention what I claim and desire to secure by Letters Patent is:—

1. An internal combustion engine having a plurality of engine units arranged in groups, each unit including a differential cylinder and piston, and a hollow rotary inlet valve for each group into which combustible mixture is supplied and which is common to and communicates in turn with each pump cylinder to admit a charge thereto, a hollow rotary transfer valve common to all the units of a group, said transfer valve being interiorly uninterrupted throughout its length and having an opening in it for each unit, and passages leading from said latter valve to each pump cylinder and to each working cylinder, the relative dispositions of the openings in the transfer valve and the passages being such that when one of such openings is in communication with the passage from the pump cylinder of one unit another of such openings is in communication with the passage leading to the working cylinder of another unit to transfer a primarily compressed charge along said valve to the said working cylinder.

2. An internal combustion engine having a plurality of engine units arranged in groups, each unit including a differential cylinder and piston, and a hollow rotary inlet valve for each group comprising a tubular member having slots in it spaced apart axially and angularly, one slot for each unit in a group, a cylindrical housing therefor, the said tubular member being supplied with combustible mixture to charge the pump cylinder of each unit in turn, a hollow rotary transfer valve for each group comprising a tubular member interiorly uninterrupted throughout its length and having slots in it spaced apart axially and angularly, one slot for each unit, a cylindrical housing therefor, passages leading from the said housing to each working cylinder and to each pump cylinder in the group, the tubular member being adapted in rotating to receive a primarily compressed charge from each pump cylinder in turn through the slot corresponding thereto and to transfer it axially along its interior to the working cylinder of a unit other than that in which it was primarily compressed.

3. An internal combustion engine having a plurality of engine units arranged in groups of three, each engine unit including a differential cylinder and piston, a tubular rotary inlet valve for each group, a tubular rotary transfer valve for each group, a single opening in said transfer valve for each unit, a housing for said transfer valve and, in each unit, two passages both terminating abreast the corresponding opening in the transfer valve from which they lead to the corresponding pump cylinder and working

cylinder, respectively, each opening in the transfer valve cooperating with the two corresponding passages to receive primarily compressed charges from the pump cylinder of one unit and to pass them along the transfer valve to the working cylinder of another unit.

4. An internal combustion engine having a plurality of engine units arranged in groups of three, each engine unit including a differential cylinder and piston, a tubular rotary inlet valve for each group, a tubular rotary transfer valve for each group, a single opening in said transfer valve for each unit, a housing for said transfer valve and, in each unit, two passages both terminating abreast the corresponding opening in the transfer valve from which they lead to the corresponding pump cylinder and working cylinder, respectively, the openings in the transfer valve each cooperating with the two corresponding passages to receive primarily compressed charges from the pump cylinder of the first unit and transfer them to the second, from the second unit and transfer them to the third and from the third unit and transfer them to the first.

In testimony whereof I affix my signature.

CECIL WEBB.