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INTERNAL COMBUSTION ENGINE

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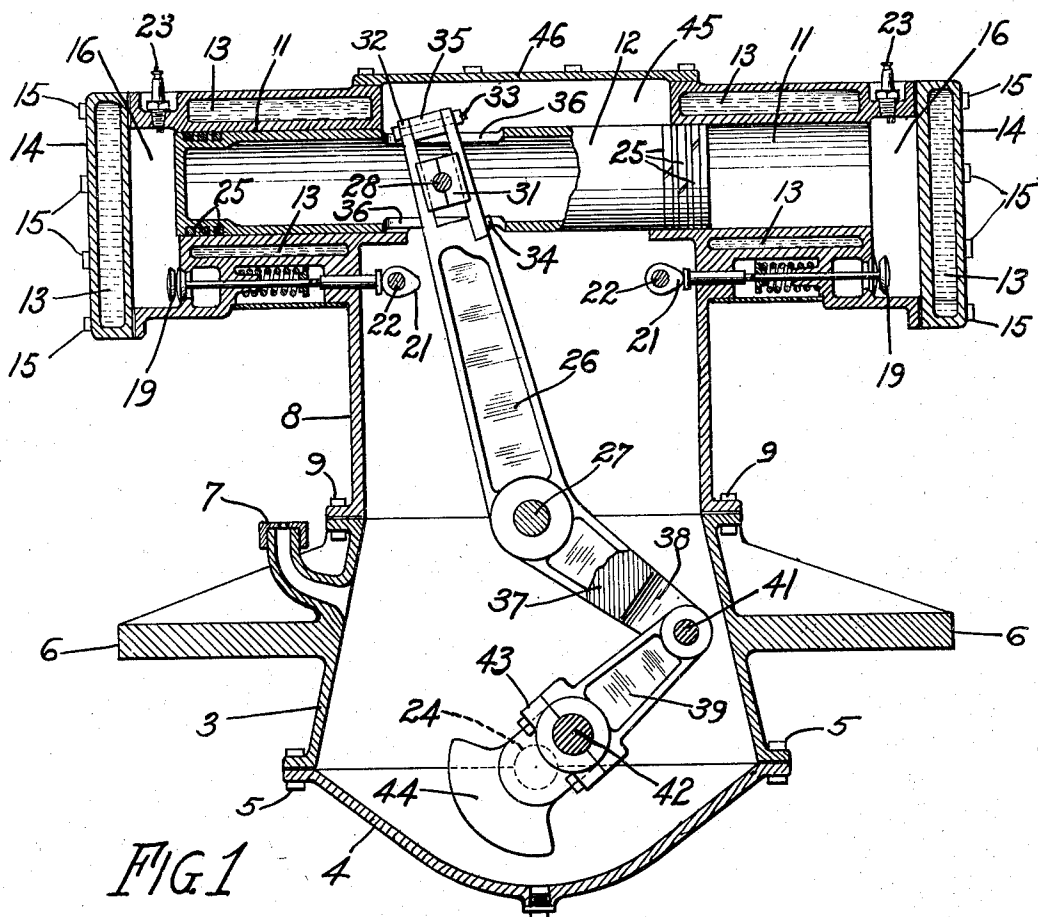


FIG 1

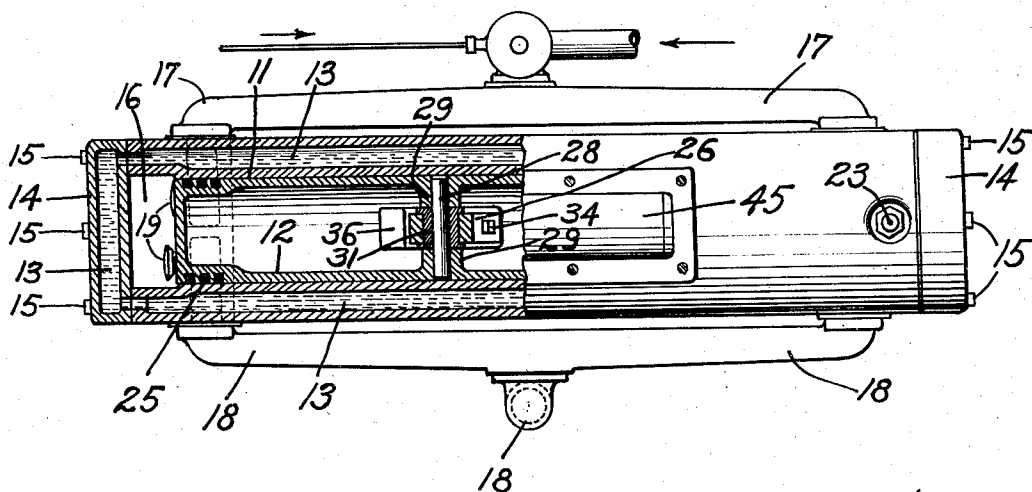


FIG. 2

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INTERNAL-COMBUSTION ENGINE.

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This invention relates to new and useful improvements in internal combustion engines, and more particularly relates to such an engine of the four-cycle type, having a double-acting piston horizontally arranged therein, and in such a manner that there will be no additional weight carried by said piston.

A further object of the invention is to provide an internal combustion engine having the pistons mounted preferably in the upper portion thereof, and having an oscillating arm mounted therein adapted to transmit power from the pistons to the crank-shaft.

A further object is to provide such an engine having the pistons and crank-shaft operatively connected together in such a manner as to reduce to a minimum the amount of weight carried by the crank-shaft.

A further object is to provide such an apparatus which will be simple and inexpensive in construction and one which will readily lend itself for use in automobiles, and the like.

Other objects of the invention will more fully appear from the following description and the accompanying drawings and will be pointed out in the annexed claims.

In the drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the accompanying drawings forming a part of this specification,

Figure 1 is a view in vertical section of my improved engine; and

Figure 2 is a plan view of Figure 1, partially in section.

In the selected embodiment of the invention here shown, there is illustrated an internal combustion engine comprising a crank-case 3 having a cover 4 secured to the bottom thereof by means of bolts 5. Outwardly extending arms 6 are preferably provided on each side of the crank-case 3 to provide means for supporting the same. The usual breather pipe 7 is shown on one side of the crank-case through which a suitable lubricant may be introduced.

A cylinder block 8 is mounted upon the crank-case 3 by means of bolts 9, and has provided therein opposed cylinders 11 inte-

gral with each other and the block 8 and having a single bore as shown adapted to receive a double-acting piston 12 as shown in Figure 1. As shown in this figure, the cylinders 11 are horizontally arranged in the cylinder block 8 and are preferably bored in axial alignment, thereby providing in effect substantially a straight bore. The usual water-jacket 13 is provided around each cylinder 11, and each cylinder is also preferably provided with a demountable cylinder-head 14 secured to its respective cylinder by means of bolts 15. The usual compression chambers 16 are shown and communicate with the intake and exhaust manifolds 17 and 18, respectively, through suitable valves 19 operated by cams 21 mounted upon cam shafts 22. The usual spark plugs 23 are also shown mounted in the walls of the compression chambers 16.

An important feature of this invention resides in the construction and arrangement of the double-acting, hollow, one-piece cylindrical piston 12 and the aligned arrangement of the cylinders, and also the novel means provided for transmitting power therefrom to the crank-shaft 24 mounted in the lower portion of the crank-case 3. As shown in Figure 1 each end of the piston 12 is provided with suitable piston rings 25 which function to seal each compression chamber against leakage as is customary in structures of this type. Thus it will be noted that the piston, while being a unitary structure, forms in effect a pair of pistons operating within their respective cylinders.

The novel means provided for transmitting power from the piston to the crank-shaft consists in the provision of an oscillating arm 26 mounted upon a shaft or pin 27 secured to the crank-case 3. This arm is connected to the piston 12 by means of a pin 28 mounted in bearings 29 provided in the walls of the piston 12. A split bearing block 31 is mounted on the pin 28 and is slidably mounted in the forked end 32 of the arm 26 as shown. One side of the fork 32 is preferably demountably secured to the arm 26 by bolts 33 and 34 in order to provide means for taking up wear in the bearing block 31. A spacing block 35 is interposed between the forks 32 of the arm 26 and functions to space the forks apart. The walls of the piston 12 are also provided with apertures 36 through which the end of the arm 26 passes.

A relatively shorter depending arm 37 is provided on the hub of the oscillating arm 26 and this arm is provided with a forked end 38 to which one end of a suitable connecting rod 39 is pivotally connected by means of a pin 41. The other end of this connecting rod is rotatably mounted upon the crank 42 of the crank-shaft 24 by means of a capped bearing 43. The crankshaft 24 may also be provided with suitable counterweights 44 adapted to counterbalance the weight of the crank-pin 42 and connecting rod 39.

In the operation of this novel engine, the piston 12 will be caused to reciprocate between the compression chambers 16 by the timed firing or igniting of the fuel mixture drawn into the compression chambers by the suction of each end of the piston in the operation thereof. Thus it will be seen that while one end of the piston is drawing into its respective cylinder a fresh charge, the other end thereof will be compressing a charge which will be subsequently ignited to return or force the piston back to the other end of its stroke. By thus applying the power alternately to each end of the piston the oscillating arm 26 connected thereto will be caused to oscillate upon the shaft 27, thereby, through the connecting rod 39, imparting a rotary movement to the crank-shaft 24. Also by connecting the arm 26 to the piston as above described, the weight of the piston will be carried entirely by the aligned cylinders and not by the oscillating arm 26. It will also be noted that very little weight will be carried by the crank-shaft 24, the weight of the connecting rod 39 being principally carried by the arm 37.

Another feature of this invention resides in the location of the fulcrum or shaft 27 supporting the oscillating arm 26. Referring to Figure 1, it will be seen that the length of the arm 26, or the distance between the pin 28 and shaft 27 is considerably greater than the distance between the shaft 27 and the pin 41 of the lower arm 37. Also by the employment of the novel construction here shown, I am enabled to construct an engine which will be simple and inexpensive in construction, and also one which will readily lend itself for use in automobiles and the like.

The cylinder block 8 is preferably provided with a chamber 45 above the piston 12 and this chamber is suitably closed by means of a plate 46. When it is desired to disassemble the engine or remove the piston from the cylinders, the cap 46 is first removed from the chamber 45. The bolt 33 in the forked end of the arm 26 is then removed, and also the bolts 9 securing the engine block 8 to the crank-case, after which

the entire engine block, with the piston 65 mounted therein, may be upwardly lifted off the crank-case leaving the oscillating arm mounted therein. The cylinder heads 14 may then be removed and the piston removed from the cylinders.

It will also be noted that I have shown no means for operating the cam shafts 22 but it is to be understood that these may be operated from any suitable means such as from the crank-shaft 24. If desired, 75 other means may also be provided for connecting the crank-pin 42 to the lower arm 37 of the oscillating arm 26, which will transmit a similar movement to the crank-shaft 24. The form of engine here shown is preferably of the four-cycle type but it is to be understood that by slightly modifying its construction it may also be used as a two-cycle engine.

I claim as my invention:

1. In an internal combustion engine, a cylinder-block having oppositely disposed cylindrical portions bored therein in axial alinement one with the other to constitute a one piece double-acting piston receiving cylinder, a double-acting hollow piston having its opposite ends closed and slidably supported upon the lower wall of the piston cylinder, and an oscillating arm connected at one end with the engine crank-shaft and the other end slidably and detachably coupled to the interior of the piston, the piston and piston cylinder each formed with registering openings for the passage of the oscillating arm, the cylinder-block with the piston therein being bodily liftable from position when the piston and oscillating arm are uncoupled without disturbing the fulcrum of the arm.

2. In an internal combustion engine, the combination with a piston-cylinder for a double-acting piston formed of a single one-piece casting having a single bore extending from end to end of the cylinder, a double-acting piston formed of a hollow one-piece body, tubular from end to end, and having its opposite ends closed by heads integral with the body, said piston being supported solely upon the lower wall of the piston-cylinder, and an oscillating arm connected at one end with the engine crank-shaft and at the other end slidably and detachably coupled to the interior of the piston, the cylinder and piston being formed with registering openings in opposite walls of each to receive the oscillating arm, the cylinder with the piston therein being bodily liftable from position when the piston and arm are uncoupled without disturbing the fulcrum of the arm.

In witness whereof, I have hereunto set my hand this 9th day of July, 1924.

RALPH V. PALMER.