Sept. 13, 1949. F. G. PRIETO 2,481,872

COMBUSTION ENGINE

Filed Sept. 19, 1947

Fig. 1.

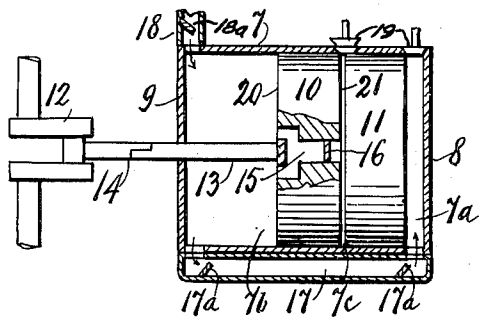


Fig. 2

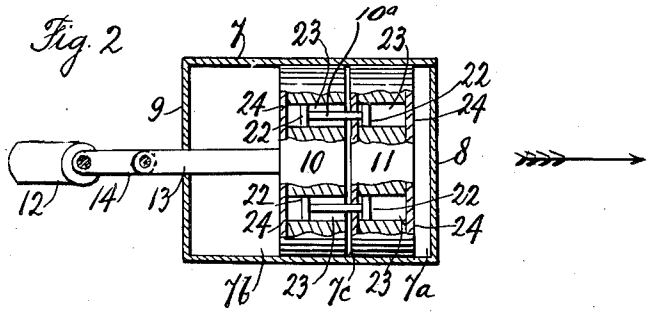
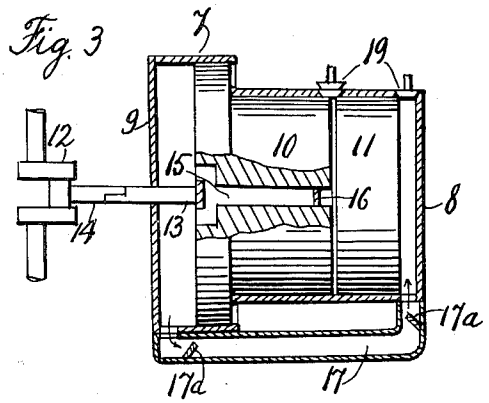


Fig. 3



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COMBUSTION ENGINE

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4 Claims. (Cl. 123—74)

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The present invention relates to an improved combustion engine and deals more specifically with a two-stroke cycle engine and with a novel manner of applying the power of said engine.

The objects of the present invention are: to provide an improved engine that has a high power output; to provide an engine of the character indicated which has an efficient weight per power output ratio and which is economical to both manufacture and operate; to provide an improved internal combustion engine which efficiently conserves fuel; to provide an improved combustion engine in which efficient scavenging of the cylinders thereof is efficiently effected.

The foregoing and other objects, features and advantages of the invention will be more clearly realized from the following detailed description of the structure illustrated in the accompanying drawing which shows, by way of example an engine embodying the present invention, and in which:

Fig. 1 is a longitudinal sectional view of an engine embodying features of the invention.

Fig. 2 is a longitudinal sectional view thereof taken at right angles to the plane of Fig. 1.

Fig. 3 is a longitudinal sectional view of a modification of the engine.

Referring to the drawing in great detail, the engine shown comprises a cylinder 7, which is closed at its ends 8 and 9 and is provided with a working piston 10 and a free piston 11. The engine further includes a crankshaft 12 connected to the working piston 10 by means of a piston rod 13 and a crank rod 14. The working piston 10 is provided with a longitudinal passage 15 controlled by a flap valve 16 which opens inwardly to allow a fuel charge to pass from the outer face 20 to the inner face 21 of said working piston. Sliding bolts 10*a* connect the pistons for both unitary and relative movement. Said cylinder is also provided with exhaust valves 19 for the gases of combustion of the engine, said valves being operated by conventional means (not shown) to alternately open in synchrony with the operation of the engine.

It will be seen that bolts 10*a* each have a head 22 on each end, that said heads are longitudinally movable in passages 23 extending through each piston 10 and 11, and that each passage 23 is provided with end abutments 24 limiting the movement of the heads and providing the slidable connection indicated.

The engine structure also includes a tube 17 arranged longitudinally alongside of the cylinder, controlled by flap valves 17*a*, one at each end

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of said tube, to allow the fuel charge to pass from the space 7*b*, at one end of the cylinder, into the space 7*a* at the other end.

The space 7*b* is provided with a fuel line 18 for admitting a fuel charge to the cylinder by displacing a back pressure valve 18*a* in said line.

The engine above set forth may be used in various ways. Herein, its operation will be described with relation to a vehicle which it propels. In such an instance, the engine is generally disposed in the plane or line of movement of the vehicle in which it is embodied.

The operation of the present structure is as follows:

During the in-stroke of the piston 10 in a direction toward cylinder end 8 a fuel charge is drawn into the space 7*b* and said piston coming into contact with the free piston, 11, compress a fuel charge which had previously been displaced into the combustion chamber formed in the space 7*a* between the free piston 11 and the cylinder head 8. The latter compressed fuel charge is ignited by a suitable spark or other firing means (not shown). The resulting gas expansion while exerting a pressure on the cylinder head 8 causes the working-stroke to begin by propelling both pistons 10 and 11 outwardly toward the cylinder end 9. The free piston 11 receives its moving force directly from the expanding gases, and the piston 10 receives its thrust by direct contact with the free piston 11. During said working-stroke the fuel charge in the space 7*b* will, in turn, be compressed said pressure automatically closing the fuel valve 18*a*. This pressure becomes a force that, through passage 15, will open the valve 16 of the piston 10 so that the fuel charge will pass through the passage 15 into a space 7*c* between the two pistons 10 and 11. The free piston 11, instead of continuing to follow the outward movement of the working piston 10, is gradually slowed up by the counteracting force of the compressed charge in chamber 7*c* until it reverses its movement. Such reversal of movement is caused by both the incoming fuel charge and the gradual loss of force of the fully expanded gases of combustion in chamber 7*a*. During the next in-stroke of the piston 10 a new fuel charge is drawn into the space 7*b* and the combustion chamber 7*a* is simultaneously exhausted while the piston 10 compresses the fuel charge in the space 7*c*, this compressed fuel charge acting in turn on the free piston 11 to propel said free piston against the cylinder head 8. The space 7*c* now becomes the combustion chamber. Upon ignition of this fuel charge, the new working-stroke be-

gins. Again, the expanding gases of combustion exert a pressure on the cylinder head 8, through the free piston 11 which is in contact with said cylinder head. The piston 10 during a part of its moving outwardly pulls the free piston 11 by means of the bolts 10*a* and then the fuel charge in the space 7*b* pass through the tube 17 into the space 7*a* which becomes again the combustion chamber, and the above described operation is repeated.

It will be evident that, upon each power stroke of the piston 10, the crankshaft 12 receives power from the engine. Simultaneously, the cylinder end 8 is subjected to either direct pressure of expanding gases in combustion chamber 7*a* or to the pressure in chamber 7*c* (as applied through piston 11) to produce a thrust that may be employed, as for moving a vehicle. This thrust is a reactive force of positive nature, and, since it is applied directly, without any transmission, while the force on the piston is absorbed in the crankshaft, the former is more effective than the latter to move a vehicle especially if the crankshaft has little or no resistance to overcome.

The engine shown in Fig. 3 is similar to that above described with the exception that the working piston 10 is formed with an enlarged end 25 and the cylinder commensurately enlarged at the fuel intake end. Thus a large fuel charge can be taken into chamber 7*b* with a resultant higher compression ratio for the engine.

Only the essentials of my engine structure have been disclosed and it is obvious that skilled persons can readily incorporate such attending instrumentalities that may be needed to complete the structure. Further, many changes may be made in the construction and arrangement of the parts without departing from the spirit and scope of the invention as claimed. I, therefore, desire to reserve to myself such variations that fall within the scope of the appended claims.

I claim:

1. A two-stroke cycle internal combustion engine comprising, at least one cylinder having opposed ends, one working piston in each cylinder, a free piston freely movable between said working piston and one end of said cylinder to form a combustion chamber between itself and said cylinder end and between itself and said working piston alternately, a crankshaft, means connecting the working piston to the crankshaft, a fuel-conducting passage outside the cylinder and communicating with the cylinder adjacent its opposed ends, an automatic valve in said passage controlling the transferring of the fuel charge from one end of the cylinder to the other, and a valve-controlled passage in the working piston for transferring the fuel charge from one end of the cylinder to the combustion chamber formed between said working piston and said free piston.

2. A two-stroke cycle internal combustion engine comprising, a cylinder having opposed ends, a piston in said cylinder and having a passage therethrough, a valve in said passage controlling flow in one direction only, a crankshaft, means extending in a direction opposite to that in which said valve opens and through one end of the cylinder operatively connecting said piston and crankshaft, a free piston in that end of the cylinder that is opposite to the latter means, means connecting the pistons for both relative movement and movement together in the same direction, and a valve-controlled passage connecting the opposite ends of the cylinder, said valve in the piston controlling flow from one end of the cylinder to between the pistons and the valve-controlled passage, alternately controlling flow between the ends of the cylinder during each cycle of the engine.

3. The engine as set forth in claim 2 in which the means connecting the pistons comprises at least one elongated member having a head on each end and movable in passages in said pistons having opposed abutments engaging said heads to limit the relative movement of the pistons.

4. The engine as set forth in claim 2 in which the piston having the valve-controlled passage is formed with an enlarged end on the end directed toward the crankshaft and in which the cylinder is enlarged to accommodate said enlarged end whereby the volume at said end of the cylinder is larger than the volume at the opposite end.

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