June 7, 1938. H. C. EDWARDS 2,119,633

INTERNAL COMBUSTION ENGINE

Filed Aug. 12, 1935

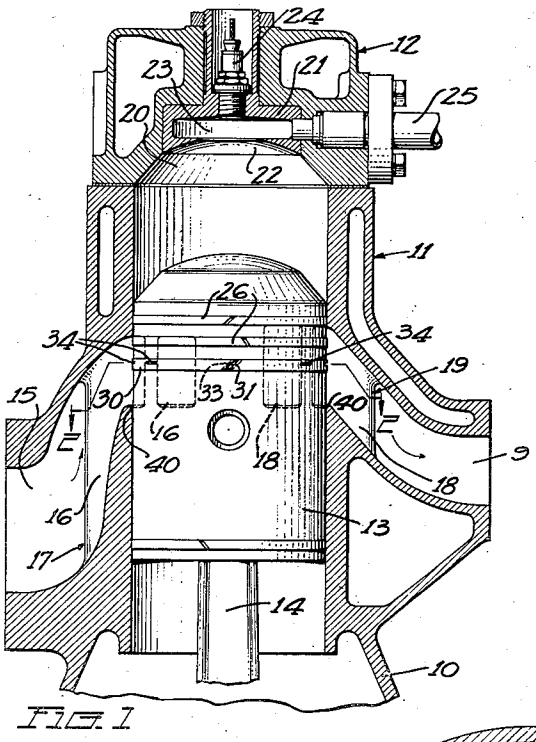


FIG. 1

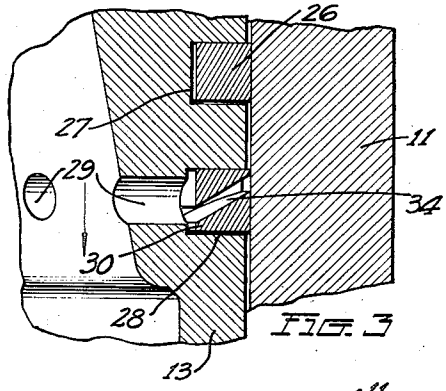


FIG. 3

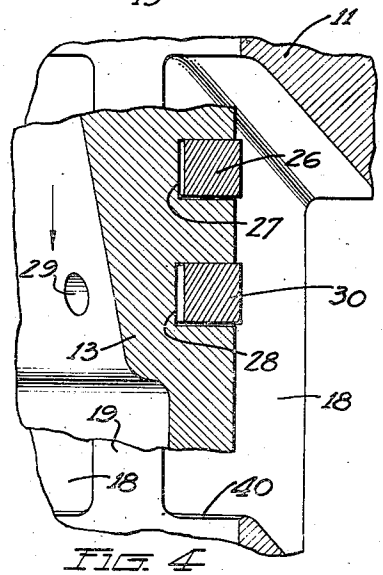


FIG. 4

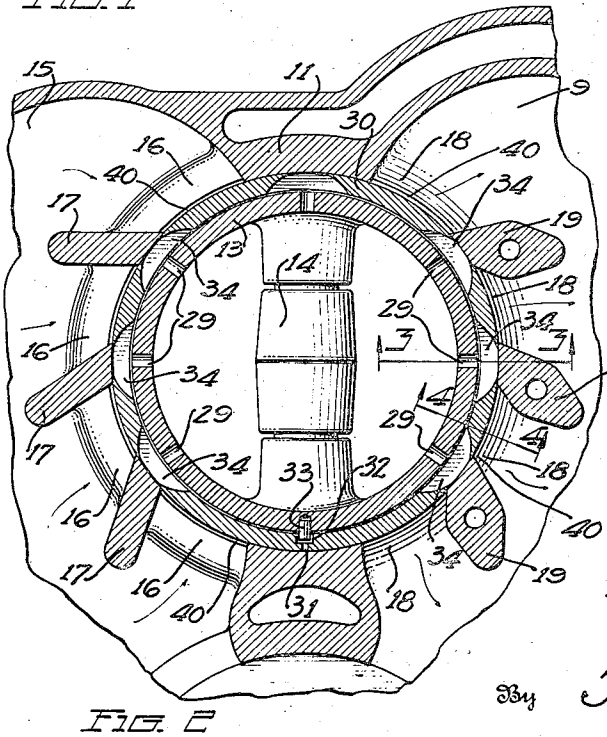


FIG. 2

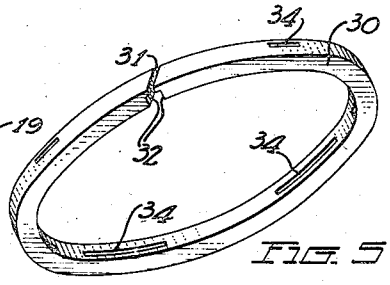


FIG. 5

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INTERNAL-COMBUSTION ENGINE

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8 Claims. (Cl. 184—18)

This invention relates to internal combustion engines and more particularly to means for controlling the lubricant between a cylinder wall and the piston therein.

In some types of engines, particularly two-cycle, fuel is introduced and/or exhaust is discharged through ports formed in the cylinder wall, these ports being controlled by the power piston in the cylinder.

Rings arranged on the piston, in the usual manner, will move the lubricant along the cylinder wall past the ports so that a considerable quantity thereof will escape through the ports and be wasted. This oil wasting condition is mainly responsible for retarding a more general use of these engines commercially and much unsuccessful development effort has been exerted for many years to overcome such condition.

An object of the invention is to provide an engine, of the type referred to, with means for controlling the lubricating oil so that it is not wasted through the cylinder ports.

Another object of the invention is to provide a lubricating system for engines with ported cylinders in which the oil is moved into effective position while the ports are closed, and away from effective position while the ports are open.

A further object of the invention is to provide an engine piston ring which is formed to control the lubricating oil so that it will not be wasted by escaping through cylinder ports.

Other objects of the invention will appear from the following description taken in connection with the drawing, which forms a part of this specification, and in which:

Fig. 1 is a fragmentary vertical sectional view through an engine having my invention incorporated therewith;

Fig. 2 is a sectional view of the same taken on line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional view through the cylinder structure taken on line 3—3 of Fig. 2;

Fig. 4 is another fragmentary sectional view of the cylinder taken on line 4—4 of Fig. 2;

Fig. 5 is a perspective view of a piston ring constructed in accordance with my invention.

Referring now to the drawing by characters of reference, 10 designates generally an engine crank case, 11 an engine cylinder and 12 a cylinder head. Arranged to reciprocate in the cylinder is a hollow piston 13 having a connecting rod 14 associated therewith and connected with a crank shaft, not shown, in the usual manner.

The engine illustrated is of the two-cycle type in which air and oil are introduced separately and mixed within the cylinder to form a combustion charge which is ignited by the heat of compression. It will be understood, however, that this invention relates generally to engines of the type in which fuel is introduced and/or exhaust is discharged through the cylinder walls and controlled by the power piston.

Associated with the cylinder is an air inlet manifold 15 communicating with a plurality of inlet ports 16, formed in the cylinder wall. The portions of the cylinder wall between such inlet ports are in the form of bars 17 which act as deflectors to direct the air tangentially so that it will rotate upon entering the cylinder. Disposed substantially diametrically from the inlet ports are exhaust ports 18, and the wall portions of the cylinder between such ports are in the form of bars 19. The inner faces of these bars form a part of the cylindrical inner face of the cylinder. The ports 18 are in open communication with an exhaust manifold 9.

The head 12 is formed with a recess having a portion 20 conforming in shape to a portion of the head end of the piston 13 which is adapted to move in close proximity thereto at the end of the compression stroke. This recess in the head also contains an insert 21 having its end 22 adjacent the piston recess shaped to conform to the shape of the piston head end. Within this insert element is formed a combustion chamber 23 restrictedly opening to the cylinder, and a glow plug 24 and an oil injection device 25 are associated with the chamber. The oil injection device is of any conventional type for delivering finely atomized oil into the air compressed in the combustion chamber.

As the piston moves away from the head, the inlet and exhaust ports will be uncovered whereupon the exhaust will move out of the cylinder and air will move into the cylinder, the air being utilized to scavenge the exhaust from the cylinder in the manner usual with engines of this type.

As the piston moves back toward the head the ports are closed and the rotating air trapped in the cylinder is compressed substantially entirely within the chamber 23. Near the end of the compression stroke, oil is discharged by the injection device 25 into the compressed air in the combustion chamber and is intermingled with the rotating air to form the fuel charge. Due to the heat of compression, this fuel charge is ignited and expands, causing the piston to move away from the combustion chamber in what is known as the power stroke, whereupon the ports are again

uncovered and the same cycle again takes place.

The piston is usually provided with compression rings **26** adjacent the head which are seated in grooves **27**, and such rings also serve to move the lubricating oil along the cylinder wall in their movement. Ordinarily, the piston is hollow and provided with apertures communicating with one of the ring grooves so that lubricating oil can be thrown from the crank case and can move through the apertures and groove to the cylinder wall. The oil is also usually thrown against the cylinder wall and moved axially thereof by the piston rings. This arrangement of lubricant movement is wasteful because the oil passes the open ports **16** and **18** and escapes therethrough.

The main purpose of this invention is to associate control means with the piston in a relation to prevent this wastage of oil through the cylinder ports. To this end the piston is formed with a ring groove **28**, and a plurality of openings **29** lead from the interior of this ring groove to the interior of the hollow piston. In the groove **28** is arranged a ring **30** of a specific type. This ring is preferably formed of resilient metal and is split as indicated at **31**. The adjacent ends of the ring are recessed at their inner portion, as indicated at **32**, to form a space into which a pin **33**, fixed in and projecting from the piston, can enter to substantially prevent rotation of the ring in the recess.

The ring is formed with openings **34**, preferably in the form of slots, which extend laterally therethrough, that is, from the exterior wall to the interior wall. These slots are arranged in a specific manner so that their outer ends, that is their peripheral portions, coincide with the bars **17** and **19** and their inner ends each coincide with an opening **29**, and are thus covered as the ring moves past the cylinder ports. The slots preferably are formed to increase in area toward the interior in order that they may contain a relatively large quantity of oil. The slots are also formed to extend at an angle so that the outer end is nearer the cylinder head than the inner end, the advantage of this form of slots being explained hereinafter.

Oil is thrown upwardly from the crank case into the hollow piston and onto the lower end of the inner wall of the cylinder so that it can move axially along the cylinder wall or it can move through the piston into openings **29** and the recess **28** from which it can travel to the cylinder wall. The oil can return from the cylinder wall to the crank case in a reverse manner to that just described. The piston ring **30** is of slightly less width than its groove and hence it has a limited movement axially of the piston during its reciprocation and the ring is also formed of a diameter such that it is spaced from the bottom of the associated groove.

Due to the arrangement of the ring slots **34**, with respect to the bars **17** and **19**, communication with the interior of the piston through such slots is cut off when the ring **30** is passing the inlet and outlet ports **16** and **18** and, therefore, there will be no escape of lubricant from the ring slots through the ports. A quantity of oil will lie in the slots **34** and in the inner portion of the groove in which ring **30** is arranged, and as the piston moves in a portion of its stroke toward and away from the head, inertia will move such oil outwardly of the slots and into contact with the cylinder wall. With the arrangement shown, inertia will hold oil at the outer ends of the slots in a range of piston movement starting before and terminating after top center position. During the rest of the piston movement the oil flows toward the interior of the slots and hence away from the cylinder wall, and during such time the ring **30** is moving past the inlet and outlet ports. The angular disposition of the slots **34** in the ring **30** allows efficient movement of oil by inertia to and from the cylinder wall.

The portions of the ring **30** which pass directly by the inlet and outlet ports are solid and as the ring moves away from the head it tends to scrape the oil from the cylinder wall so that it flows into the space between its lower wall and the lower wall of the recess where it is collected so that it will not flow into the inlet and outlet ports to any appreciable extent. In order to further prevent any tendency of this so collected oil to be scraped into the inlet and outlet ports, the cylinder wall portions forming the lower boundary of the ports are chamfered, as indicated at **40**, so that such edges will be slightly inclined away from the outer face of the ring **30**.

I have found that in the operation of engines with ported cylinders having an oil control system of the type described, there is practically no escape of lubricant oil through the inlet or exhaust ports. This arrangement therefore provides for economical lubrication of an engine of the ported cylinder type.

Although the invention has been described in connection with a specific embodiment, the principles involved are susceptible of numerous other applications which will readily occur to persons skilled in the art. The invention is therefore to be limited only as indicated by the scope of the appended claims.

What I claim is:

1. In an engine, the combination with a cylinder having annularly spaced ports through its wall, and a piston in the cylinder having a peripheral ring groove therein, of a ring in said piston groove engaging said cylinder, said ring having slots therein arranged to pass along the cylinder wall surface intermediate the ports.

2. In an engine, the combination with a cylinder having annularly spaced ports through its wall, and a hollow piston in the cylinder controlling said ports in its movement, said piston having a peripheral groove therein and passages from the groove to the interior, of a ring in said groove engaging said cylinder, said ring having slots extending therethrough in relation to establish communication between the exterior of the outer ring portion and said piston openings, said ring slots being arranged to be covered by the wall portions of the cylinder between the ports therein when passing thereby.

3. In an engine, the combination with a cylinder having annularly spaced ports therein and a piston in the cylinder having a peripheral ring groove, of a ring in said groove engaging said cylinder, said ring having slots extending therethrough at an angle to its axis in which lubricating oil is moved by inertia into contact with the cylinder wall while the piston is in a relation covering the cylinder ports.

4. In an engine, the combination of a cylinder having annularly spaced ports therein, the edge portions of the cylinder forming the bottom of the ports being chamfered, a piston in said cylinder having a peripheral ring groove, and a ring in said piston groove engaging the cylinder and slightly movable axially of the piston, the inclination of the chamfered cylinder portions at the bottom of the ports being in a direction

away from the peripheral face of said ring to prevent the ring from scraping oil from the cylinder wall into the ports.

5. In an engine, the combination with a cylinder having annularly spaced exhaust ports through its wall, and a hollow piston in the cylinder open at the skirt end and having a peripheral ring groove and ports connecting the groove with the interior thereof, of a piston ring carried in said groove and engaging said cylinder wall, said ring having slots extending between the peripheral and inner portions thereof, such slots increasing in area inwardly and being arranged at their peripheral portion to be closed by the cylinder portions between the ports when passing thereby.

6. In an engine, the combination with a cylinder having annularly spaced exhaust ports through its wall and a hollow piston in the cylinder open at its skirt end, said piston having a peripheral ring groove and ports connecting the groove with the interior thereof, of a piston ring carried in said groove and engaging said cylinder wall, said ring having slots extending therethrough between its peripheral and inner portions, such slots extending at an angle to the ring axis with the peripheral ends uppermost and arranged to be closed by the cylinder wall portion between the ports when passing thereby.

7. In an engine, the combination with a cylinder having annularly spaced exhaust ports through its wall, and a hollow piston in the cylinder open at the skirt end and having a peripheral ring groove and ports connecting the groove with the interior thereof, of a free piston ring carried in said groove and of a lesser dimension than said groove axially of the piston, said piston ring engaging the cylinder wall and having slots extending therethrough between the inner and peripheral portions thereof, said slots extending at an angle to the ring axis with the peripheral ends uppermost and arranged so that their peripheral portion will be closed by the portion of the cylinder between the ports when passing thereby.

8. In an engine, the combination of a cylinder having spaced ports therein and a piston in the cylinder having a peripheral ring groove, of a ring in said groove and engaging said cylinder, said ring having slots therein in which lubricating oil is moved by inertia into contact with the cylinder wall during a portion of the piston movement in each cycle of its operation, the peripheral ends of said ring slots being arranged to lie between the cylinder ports and closed thereto in the operation of the piston.

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