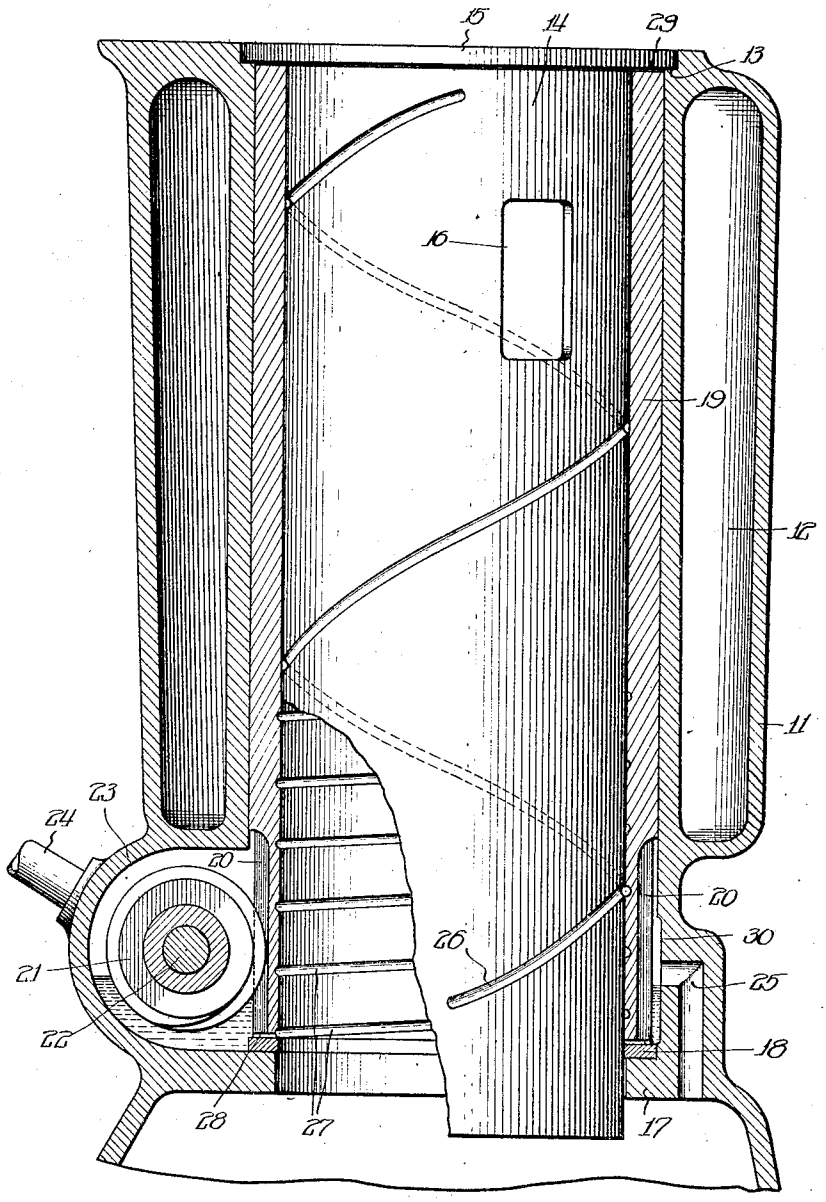
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1,459,819

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LUBRICATING SYSTEM

Filed April 8, 1921



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UNITED STATES PATENT OFFICE.

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LUBRICATING SYSTEM.

Application filed April 8, 1921. Serial No. 459,699.

To all whom it may concern:

Be it known that I, CLARENCE E. BONNER, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Lubricating Systems, of which the following is a specification.

This invention relates to a new and improved cylinder construction for internal combustion engines, and more particularly to a lubricating system adapted for application to such apparatus.

The invention is designed with reference to internal combustion engines of the rotating sleeve-valve type and relates to the means and method for lubricating the interengaging surfaces of the rotating valve and the adjacent parts.

Considerable difficulty in lubricating devices of this kind has been found for the reason that the valve sleeve is closely pressed between the outer supporting walls and the inner cylinder by the explosive pressure of the cylinder; and moreover there is a tendency for the heated gases to pass downward between the valve and cylinder through their interfitting surfaces at the edges of the ports formed in the cylinder. This latter difficulty causes carbonization of the lubricant adjacent the ports, with consequent wear and heating.

A further difficulty lies in the necessity that the surface must not be over-lubricated, since in such case the lubricant working to the port openings will carbonize at that point and in the cylinder.

A factor which must be considered in the design of lubricating systems of this type also is the fact that centrifugal force acts upon the oil adhering to the rapidly rotating sleeve valve.

It is an object of the present invention to provide means whereby the interengaging surfaces of a sleeve valve may be adequately lubricated without danger of carbonization, and with the uniform distribution of the lubricant.

It is a further object to provide means of this character adapted to adequately and simply lubricate both the outer and inner faces of the valve.

It is also an object to provide means by which lubricant is carried up from the lower end of the sleeve, thus avoiding the necessity for the placing of pipes or formation of conduits adjacent the upper end of the cylinder.

It is an additional object to provide a lubricant supply source in association with lubricant distributing means so that the supply is constant but cannot become so great as to cause overlubrication.

Other and further objects will appear as the description proceeds.

Broadly, my invention comprises the placing of a lubricant cavity adjacent the lower end of the sleeve valve, the formation of oil carrying passages through the valve, and the formation upon the inner surface of the valve member and the outer surface of the cylinder member of oil distributing means. More specifically, this means consists in grooves in the form of spirals upon these two surfaces, that upon the cylinder extending upwardly in the direction of rotation of the sleeve, and that upon the sleeve extending in the opposite direction and being of less pitch. An oil discharge port is provided in such manner as to limit the oil level in the oil cavity.

I have illustrated a preferred embodiment of my invention in the accompanying drawing, in which the single figure is a fragmentary cross section illustrating my invention applied to a sleeve valve.

The type of motor shown in the drawing is that disclosed in my co-pending application Serial No. 465,176 filed April 28, 1921.

In the drawing the cylinder case or outer casting 11 is formed with the water jacket cavity 12 and at its upper end is provided with the circumferential seat 13 adapted to receive the flange 15 upon the cylinder 14. The cylinder is provided with ports 16 adapted to register with similar ports in the outer case 11. The lower end of the cylinder passes through a flange 17 formed upon the case member, making a slight clearance therewith. An accurately machined steel ring 18 fits upon the shoulder 17 and closely engages the cylinder 14, holding it exactly centered and aligned in the case.

A space is formed between the case 11 and the cylinder 14 into which is fitted the cylindrical sleeve valve 19. This valve has cut

upon its lower outer surface the gear teeth 20 which are engaged by the worm gear 21 carried on shaft 22. This worm gear 21 is housed in a pocket 23 formed on the outer case 11. The oil feed pipe 24 leads into this pocket and the pocket is in communication throughout the circumference of the sleeve valve with the space around the lower portion thereof formed by cutting away the outer case 11 at 30. The oil drain port 25 is formed in the casing 11 and prevents the oil from rising above a predetermined level, the port discharging downwardly into the crank case.

The cylinder 14 is provided with the spirally extending oil distributing groove 26 upon its outer surface. The sleeve valve 19 is provided upon its inner surface with the spirally extending oil distributing groove 27. The lower edge of the sleeve valve is provided with notches 28 adapted to permit passage of the oil through the valve. The upper edge 29 of the sleeve valve is formed to have a minute clearance with the flange 15 of the cylinder.

It will be noted that the spiral 26 upon the cylinder is of materially greater pitch than the spiral 27 upon the sleeve valve, and further that the two spirals extend in opposite directions. Also, while the spiral 26 extends substantially the full height of the cylinder, the spiral 27 is formed only upon the lower part of the sleeve valve. An important feature is the fact that the succeeding turns of the spiral 26 are placed at the maximum possible distance from the port 16.

In the operation of my oiling system, the oil is supplied to the cavity or pocket 23 through the pipe 24, and this oil is prevented from rising above a predetermined level by the drain port 25. This lubricant in the pocket fully lubricates the worm gear 21 and also the gear teeth 20 formed upon the sleeve 19. It further lubricates the point of contact between the lower edge of the sleeve 19 and ring 18 upon which it rotates.

The oil passes through the notches 28 in the lower end of the sleeve 19 and thus reaches the engaging surfaces of the sleeve and cylinder. The cylinder remains stationary and the sleeve is rotated in the direction of the spiral 26, that is, in the counter-clockwise direction, looking down from above upon the device as shown in the drawing. The spiral 27 upon the sleeve therefore has a scooping action upon the lubricant through which it passes and tends to cause the lubricant to flow up its spiral. Further, a certain amount of lubricant is transferred to the spiral 26 and due to the fact that the engaging points of the spirals 26 and 27 are constantly rising during the rotation of the sleeve, the lubricant is carried up the spiral 26. The lubricant reaching the top of the sleeve valve 19 is carried across the top through the minute clearance 28 by means of centrifugal force due to the rotation of the sleeve valve. It then passes downwardly between the outer surface of the sleeve valve and the casing, due to gravity, and thus returns to the oil pool in the oil pocket.

It has been found by experience that it is entirely unnecessary and also undesirable to provide any oil distributing grooves upon the outer surface of the sleeve valve or upon the inner surface of the case. It has further proved undesirable to extend the oil distributing groove on the inner surface of the sleeve valve above the lower portion thereof, since the oil tends to remain in these grooves due to centrifugal force and thus fails to adequately lubricate the surface of the cylinder. The extension of this groove together with the groove in the cylinder would overlubricate the surfaces and carry too great an amount of oil.

The provision of the single spiral groove upon the cylinder 14 with its widely spaced turns has proved particularly effective in the lubrication, and this allows the provision of closely interfitting surfaces extending some distance away from the ports and thus prevents a tendency for leakage between the surfaces at the ports. No grooves are formed on the sleeve adjacent the ports, which further avoids the excessive oiling adjacent the ports with the consequent danger of carbonization at those points.

The construction shown is extremely simple and avoids all piping or formation of conduits in the casing adjacent the upper part of the cylinder, with consequent complication of the casting. It provides a simple, positive and adequate oiling system for valves of this character.

I claim:

1. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, a spiral oil distributing groove formed upon the outer surface of the cylinder member, and a coacting reversely extending spiral groove formed upon the inner surface of the valve member.

2. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, an oil distributing groove formed upon the outer surface of the cylinder member, and a coacting circumferentially extending groove formed upon the inner surface of the valve member, a clearance being provided above the upper edge of the valve member, the outer face of said member being uninterrupted.

3. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, an oil distribut-

ing groove formed upon the outer surface of the cylinder member, and a coacting circumferentially extending groove formed upon the inner surface of the valve member, said last-named groove being of less pitch than the first-named groove.

4. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, a spiral oil distributing groove formed upon the outer surface of the cylinder member, and a coacting reversely extending spiral groove formed upon the inner surface of the valve member, said first-named groove extending substantially the full height of the cylinder and said last-named groove extending over the lower portion of the sleeve valve.

5. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, a spiral oil distributing groove formed upon the outer surface of the cylinder member, and a coacting reversely extending spiral groove formed upon the inner surface of the valve member, said first-named groove extending substantially the full height of the cylinder and said last-named groove extending over the lower portion of the sleeve valve and being of less pitch than the cylinder groove.

6. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, an oil containing pocket in communication with the outer face of the sleeve valve, a transverse channel formed in the lower edge of the sleeve valve adapted to permit passage of the oil, and grooves adapted to distribute oil on the contacting sleeve and cylinder member faces.

7. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case and a sleeve valve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, coacting spiral grooves upon the outer face of the cylinder member and the inner face of the sleeve valve adapted to carry the oil up between said faces, and a clearance above the sleeve valve whereby the oil may pass outward and down between the meeting faces of the sleeve and case.

8. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a sleeve valve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, coacting spiral grooves upon the outer face of the cylinder member and the inner face of the sleeve valve adapted to carry the oil up between said faces, and a clearance above the sleeve valve whereby the oil may pass outward and down between the meeting faces of the sleeve and case, said faces being smooth.

9. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case and a rotating sleeve valve operating between said cylinder member and case, gears carried by said sleeve for rotating the sleeve, an oil containing pocket located in the case in contact with the sleeve valve at the level of the gears, a driving gear housed in the pocket, an oil port through the sleeve valve, coacting spiral grooves upon the outer face of the cylinder member and the inner face of the sleeve valve adapted to carry the oil up between said faces, and a clearance above the sleeve valve whereby the oil may pass outward and down between the meeting faces of the sleeve and case.

10. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a rotating sleeve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, an oil distributing groove formed in the outer surface of the cylinder extending spirally upward in the direction of rotation of the sleeve, and a coacting groove carried by the outer face of the sleeve, said groove being an oppositely directed spiral.

11. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a rotating sleeve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, an oil distributing groove formed in the outer surface of the cylinder extending spirally upward in the direction of rotation of the sleeve, and a coacting groove carried by the outer face of the sleeve, said groove being an oppositely directed spiral of materially less pitch than the first spiral.

12. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a rotating sleeve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, an oil distributing groove formed in the outer surface of the cylinder extending spirally upward in the direction of rotation of the sleeve, and a coacting groove carried by the outer face of the sleeve, said groove being an oppositely directed spiral, the first groove extending approximately the full

height of the cylinder and the coacting groove being upon the lower portion of the sleeve.

13. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a rotating sleeve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, an oil distributing groove formed in the outer surface of the cylinder extending spirally upward in the direction of rotation of the sleeve, and a coacting groove carried by the outer face of the sleeve, said groove being an oppositely directed spiral of materially less pitch than the first spiral, the first groove extending approximately the full height of the cylinder and the coacting groove extending upon the lower portion of the sleeve.

14. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a rotating sleeve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, an oil distributing groove formed in the outer surface of the cylinder extending spirally upward in the direction of rotation of the sleeve, a coacting groove carried by the outer face of the sleeve, said groove being an oppositely directed spiral, and means adapted to limit the oil level in the pocket.

15. In an internal combustion engine, a cylinder construction comprising an inner cylinder member, an outer case, and a rotating sleeve operating between said cylinder member and case, an oil containing pocket located in the case in contact with the sleeve valve, an oil port through the sleeve valve, an oil distributing groove formed in the outer surface of the cylinder extending spirally upward in the direction of rotation of the sleeve, a coacting groove carried by the outer face of the sleeve, said groove being an oppositely directed spiral of materially less pitch than the first spiral, the first groove extending approximately the full height of the cylinder and the coacting groove upon the lower portion of the sleeve, a clearance above the sleeve whereby oil may pass over and down between the sleeve and case, said surfaces being smooth, and an oil discharge port limiting the oil level in the pocket.

16. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, an oil distributing groove formed upon the outer surface of the cylinder member, a coacting circumferentially extending groove formed upon the inner surface of the valve member, and coacting ports through said cylinder, sleeve and case, said grooves being spaced from said ports.

17. In combination with an engine cylinder having an inner cylinder member, an outer case, and a sleeve valve operating between said member and case, a spiral oil distributing groove formed upon the outer surface of the cylinder member, a coacting reversely extending spiral groove formed upon the inner surface of the valve member, and coacting ports extending through said cylinder, sleeve and case, said grooves being spaced from said ports at all times in the operation of the sleeve valve.

Signed at Chicago, Illinois, this 28th day of March, 1921.

CLARENCE E. BONNER.