Dec. 10, 1946. C. W. HALL 2,412,261

ROTARY VALVE

Filed March 20, 1945

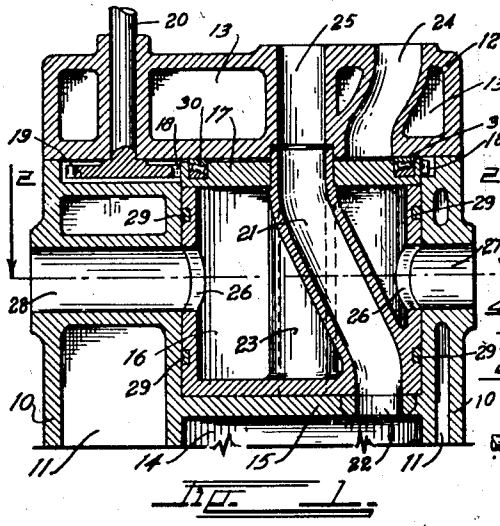


Fig. 1.

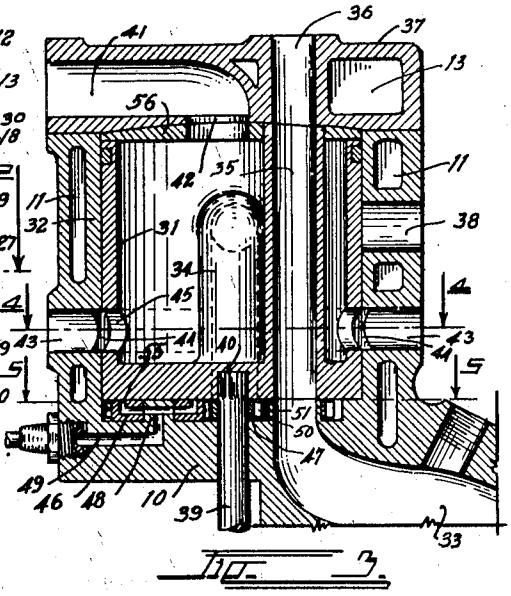


Fig. 3.

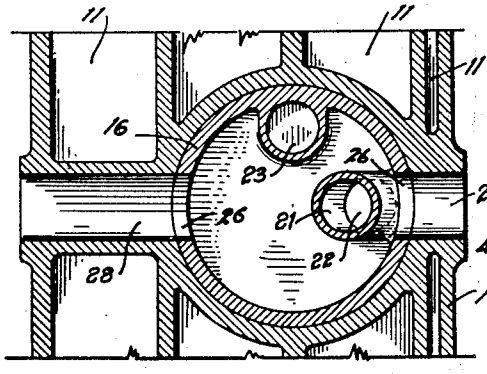


Fig. 2.

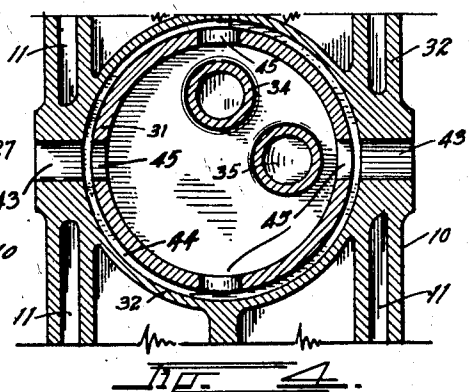


Fig. 4.

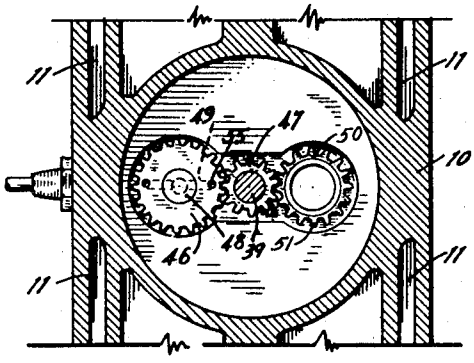


Fig. 5.

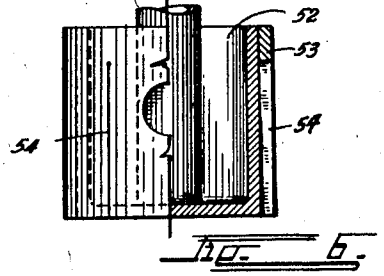


Fig. 6.

INVENTOR.
CHARLES W. HALL.
BY
ATTORNEY.

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ROTARY VALVE

Charles W. Hall, Denver, Colo., assignor to Malcolm S. Losey, Denver, Colo.

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5 Claims. (Cl. 123—190)

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This invention relates to a rotary valve for internal combustion engines, and has for its principal object the provision of a valve of this character through which cooling air can be circulated for maintaining the valve at the proper operating temperature.

Another object of the invention is to provide a sealing device for a valve of this character which will rotate with the valve so as to prevent the wearing of grooves in the valve surface and to properly lubricate the same.

Another object is to so construct the valve that it will accommodate thermal expansion without affecting the running and sealing qualities of the valve. Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention, reference is had to the accompanying drawing which forms a part hereof. Like numerals refer to like parts in all views of the drawing and throughout the description.

In the drawing:

Fig. 1 is a vertical section through the head of a typical combustion engine cylinder, illustrating one form of the improved valve in place thereon;

Fig. 2 is a cross-section through the valve of Fig. 1, taken on the line 2—2, Fig. 1;

Fig. 3 is a vertical section through an alternate form of the valve, embodying the same basic principles;

Fig. 4 is a cross-section through the form of Fig. 3, taken on the line 4—4, Fig. 3;

Fig. 5 is a similar section taken on the line 5—5, Fig. 3; and

Fig. 6 is a detail view partially in section, illustrating the improved valve provided with a sealing skirt.

In Figs. 1 and 2 a typical engine cylinder block is indicated at 10 provided with the usual water jacket space 11. The block 10 is closed by means of a cylinder cap 12, which may also be provided with water jacket space 13. The block 10 is provided with any desired number of operating cylinders, one of which is indicated at 14, having a cylinder head 15.

A cylindrical valve bore is formed in the block 10 above the cylinder head 15 to receive a cup-shaped rotary valve 16. A circular valve plate 17 rests upon the edge of the open extremity of the valve 16, and is provided with peripheral gear teeth 18 which mesh with a drive pinion 19. The drive pinion 19 is mounted on a valve shaft 20

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by means of which rotation is imparted to the valve 16.

The valve 16 contains an exhaust tube 21 extending concentrically through the plate 17 from an eccentric position through the bottom of the valve 16. The lower extremity of the tube 21 is positioned to register with a cylinder port 22 communicating with the cylinder 14 once in each revolution of the valve 16.

The valve 16 is also provided with an intake tube 23 extending from an eccentric position through the plate 17. The tube 23 is so positioned that it will also align with the cylinder port 22 once in each revolution.

The upper extremity of the tube 23 simultaneously aligns with an intake passage 24 through the cap 12 when it is in alignment with the port 22. The exhaust tube 21 is in constant communication with an exhaust passage 25 through the cap 12.

It can be readily seen that the tube 23 will align with the cylinder port 22 during the intake cycle of the cylinder 14, and that the bottom of the valve 16 will close the port 22 during the compression and explosion cycles. The exhaust tube 21 will then align with the port 22 to exhaust the gases through the passage 25 during the exhaust cycle.

It has been found that in the usual rotary valve the incoming gases are so expanded by pre-heating in passing through the hot rotary valve that the efficiency of the motor is diminished. In this invention, however, means are provided for cooling the rotary valve. This is accomplished by placing a plurality of oppositely positioned air ports 26 in the side or skirt of the valve. These ports align with an air intake passage 27 and an air discharge passage 28 positioned in the opposite sides of the block 10. This allows cooling air to be continually forced through the valve during its operation to remove the heat from the valve and from the gas tubes 21 and 23. A cooling liquid could be substituted for the cooling air if desired.

Two sealing rings 29 completely surround the valve 16 above and below the air ports 27 and 28 to seal off air leakage around the valve. The plate 17 is provided with a thrust bearing 30 in its upper surface for absorbing the upthrust of the valve.

Alternate form

In Figs. 3, 4, and 5 an alternate form of the invention embodying the same principles of operation is illustrated. In this form a hollow cup-

shaped rotary valve 31 is mounted in a cylindrical valve housing 32. A cylinder passage 33 communicates from an eccentric position in the bottom of the valve housing with any desired operating cylinder of an internal combustion engine.

The valve 31 is provided with a curved exhaust tube 34 and a straight intake tube 35, both of which communicate through the bottom of the valve 31 eccentrically of the axis thereof so as to align with the cylinder passage 33 at predetermined times.

The upper extremity of the intake passage 35 simultaneously aligns with an intake passage 36 formed in a valve head 37 covering the valve 31. The exhaust tube 34 exits through the wall of the valve 31 to align with an exhaust passage 38 simultaneously with its alignment with the cylinder passage 33. The valve is rotated from a valve shaft 39 which is splined concentrically into the bottom of the valve 31, as shown at 40.

It can be seen that, if the valve 31 is rotated at one-half crank-shaft speed, it will connect the cylinder passage 33 with the intake passage 36 during the intake cycle, thence close the cylinder passage 33 for the compression and explosion cycles. It will then connect the cylinder passage 33 through the tube 34 with the exhaust 38.

Provision is made for aircooling this valve by placing an air passage 41 in the head 37, which terminates in a nozzle 42 extending downwardly into the valve 31 to direct incoming air toward the bottom thereof. The air exits through air outlet opening 43. The opening 43 communicates with a circumferential air channel 44 which surrounds the valve 31, there being air openings 45 through the wall of the valve communicating with the channel.

It can be readily seen that cooling air can be forced into the valve through the channel 41, filling the hollow interior thereof, and that the heated air will flow through the openings 45 into the channel 44 and thence exit through the air outlet opening 43.

This form is provided with a rotary oiling ring gear 46 having gear teeth on its peripheral edge, meshing with a drive pinion 47 on the valve shaft 39. The gear 46 is provided with oil discharge openings 55 which spread lubricant over the bottom face of the valve. The ring gear is journalled on a stud 48 having oil passages to which oil is fed from an oil channel 49. The block is so arranged that the oil openigns 55 do not open to the oil channels in the stud 48 during the intake stroke of the motor so as to prevent oil from being drawn in by vacuum.

This form is also provided with a rotary sealing ring 50 between the cylinder passage 33 and the bottom of the valve. The sealing ring is formed with peripheral gear teeth 51 which mesh with the teeth of the pinion 47 so that the ring will constantly rotate during operation of the valve, so as to spread lubricant and to prevent cutting rings in the bottom of the valve. The oiling block 46 and the ring 51 may be forced against the bottom surface of the valve by any desired resilient means.

In Fig. 6, an alternate method of sealing the external surface of a rotary valve to its peripheral gas and air ports is illustrated. In this form a rotary valve 52 of the open top, cup-shaped form is surrounded by a sealing skirt 53. The skirt is snugly and permanently shrunk onto and around the open extremity of the valve and depends toward the closed extremity thereof but is slightly spaced away as it approaches the closed extremity.

The lower portion of the skirt is split as shown at 54, to allow this lower extremity to flex inwardly when the valve is forced within its seat. The natural tendency of the skirt is to expand, and this maintains a tight sealing contact with the walls of the valve cavity so as to seal any port openings therein.

The form of Fig. 3 may be provided with a sealing plate 56 across the top having a central opening for alignment with the nozzle 42 and with a side opening through which the intake tube passes. It is preferred to form the plate 56 with a slightly conical top surface as illustrated. This conical surface fits against a conical depression in the lower surface of the valve head 37 to form a perfect, self-centering seal in the latter.

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what is claimed and desired secured by Letters Patent is:

1. In a rotary valve of the hollow cylindrical type, means for lubricating one end of said valve comprising: a rotary button; gear teeth around said button; a toothed pinion axially mounted on said valve in mesh with said teeth so that said button will rotate simultaneously with said valve; oil passages in said button; and means for supplying oil to said passages.

2. In a rotary valve of the cylindrical type having a cylinder port opening to one extremity of said valve, means for sealing said port to said valve comprising: a rotary ring around said port; teeth surrounding said ring; a pinion axially mounted on said valve in mesh with said teeth so that said ring will rotate with said valve in a direction opposite thereto.

3. In a rotary valve of the hollow cylindrical type, means for lubricating one end of said valve comprising: a rotary button; gear teeth around said button; a toothed pinion axially mounted on said valve in mesh with said teeth so that said button will rotate simultaneously with said valve; oil passages in said button; means for supplying oil to said passages; a cylinder port opening to one extremity of said valve; means for sealing said port to said valve; a rotary ring around said port; teeth surrounding said ring; a pinion axially mounted on said valve in mesh with said teeth so that said ring will rotate with said valve in a direction opposite thereto.

4. In a rotary valve of the hollow cylindrical type, means for lubricating one end of said valve comprising: a rotary button; gear teeth around said button; a toothed pinion axially mounted on said valve in mesh with said teeth so that said button will rotate simultaneously with said valve; oil passages in said button; means for supplying oil to said passages; a cylinder port opening to one extremity of said valve; means for sealing said port to said valve; a rotary ring around said port; teeth surrounding said ring; a pinion axially mounted on said valve in mesh with said teeth so that said ring will rotate with said valve in a direction opposite thereto; resilient means for forcing said button and said ring against said valve.

5. A rotary valve comprising: a hollow cup-shaped valve member rotatably mounted in a

chamber of corresponding shape; a cylinder port communicating with one extremity of said valve chamber eccentrically of the axis thereof; a first straight tubular passage communicating through the bottom of said valve at a point to periodically align with said cylinder port and extending through said valve parallel to the axis thereof; a second tubular passage communicating through the bottom of said valve at a point to periodically align with said cylinder port and extending through the cylindrical side wall of said valve;

a head enclosing said valve, said head having an opening in the path of rotation of said first tubular passage, there being a second opening in the cylindrical side of said chamber in the path of rotation of said second tubular passage; an air discharge nozzle discharging axially into the open top of said valve; and air discharge openings through the cylindrical wall of said valve and its chamber to allow air to be circulated through the former.

CHARLES W. HALL.