

H. H. GOVE.
 ROTARY VALVE FOR INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED APR. 12, 1915. RENEWED OCT. 18, 1917.

1,249,066.

Patented Dec. 4, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

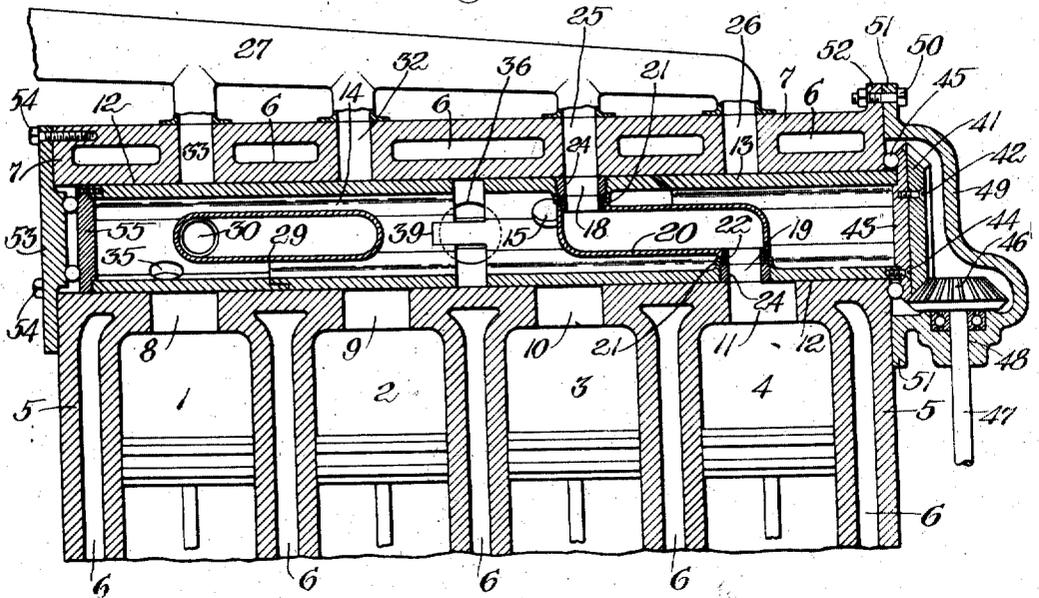


Fig. 2.

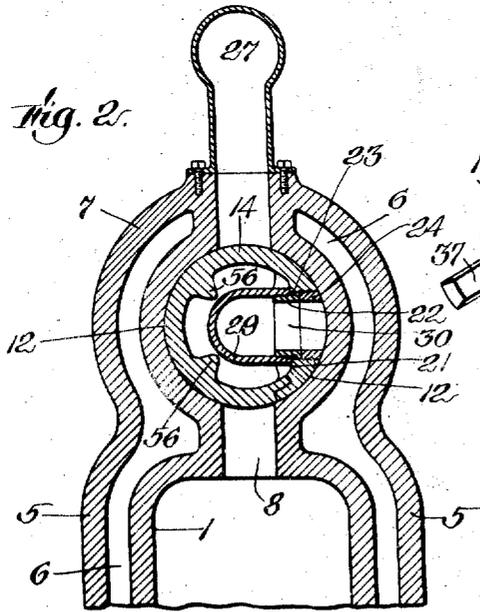


Fig. 3.

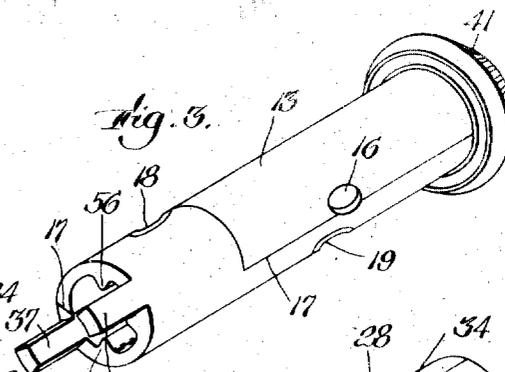
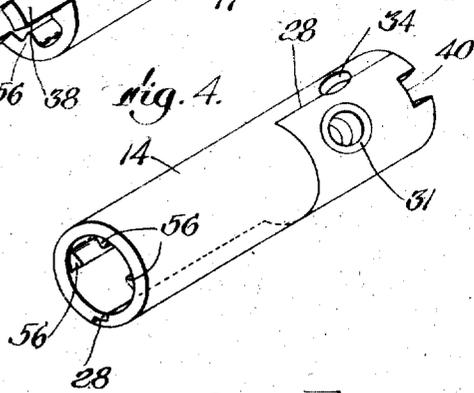


Fig. 4.



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 James R. Hodder
 Sebastian Vaughan

Inventor:
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Fig. 5.

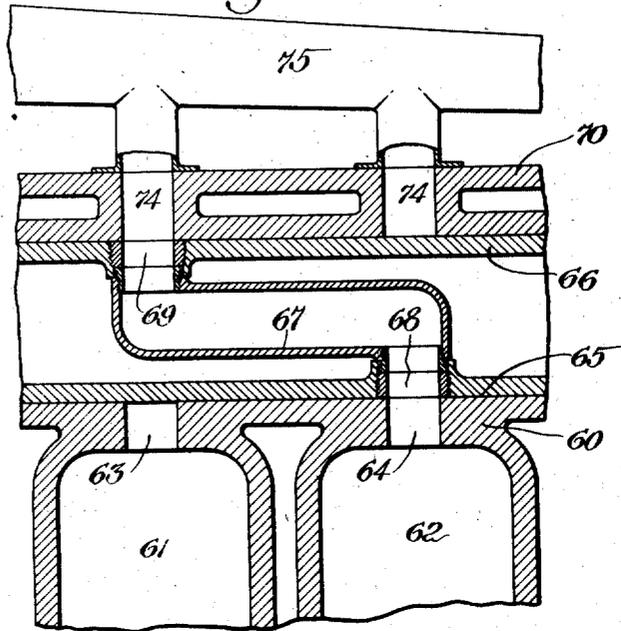
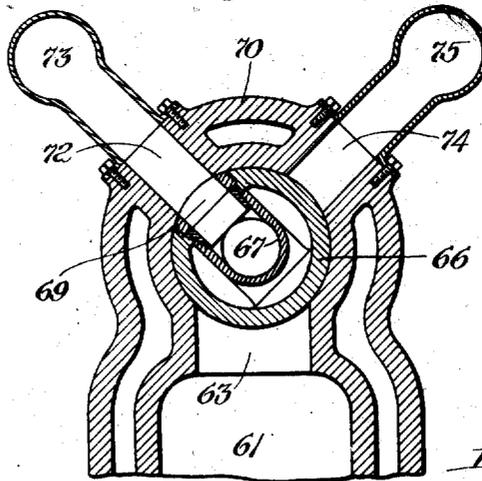


Fig. 6.



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UNITED STATES PATENT OFFICE.

HENRY H. GOVE, OF BIDDEFORD, MAINE, ASSIGNOR OF ONE-HALF TO JOHN F. DEAN,
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ROTARY VALVE FOR INTERNAL-COMBUSTION ENGINES.

1,249,066.

Specification of Letters Patent.

Patented Dec. 4, 1917.

Application filed April 12, 1915, Serial No. 20,600. Renewed October 18, 1917. Serial No. 197,376.

To all whom it may concern:

Be it known that I, HENRY H. GOVE, a citizen of the United States, and resident of Biddeford, in the county of York and State of Maine, have invented an Improvement in Rotary Valves for Internal-Combustion Engines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The object of my present invention is to improve the construction of a rotary valve for an internal combustion engine, preferably a multi-cylinder engine. Important features are to provide a novel form of valve, having provision for automatically seating firmly and under tension against the bearing surface in which said valve rotates to render it compression-tight; to make said valve in longitudinal sections, allowing for individual expansion and contraction of each section; and to prevent undue heating by utilizing the exhaust and supply to equalize temperatures. In my co-pending application, Serial No. 830,906, filed April 10, 1914, I have illustrated a similar type of valve in its general features, and the present application is an improvement on the type of rotary valve therein illustrated.

Other improvements and important features of the invention are to provide a valve construction which will be simple and economical to manufacture, reducing the expense of grinding and milling the valve parts to a minimum, to simplify the work of assembling, and to produce a strong, solid construction which will withstand long use and heavy strain and heat of an internal combustion engine.

Further details of construction, novel combination of parts, and advantages will be hereinafter more fully described and claimed.

Referring to the drawings,

Figure 1 is a side view partly in longitudinal cross section with the upper part of a four-cylinder engine and valve construction, illustrated in fragmentary form;

Fig. 2 is a cross sectional view on an enlarged scale through the middle section of one cylinder;

Fig. 3 is an enlarged perspective of one of the rotary valve sections;

Fig. 4 is a corresponding perspective view

of the valve section adjacent to that shown in Fig. 3;

Fig. 5 is a fragmentary view, partly in cross section, of a modified form of the invention; and

Fig. 6 is a cross sectional view of said modified form through one of the cylinders.

As illustrated in the drawings, I have shown my invention as applied to a four-cylinder engine, said cylinders being at 1, 2, 3 and 4, all inclosed in casing 5, formed with the usual provision for water passages 6 throughout the casing. I have also shown the valve casing 7 cast integral with the engine cylinders and casing or jacket 5, although it will be readily understood that in actual practice I may cast the engine cylinders separately from the valve casing 7, the latter being of substantially equal extent to cover the widths of the plurality of cylinders constituting the engine, and being bolted to the top of the engine casing in a well-known manner. Each of the engine cylinders 1, 2, 3 and 4 is provided with a single port 8, 9, 10 and 11 respectively, which ports open into the rotary valve seat 12 extending longitudinally across the entire number of cylinders. In the valve seat 12 I arrange a plurality of rotary valve sections each longitudinally separated from the other and so connected as to be rotated in unison, and preferably by a gear or sprocket at one end. These rotary valve sections are preferably made with a longitudinal cut and of sufficient inherent expansiveness so that each section will automatically tend to spring outwardly against the walls of the valve seat 12 and bear thereon throughout their entire length with a spring-like action, and take up any expansion automatically. This arrangement enables the rotary valve to be maintained compression-tight in its seat, bearing firmly against the walls, and therefore overcoming the great objection heretofore found against rotary valves in internal combustion engines, during actual use.

While I may employ different types of rotary valves with the automatic spring expansive feature just explained, I prefer to utilize a hollow valve which will serve to conduct the supply or inlet of combustible gas to the cylinders in proper timed relation, and also to employ a novel type of exhaust passage extending partly through the hollow valve and preferably acting alternately

as the exhaust port passage for two adjacent cylinders. This construction enables me to utilize the heat of the exhaust and the cooling action of the supply to respectively equalize the temperatures of exhaust and supply, as well as to aid in maintaining the rotary valve parts cool where the same bear against the walls of the seat 12, and thus further insuring the proper and smooth running of the valve. This construction also enables me to rotate the valve slowly, at one-half the speed of the crankshaft. My rotary valve as herein shown comprises the sections 13 and 14, each being hollow and each covering two adjacent cylinders. The section 13 is formed as a sleeve and is provided with a supply port 15 for the cylinder 3 and a port 16 for the cylinder 4, through which the supply may pass at proper times during the rotation of the valve. This valve section is split longitudinally by a diagonal saw cut 17, which cut is staggered to pass through the supply ports 15 and 16, while permitting the exhaust ports 18 and 19 to be formed in solid portions of the wall 13. It will be appreciated that it is comparatively unimportant to have the valve compression-tight while the supply ports 15 and 16 are registering with the respective ports 10 and 11 in the cylinders 3 and 4, as this is during the suction stroke of the piston when the intake is being forced into the cylinders. Therefore, the diagonal split 17 does no harm in passing through these intake ports in the valve, while this longitudinal division permits the entire valve to automatically spring outwardly in its valve seat and hold the ports 10 and 11 closed during the compression and power strokes of the pistons. The exhaust ports 18 and 19 are connected by a short length of pipe 20, having each end opposite the exhaust ports 18 and 19 and being secured to the valve 13 at said ports in any suitable manner. Preferably I form the said ports 18 and 19 with a short annular shoulder 21 to receive the open ends of the pipe 20. I also thread the inner end of said pipe and draw the same tightly against the inner end of the flange or part 21 by a threaded open nut 22, interposing a gasket 23 between the flange of said nut and the bearing shoulder 21. The outer part of the exhaust ports are threaded to a larger internal diameter than that of the nut 22 and a clamping ring 24 is threaded on top of same. Thus the exhaust pipe 20 is held firmly and securely adjacent the ports 18 and 19. I prefer to make the several ports 8, 9, 10 and 11 from each cylinder into the valve seat as a relatively long slot, of greater length than the width of the exhaust ports 18 and 19 just described, so as to permit the supply ports 15 and 16 to be brought into register with a part of the

long port in the engine cylinders during the rotation of the valve. Also by arranging the exhaust ports 18 and 19 substantially as illustrated in Fig. 1, I am enabled to utilize these ports and the single short exhaust pipe 20 is alternately the exhaust passage first for the cylinder 4 and then for the cylinder 3. Cooperating passages 25 and 26 being formed in the top of the casing 7, to which a single exhaust pipe 27 is connected to receive the exhaust gases from all the cylinders. During the rotation of the valve the exhaust port 19, for example, is brought into register with a part of the single port 11 in the cylinder 4, and simultaneously the other end of the exhaust pipe 20 is brought into register with the passage 25 leading to the conduit 27 and the consumed gases in the cylinder 4 are exhausted therethrough, the port 11 is then closed by the wall of the valve 13 and the supply port 16 brought into register with the long port 11 in said cylinder to give a fresh supply of gas to said cylinder during the next or downward stroke of the piston. Meanwhile, the adjacent cylinder 3 has gone through its compression and explosive stroke, and the exhaust port 18 of the valve 13 is brought into register with the port 10, and simultaneously the port 19 at the other end of the short exhaust pipe 20 registers with the passage 26; and the cylinder 3 exhausts through said pipe 20 and into the conduit 27.

The adjacent section of the valve 14 is substantially similar in construction and operation to that just described, although in this section I have illustrated a different form of longitudinal division, shown as a mortise-joint 28. In this section the short pipe 29 connects the exhaust ports 30 and 31 to register alternately with the port 8 of cylinder 1, and the passage 32 into the exhaust conduit 27, and the port 9 of cylinder 2 and passage 33 into the conduit 27. Supply ports 34 and 35 in this section are also shown as through the longitudinal split 28.

In the construction herein shown, I prefer to supply the intake gases for each pair of cylinders and each valve at approximately the center of the engine, a supply pipe 36 being shown therefor, leading into the valve seat at approximately the longitudinal center thereof, and I prefer to space apart the rotary valve sections 13 and 14 to permit the intake gases from the pipe 36 to have access into the central hollow portions of each valve. This is accomplished by providing on the valve 13 projecting lugs 37 and 38, which fit into recesses 39 and 40 respectively, in the adjacent end of the valve section 14, said lugs being of greater length than the depth of such recesses. This construction enables the supply gases to flow into the center of each valve section at all

times during the continued rotation of the valve, and furthermore, acts as a means to rotate the two sections in unison. For the purpose of rotating the valve I affix at one end a bevel gear wheel 41, secured by screws 42 to an end plate 43, closing the open end of the rotary valve and held thereto by screws 44 arranged around its periphery. By extending the plate 43 to overlap the ends of the valve 13, I provide a convenient arrangement for a ball-race, ball bearings 45 being therein illustrated. A corresponding bevel gear 46 with its axle 47 receiving power from the crankshaft in timed relation therewith, actuates the rotary valve. Said shaft 47 may be conveniently journaled in bearings 48 of a bracket 49 secured to the engine casting by bolts 50 through holes in cooperating flanges 51 and 52. The opposite end of the valve seat 12 may be conveniently closed by a plate 53 held to the engine casting by bolts 54, and, if desired, a ball bearing raceway may be provided between the inner face of the plate 53 and an end section 55 closing the adjacent outer end of the valve section 14. To facilitate the flow of supply gases along the exhaust pipes 20 and 29, and also to stiffen the rotary valve sections longitudinally without effecting circumferential expansion, and prevent distortion, I may form longitudinal ridges 56 on the inner surface of each valve section, as illustrated in drawings.

In Figs. 5 and 6 a slightly modified form is shown wherein I dispense with separate inlet and exhaust ports and eliminate the hollow rotary sleeve as a supply conduit, utilizing the type of short exhaust pipe already described for both supply and exhaust, having the same cooperate with separate supply and exhaust conduits on the outside of the casing. Fig. 5 illustrates in fragmentary form a section of engine casting 60, having two cylinders 61 and 62, each with a single port 63 and 64 respectively, opening into the rotary valve seat 65. These ports 63 and 64 are relatively long widthwise of the valve in place of the relatively long slots 8-11 lengthwise of the valve, in the form shown in Fig. 1. The rotary valve 66 is of substantially similar form and is similarly operated to that already described, but is without inlet ports, being provided with a short interior conduit pipe 67 united at its ends to openings 68 and 69 by means of locking nuts, flanges, and locking rings similar to that illustrated in Fig. 2, already described. The valve casing 70, however, is provided with parallel sets of ports, one set on one side, see Fig. 6, being indicated at 72 and opening into a supply conduit 73 and the other set 74 on the other side of the valve opening into an exhaust conduit 75. As the valve 66 is rotated, the port 69, for example, opens into the exhaust passage 74

simultaneously with the registering of the port 68 with the first part of the single port 64 in the cylinder 62 and receives the exhaust therethrough. Continued rotation of the valve 66 closes on registering of said valve with the exhaust port 74 and opens the same end 69 with the supply conduit 72 and 73, while the port 68 is still in register with the last part of the long slot 64 in said cylinder 62, thus receiving and conducting a supply of fresh gases thereto. Continued rotation of the valve reverses the operation just described for the next adjacent cylinder 61, the constant alternating of the heat of the exhaust and the cooled supply of fresh gases through the same conduit 67, tending to prevent the valve from becoming overheated in its bearings.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. Rotary valve construction for internal combustion engines, comprising a casing having a valve seat extending transversely of the engine cylinders, a port from each cylinder opening into said valve seat, and a rotatable valve consisting in a hollow sleeve having a plurality of sections, each section extending over the ports of two cylinders, said section containing a longitudinal and partly circumferential cut throughout its entire length in staggered relation to the inlet and exhaust ports in each section, said inlet ports being in the line of the longitudinal cut, whereby an inherent outwardly springing valve is provided for each section, independently of the adjacent valve sections.

2. Rotary valve construction for internal combustion engines, comprising a hollow rotary valve adapted to receive and conduct the supply and exhaust therethrough, a longitudinal internal pipe within said valve between spaced ports through the outer walls of said valve, said ports having threaded walls adapted to receive a correspondingly threaded flanged hollow binding nut cooperating with the open ends of said pipe, and means to rotate said valve section.

3. A rotary valve for internal combustion engines, having a longitudinal cut throughout its entire length to allow said valve to normally expand and automatically seat itself and compensate for wear within its casing, longitudinal stiffening ribs within said valve, and spaced ports through the walls of said valve having a connecting pipe extending longitudinally of said valve.

4. A rotary valve of the kind described for internal combustion engines, comprising an inclosing casing, a plurality of independent hollow valve sections adapted to rotate within said casing, each section having a cut longitudinally and partly circumferentially therethrough, allowing the valve section to expand normally and to seat itself

- automatically within the valve walls, longitudinal stiffening means for each section, connecting devices for the abutting ends of adjacent sections providing for uniform rotation of all sections and independent expansion of each section, and staggered ports through each valve section united by a connecting pipe to conduct the exhaust there-through.
- 5
- 10 5. A rotary valve of the kind described for internal combustion engines, comprising an inclosing casing and a plurality of independent hollow valve sections adapted to rotate within said casing, each section having a cut longitudinally and partly circumferentially therethrough, allowing the valve section to expand normally and to seat itself
- automatically within the valve walls, longitudinal stiffening rods for each section, dovetailed means connecting the abutting ends of adjacent sections having provision for uniform rotation of each section and independent expansion of each section for fuel intake around said dovetailed connection, and staggered ports through each valve section united by a connecting pipe to conduct the exhaust therethrough.
- 20
- 25
- In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.
- HENRY H. GOVE.
- Witnesses:
EDWIN M. CHADHAM,
HENRY G. HUTCHINSON.