C. S. GOBY.

VALVE FOR INTERNAL COMBUSTION ENGINES AND THE LIKE.

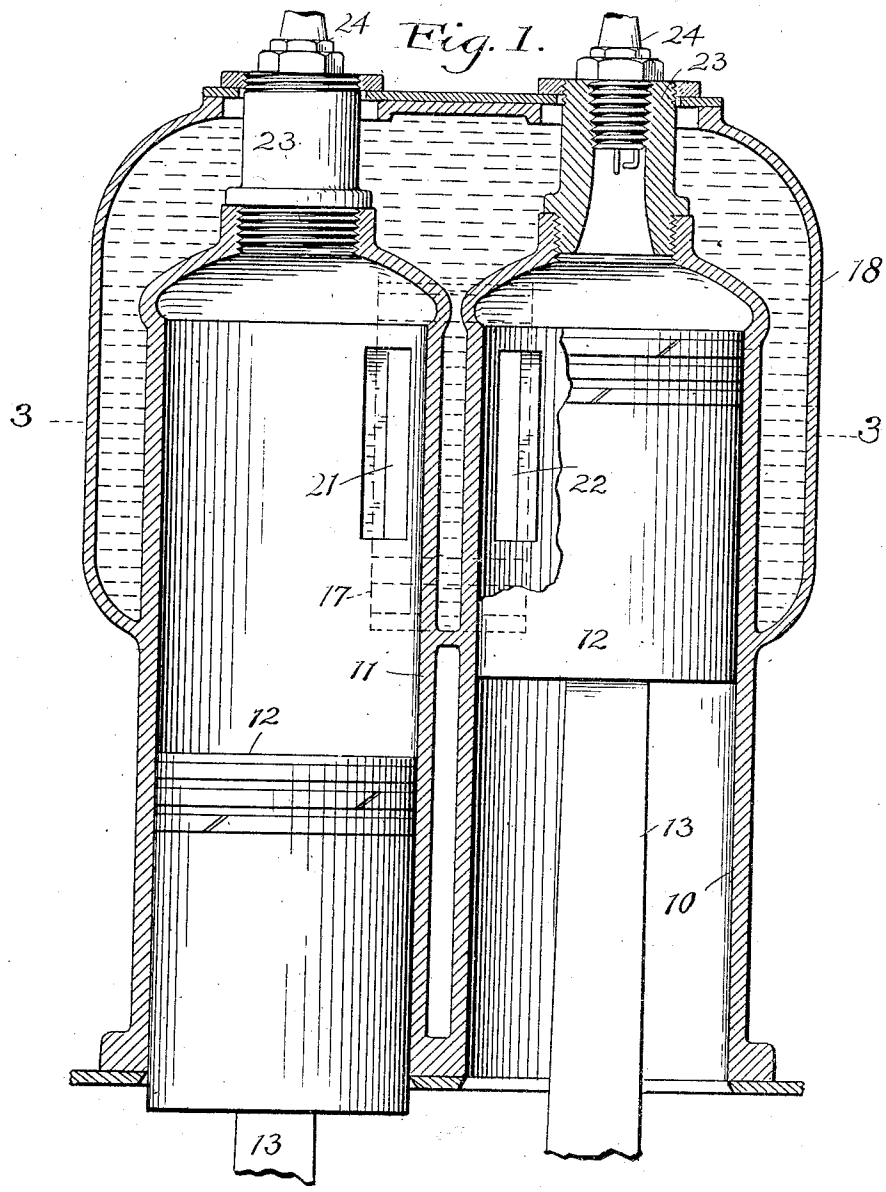
APPLICATION FILED NOV. 8, 1913.

1,234,458.

Patented July 24, 1917.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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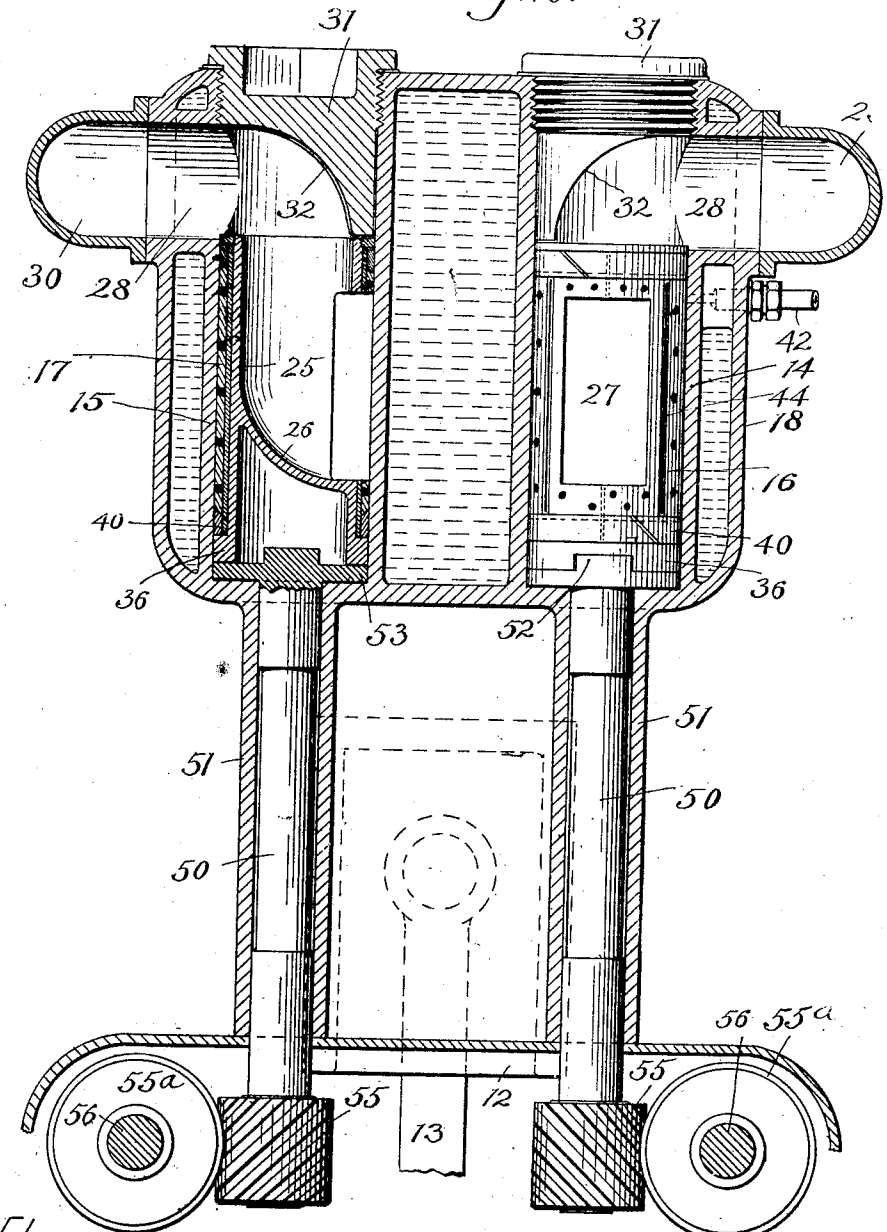
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3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

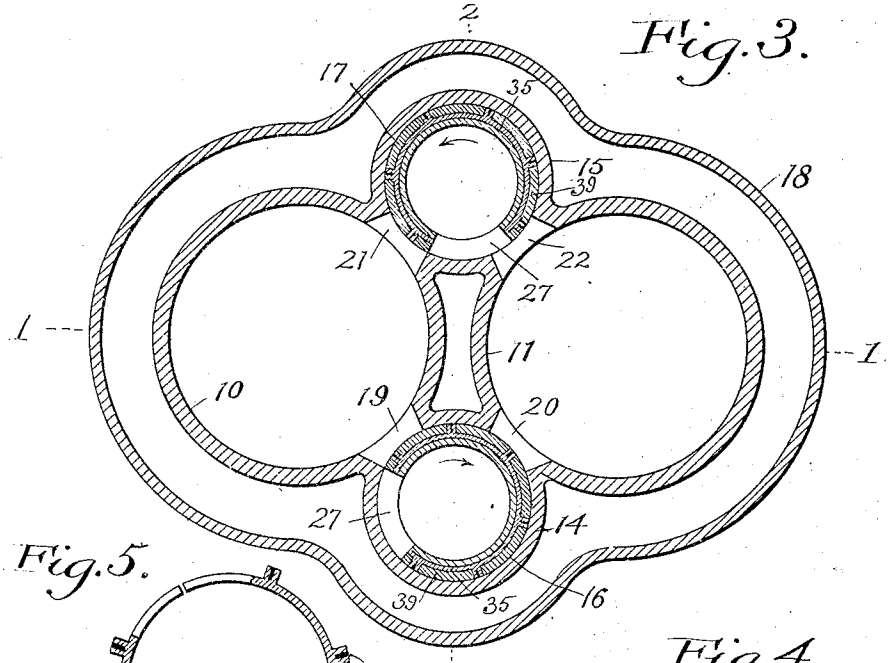


Fig. 5.

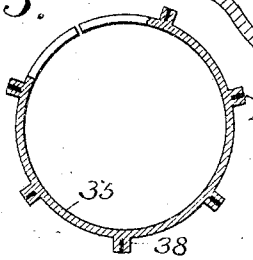


Fig. 7.

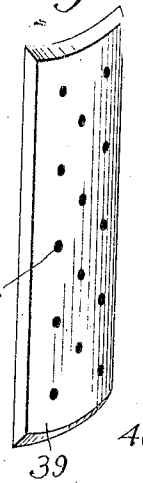


Fig. 4.

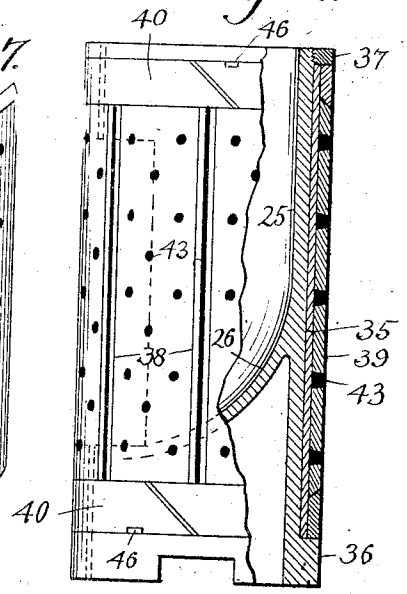
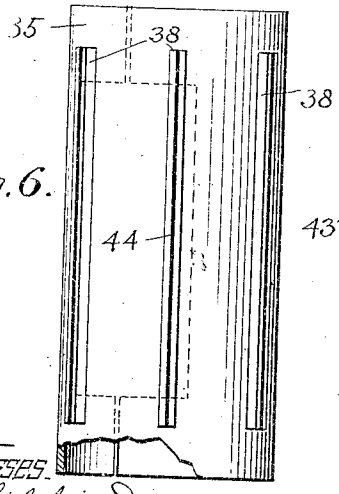


Fig. 6.



Witnesses.
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UNITED STATES PATENT OFFICE.

CLIFFORD S. GOBY, OF CLEVELAND, OHIO.

VALVE FOR INTERNAL-COMBUSTION ENGINES AND THE LIKE.

1,234,458. Specification of Letters Patent. Patented July 24, 1917.

Application filed November 8, 1913. Serial No. 799,949.

To all whom it may concern:

Be it known that I, CLIFFORD S. GOBY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Valves for Internal-Combustion Engines and the like, of which the following is a full, clear, and exact description.

This invention relates to improvements in valves, especially rotary valves, and has particular utility in internal combustion engines, although not necessarily confined to that field of use.

Considering my invention more specifically, it relates chiefly to a novel form of valve packing, the principal object of the invention being to provide a packing, the construction of which is such that the operation and functioning of the valve is unaffected by expansion or contraction due to changes in temperature, and which prevents leakage, both axially and circumferentially of the valve, and at the same time readily adapts and adjusts itself to the inner wall of the valve chamber as the valve is rotated or operated in said chamber.

The above and additional objects which will be brought out in the specification are accomplished by my invention which may be here briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings, wherein I have shown one embodiment of my invention applied to an internal combustion engine, Figure 1 is a vertical sectional view through the upper part of the engine, the section being taken through the cylinders substantially along the line 1—1 of Fig. 3. Fig. 2 is a vertical sectional view taken at substantially right angles to the section of Fig. 1, this section being taken through the valve chambers substantially along the line 2—2 of Fig. 3, one of the valves being shown in elevation and the other being shown in section. Fig. 3 is a transverse sectional view substantially along the line 3—3 of Fig. 1. Fig. 4 is a detached view on an enlarged scale of one of the valves,—the valve being shown partly in side elevation and partly in section. Fig. 5 is a transverse sectional view through the expansion sleeve which surrounds the body of the valve. Fig. 6 is a side view of the expansion sleeve shown in Fig. 5, a portion being broken away; and Fig. 7 is a perspective view of one of the sector plates which are utilized on the valve in conjunction with the expansion sleeve.

Referring again to the drawings, wherein I have shown for convenience a two-cylinder engine, it will be seen that the two cylinders 10 and 11 receive in the usual manner reciprocating pistons 12 adapted to be connected by connecting rods 13 to the cranks (not shown), one of the pistons being here shown at the end of its upward stroke and the other piston being at the end of its downward stroke. On opposite sides of the cylinders and between the same and extending into the reëntrant angles formed at the junction of the cylinders are two valve cylinders 14 and 15, the former of which contains a rotary cylindrical inlet valve 16, and the latter of which contains a rotary cylindrical exhaust valve 17. The two main cylinders 10 and 11 and the valve cylinders 14 and 15 are in this instance cast *en bloc*, or in one integral part, as shown in Fig. 3. This construction, including the arrangement of exhaust and inlet valve chambers or cylinders, is an important factor in the attainment of compactness, which is one of the features of my engine.

It will be observed that both the main cylinders and the valve cylinders are inclosed within a water jacketing wall 18, which substantially encompasses the valve cylinders and the upper portions of the main cylinders.

Before passing to the construction of the valves, it may be noted that the inlet valve cylinder 14 communicates with the two cylinders 10 and 11 through inlet ports 19 and 20, and that the exhaust valve cylinder 15 communicates with the cylinders 10 and 11 through exhaust ports 21 and 22. It will be observed that the center lines of the ports of each pair are substantially 90 degrees apart. It will be seen also that the upper ends of the ports are somewhat below the upper limits of piston movement, and, in consequence that the ports of each cylinder will be closed before the corresponding piston reaches the upper limit of its movement, and will not be uncovered until after a predetermined downward movement of the piston. Preferably the piston will not uncover or begin to uncover the port until it has traveled downwardly a linear distance equivalent to 20 degrees of movement. The

advantage of this arrangement is that the valve is protected from the heating action of the gases at the time of ignition, and wire drawing of the incoming gases during the suction stroke is minimized, as will be hereinafter explained.

The combustion space is formed by the upper part of the cylinder and by a sleeve 23 which is screwed onto the top of the cylinder, as shown in Fig. 1 and extends upwardly through the water jacket. In the upper end of the sleeve is screwed a spark plug 24.

Each of the valves includes a cylindrical body 25, which may be a casting. This body is provided with an open upper end and somewhat near its lower end with a curved partition 26 constituting a deflector for deflecting the gases either into the cylinder, as is the case with the inlet valve, or for deflecting the gases upwardly, as they pass from the cylinder, as is the case with the exhaust valve. Each valve is provided nearly midway between its ends and in the side wall thereof with a substantially rectangular port 27 properly arranged with reference to the deflector 26.

Near the upper ends of the valve cylinders are laterally extending inlet and outlet passageways 28, one of which communicates with an inlet manifold 29 and the other with an exhaust manifold 30 which can be secured to suitably machined or faced portions of the valve cylinders. In the extreme upper ends of the valve cylinders are end plugs 31 which are screwed into place. Each of these closure plugs is provided with a curved section or portion 32 shaped to serve as a deflector and arranged opposite the laterally extending passageway 28, and one serving to deflect the incoming gases downward to the lower deflector 26 in the valve, and the other serving to deflect laterally into the exhaust manifold the upcoming burnt gases. It will be seen therefore that the construction is such as to afford the least possible resistance to the passage of the gases between either manifold and a cylinder, whether the gases are passing into the cylinder or from the cylinder. It will be seen also that each valve has only one port, and that the passage of gases through the upper end of the valve, whether the gases are incoming or outgoing, is not obstructed by a passageway which is alternately closing and opening. This arrangement has a very distinct advantage over constructions wherein the gases pass through two ports in the valve, especially as the two-port construction increases wire drawing, and offers more resistance to the passage of the gases.

Although I have here shown the manifolds secured to the sides of the valve chambers, it might be desirable to arrange the manifolds directly over the valve chambers. This would, of course, eliminate the necessity for the end closure plugs 31 and the deflector 32 formed therein, for the gas would then flow directly downward from the intake manifold to the intake valves and directly upward from the exhaust valves into the exhaust manifold.

I shall next describe in detail the construction of the valve, wherein important features of my invention are embodied. As before stated, each of the valves includes an inner cylindrical body 25. The body is surrounded by a cylindrical expansion sleeve 35, which is held between a flange or shoulder 36 at the lower end of the valve body, and a nut 37 which is screwed onto the threaded upper end of the valve body, as shown particularly in Fig. 4. This expansion sleeve, as will be observed particularly from Figs. 5 and 6, is split or divided at one point,—the division in this case being made upon the longitudinal center line of the port 27. The expansion sleeve is provided at intervals with outstanding ribs 38 which extend longitudinally of the sleeve and terminate a short distance from each end thereof. As will be observed later, the purpose of these radial ribs is to minimize leakage circumferentially of the valve. Between the ribs 38 are sectors or sector plates 39, which are held in position by split rings 40 which surround the end portions of the expansion sleeve and engage respectively the shoulder 36 and the nut 37, the said rings having undercut portions which overlap the ends of the sectors which are correspondingly beveled as shown most clearly in Fig. 4. These rings not only serve to hold in place the sectors, but perform the function of an ordinary piston ring, that is, to prevent leakage of gases endwise of the valve. As shown in the drawings, the valve body, expansion sleeve, and one of the sectors have registering openings or ports forming the valve port 27.

In practice the lower shoulder 36 and the upper nut 37 bear, if at all, very lightly on the cylindrical wall of the valve cylinder, even when the valve is subjected to the maximum heating action of the burnt or exhaust gases. However, the rings 40, sectors 39 and ribs 38 of the expansion sleeve bear substantially uniformly against the wall of the valve cylinder, and admit of contraction and expansion without any sticking or undue loosening of the parts. The sectors are held snugly against the valve chamber walls by the outward pressure exerted by the expansion sleeve, and as they are not integrally united, they are free to conform to any minute irregularities of the valve chamber walls and thus form virtually a gas tight joint between the valve and valve chamber. The expansion sleeves therefore serve a dual purpose, for they not only, with the assist-

ance of the sectors, prevent leakage, but with the coöperation of the split rings serve to automatically compensate for changes due to expansion and contraction, thus making it impossible for the valve to stick.

The rings 40 are of sufficient width to prevent grooves being cut in the valve chamber walls, and the outward pressure exerted by the rings will be sufficient to check leaking endwise of the valve. It may be noted that while the sector plates fit fairly closely between the ribs, the fit will not be so tight as to prevent expansion of the sleeve due to rise in temperature. Preferably, outer edges or corners of the ribs are sharp, so as to prevent to the highest possible degree leakage of gases circumferentially of the valve.

The valves are preferably lubricated by lubricant supplied through pipes, one of which is shown at 42 in Fig. 2. Each of these pipes will be connected to the valve chamber at a point near the upper end of the valve, so that the lubricant may pass downwardly toward the lower end of the valve. In addition to the lubrication secured in this manner, the valve itself may be provided with a solid or semi-solid lubricating substance, such as graphite, and in this instance the sector plates are provided at intervals with openings 43, and the ribs 38 are provided with longitudinal slots 44, both of which are preferably filled with graphite or equivalent lubricating substances. The expansion sleeve 35 and rings 40 of each valve may be prevented from turning relative to the valve body in any suitable manner, such as by pins 46 or equivalent means.

The valves are continuously rotated in opposite directions by vertical shafts or spindles 50, which are connected at their upper ends to the lower ends of the valves and which extend downwardly through cylindrical sleeve-like extensions 51 of the valve cylinders. Each of these shafts is connected to the valve by a tongue and groove or dental clutch connection consisting simply of a cross rib or projection 52 on the upper face of a disk or flange-like enlargement 53 at the upper end of the shaft, and rectangular notches formed in the lower edge portion of the valve, and engaged by said cross rib. The valve is prevented from moving endwise upwardly or away from the driving shaft by the lower end of the closure plug 31 in the upper end of the valve cylinder. The construction is such that the upper end of the valve normally just clears the lower end of the closure plug 31, but nevertheless a very slight endwise movement of the valve or expansion in the endwise direction may take place. Each of the shafts 50 is rotated at half crank shaft speed by driving mechanism, including a worm 55 on the lower end of the shaft and worm wheel 55ª engaging the worm and fixed to a shaft 56 which can be driven from the crank shaft at crank shaft speed by any suitable driving mechanism, such as chain and sprocket gearing, which, in this instance is not shown.

From the above, it will be apparent that since the valves are not secured solidly to the driving spindles, they are free to be withdrawn from the valve chambers should removal of the same be desired. Furthermore, by reason of this construction, none of the stresses due to driving by the gears are transmitted to the valve so as to distort the latter. Thus it will be seen that the valve with its packing members in reality floats in the valve chamber, and is free to adjust itself to the valve chamber and to compensate for changes due to variations in temperature as before stated.

Although the timing of the valves may be adjusted to suit requirements, in Fig. 3 the inlet valve 16, which as shown is rotated in the clockwise direction, is about to open the inlet port leading to the cylinder 10, whose piston is about to start its downward suction stroke, and the exhaust valve which is rotated in a counter clockwise direction, as the same is viewed in Fig. 3, has just closed the exhaust port of cylinder 10, and has partially opened the exhaust port of the cylinder 11, whose piston is about to start on its upward exhaust stroke. The inlet port 19 of cylinder 10 remains covered or closed by the piston at the time of ignition, and while the piston is traveling downward through substantially twenty degrees of movement. Due to the fact that the port is sealed by the piston when ignition takes place, the valve is protected from the full force of the explosion or ignition, and its resulting pressure. While the piston is traveling downward to this extent, the inlet valve 16 is, of course, given a ten degree movement, thus partially opening or uncovering the port. In consequence, the inlet port is opened or uncovered by the simultaneous movement of both the piston and the valve, and as the piston is moving rapidly at the instant that it begins to uncover the port and as the valve had, prior to that time, partially opened or uncovered the port, it will be seen that the effect of this action is to produce a very rapid port opening, and wire drawing and resistance to movement of the incoming gas is minimized.

Furthermore, the passage of gases to and through the valve is free and practically unobstructed by reason of the fact that the gases pass from the manifold into the valve chamber and are deflected downward by the upper curved deflector 32 and pass freely into the open end of the cylindrical valve, and are thence deflected laterally by the lower deflector in the valve toward the now

open port. The same is true of the exhaust valve, but the exhaust gases pass outwardly from the cylinder even more freely and with less resistance than the incoming fresh gas, for the reason that the exhaust port is nearly half open or uncovered at the time the piston begins its upward exhaust stroke, as will be seen by the position of the port 27 of valve 17 with reference to the exhaust port 22 of cylinder 11.

After substantially 180 degrees of piston movement or ninety degrees of valve movement, the exhaust port of cylinder 11 is closed, and at the same time the port 27 of inlet valve 16 is in position to open the inlet port 20 of cylinder 11.

At the completion of the compression and working strokes of the piston in cylinder 11, and at the beginning of the exhaust stroke of the piston in this cylinder the port 27 of exhaust valve 17 will have partly opened the exhaust port 21 of cylinder 10, whereupon the exhaust will take place in the cylinder, and after the exhaust stroke, both valves will then again be in the positions shown in Fig. 3.

While I have shown only one valve construction in the drawings, it will be understood that I do not wish to be confined to the exact details or arrangements shown, but aim in my claims to cover all modifications which do not involve a departure from the spirit and scope of my invention. Furthermore, while I have shown and described in detail one arrangement of the valves with respect to the cylinders, I wish it to be understood that I am not to be confined to the particular arrangement shown, as the valve may be otherwise arranged.

Having described my invention, what I claim is:

1. A valve comprising an annular body, an expansible sleeve surrounding the body and extending substantially the length thereof, both the body and sleeve having registering port openings and split spring rings at the ends of the sleeve.

2. A valve comprising an annular valve body having a split spring sleeve, provided with external ribs for preventing leakage circumferentially of the valve.

3. A rotary valve comprising an annular valve body, annular devices surrounding the body for preventing leakage circumferentially and axially, one of said devices having a port opening and also circumferentially spaced leakage preventing portions.

4. A valve comprising an annular body having means for preventing leakage both axially and circumferentially of the valve, said means comprising an expansible sleeve surrounding the body and provided with external ribs and expansible rings at the ends of the sleeve.

5. In a valve an annular expansible member provided with external ribs for preventing leakage circumferentially of the valve, and means filling the spaces between the ribs.

6. A valve comprising an annular body, an expansible sleeve surrounding the body and provided with external ribs extending lengthwise of the sleeve, and sectors between the ribs.

7. A valve comprising a valve body, an annular member surrounding the valve body and provided with external longitudinal ribs, sectors separate from said member between the ribs, and a ring surrounding said member and engaging the sectors.

8. In a valve an expansible member provided with external longitudinally extending ribs, sectors between the ribs, and expansible rings at the ends of the member and engaging the sectors.

9. In combination in an internal combustion engine, a cylinder, an annular valve chamber, a rotary valve in the chamber, said valve being provided with an expansible sleeve having external longitudinally extending ribs, sectors between the ribs, and expansible rings surrounding the sleeve and engaging the sectors, said valve having a port in its side wall.

10. A valve comprising an annular body, an expansible member surrounding the body, said expansible member having means for preventing leakage circumferentially of the valve.

11. A valve comprising an annular body, expansible means surrounding the body, and having on the exterior thereof a plurality of longitudinally extending edges.

12. A valve comprising an annular body, an expansible member surrounding said body, said member having means for preventing leakage circumferentially of the valve, and means for preventing leakage longitudinally of the valve.

13. A valve comprising an annular body, an expansible sleeve surrounding said body and having means forming longitudinally extending edges for preventing leakage circumferentially of the valve, and means comprising a plurality of split spring rings for preventing leakage longitudinally of the valve.

14. A valve comprising a valve body, expansible means surrounding the valve body and provided with a port opening and with circumferentially spaced edges extending longitudinally and axially spaced edges extending circumferentially of the valve.

15. A valve comprising a valve body, annular expansible means surrounding the valve body and provided at intervals with means for preventing or checking leakage circumferentially of the valve.

16. A valve comprising a valve body with a packing including a plurality of sectors

or segments surrounding the valve body, and annular expansible means for pressing the sectors or segments outwardly.

17. A valve comprising a valve body and a packing comprising independent sectors or segments surrounding the valve body, annular expansible means for pressing the same outwardly, and annular retaining means for said sectors or segments.

18. A valve comprising a valve body and a packing comprising a plurality of independent sectors or segments surrounding the valve body, and means comprising an annular split member between the body and said sectors or segments and adapted to press the latter yieldingly against the wall of the chamber containing the valve.

In testimony whereof, I hereunto affix my signature in the presence of two witnesses.

CLIFFORD S. GOBY.

Witnesses:
L. I. PORTER,
A. F. KWIS.