PATENT SPECIFICATION

Convention Date (United States): Aug. 10, 1929.

355,268

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Complete Accepted: Aug. 20, 1931.

COMPLETE SPECIFICATION.

Improvements in or relating to Rotary Valves for Internal Combustion and other Engines.

We, ADDISON INVESTMENT COMPANY, a corporation of the State of California, United States of America, of 215, West 7th Street, Los Angeles, California, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to rotary valves for internal combustion and other engines of the type wherein sealing means are provided with a view to preventing leakage of fluid round the port or ports of the rotary valve member, said sealing means comprising an element which is resiliently pressed against the periphery of the valve element and has a passage or conduit for the flow of fluid therethrough.

It is an object of the invention to provide an improved form of sealing means for preventing leakage around the valve ports.

It has previously been proposed in a rotary valve of the above type to provide with the sealing means a diaphragm clamped between a packing ring and the cylinder head valve casing.

The invention consists in a rotary valve for internal combustion and other engines of the above type wherein said sealing element comprises a tubular member having a curved face at one end adapted to bear against the periphery of the valve member and provided with a laterally projecting flexible flange or diaphragm.

Referring to the drawings which are for illustrative purposes only:—

Fig. 1 is a simple elevational view of an engine having a valve mechanism embodying the principles of our invention.

Fig. 2 is an enlarged cross section on a plane represented by the line 2—2 of Fig. 1 showing the valve mechanism in exhaust position.

Fig. 3 is an enlarged cross section on a plane represented by the line 2—2 of Fig. 1, showing the upper portion of the engine cylinder and valve mechanism, and showing the movable member of the valve mechanism in intake position.

Fig. 4 is an enlarged cross section on a horizontal plane represented by the line 4—4 of Fig. 1, showing the valve member in exhaust position.

Fig. 5 is a section taken as indicated by the line 5—5 of Fig. 4.

Fig. 6 is a perspective view showing the rotary valve member of the invention in cross section.

Fig. 7 is a cross section on the plane represented by the line 7—7 of Fig. 6.

Fig. 8 is a cross section on the plane represented by the line 8—8 of Fig. 6.

Fig. 9 is a cross section on the plane represented by the line 9—9 of Fig. 6.

Fig. 10 is a partly sectioned elevational view showing an alternative form of sealing member which may be employed in the practice of the invention.

Although the invention may be employed with various types of engines wherein a fluid under pressure is employed as a power medium, we have, for the purpose of disclosing our invention in simple form, shown in Fig. 1 a single cylinder internal-combustion engine 12 having a cylinder 13 with a valve mechanism 14 situated at its upper end. As shown in greater detail in Figs. 2, 3 and 4, this valve mechanism includes a valve casing 16 which is secured by bolts 17 to the upper end of the cylinder 13 in such position that the upper walls 18 of the cylinder 13 will cooperate with walls 19 forming a recess 20 in the valve casing 16 to provide, as shown in Fig. 3, an opening communicating between the interior of the cylinder 13 and the interior of the valve casing 16, which opening will be hereinafter referred to as a cylinder port 21.

In Fig. 4, the vertical plane of the zone in which the cylinder port 21 lies is indicated by the line A—A. On planes of the zone B—B and C—C an intake port 23 and an exhaust port 24 are respectively located. A cylindrical rotary valve member 25 is supported axially within the bore 26 of the casing 16 by means of anti-friction bearings 27 and 28 which are held in the ends of the bore 26. The leftward end of the valve member 25 has a cylindrical projection 29 which fits into the bearing member 27, and the rightward

end of the rotary valve member 25 is provided with a pin or shaft 30 which is pressed into a recess or counterbore 31 in the rightward end of the member 25 and is secured therein by a pin 32.

The leftward end of the bore 26 is closed by a cover plate 33 which also serves to hold the bearing member 27 in place, and the rightward end of the bore 26 is provided with a plate member 35 having a bore therein through which the shaft 30 extends and being equipped with a gland member 36 for compressing packing 37 around a sleeve 38 which surrounds that portion of the shaft 30 between the bearing member 28 and a gear 39 which is keyed onto the end of the shaft 30 for the purpose of imparting the necessary movement to the valve member 25 to cause consecutive engagement between passages 41 and 42 of the valve member 25 and the ports of the valve casing 16. The gear 39 may be secured on the outer end of the shaft 30 by means of a nut 43 which forces the gear 39, the sleeve 38, and the inner portion 44 of the bearing member 28 tightly against a flange or shoulder 45 on the shaft 30 adjacent to the rightward end of the valve member 25.

The valve passage 41 has an inlet opening 47 which is situated in such a position as to rotate in the plane B—B of Fig. 4 when the valve member 25 is rotated. From the inlet opening 47 the intake passage 41 extends rightwardly within the valve member 25 and then bends laterally to an outlet opening 48 lying in the zone of plane A—A. The passage 42 has an inlet opening 50 lying in the zone of plane A—A in a position adjacent to the outlet opening 48 of the passage 41 and extends leftwardly from the inlet opening 50 within the valve member 25 and then bends laterally to an outlet opening 51 lying in the zone of plane C—C.

The intake and exhaust passages 41 and 42 are cored in the valve member 25 during the casting thereof, thereby enabling the valve member 25 to be made of a single integral structure having ample strength to resist severe bending stresses so as to prevent the member 25 from being forced into frictional contact with the walls forming the bore 26 of the valve casing 16. The bearing members 27 and 28 are of such character and size that the valve member 25 is thereby held in axial alignment with the bore 26. In the practice of the invention it is preferable to allow a slight clearance between the member 25 and the bore 26, which clearance may be as great as ten or fifteen thousandths of an inch without affecting the operation of the valve mechanism.

As especially pointed out in Fig. 3, a sealing member 55 is located in the recess 20 which forms part of the cylinder port 21. This sealing member 55 includes a semi-cylindrical body 56 provided with a curved face 57 adapted for engagement with the exterior of the valve member 25, and a laterally projecting cylindrical wall 58 through which an opening 59 extends from substantially the center of the curved face 57 to communication with the interior of the cylinder 13.

The upper wall 18 of the cylinder 13 is constricted, as indicated at 60, so as to fit closely around the end of the cylindrical wall 58 of the sealing member, and extending laterally from the wall 58 is a flange or thin wall forming a diaphragm 61, the periphery 62 of which is gripped between filler or gasket rings 63 placed on the upper end of the cylinder 13 and a shim ring 64 which rests in a counterbore 65 positioned to receive the periphery 62 of the diaphragm portion 61 of the sealing member 55. Ends 67 of the semi-cylindrical wall portion 56 project above the diametral plane D—D, indicated in Fig. 3, so that the curved surface 57 of the sealing member 55 extends over half the circumference of the valve member 25 and is sufficient to entirely seal either one of the openings 48 or 50 when the other is in communication with the passage or opening 59 of the sealing member 55. The upper wall 18 of the cylinder 13 may fit tightly around the lower end of the cylindrical wall 58 or a small space 70 may be left therebetween, as desired.

In the practice of the invention, we prefer to make the shim ring 64 of such thickness that when the casing 16 is clamped onto the upper end of the cylinder 13 the periphery 62 of the diaphragm 61 will be flexed upwardly, with the result that the face 57 of the sealing member 55 will be resiliently held in engagement with the valve member 25, thereby forming a practical and efficient seal between the valve member 25 and the opening or port 21 which leads into the cylinder 13.

It will be recognized that as wear takes place between the member 25 and the sealing member 55 the thickness of the shim 64 may be decreased so as to give a desired pressure of the sealing member 55 against the valve member 25. During the existence of pressure within the cylinder 13, the sealing member 55 will be forced upwardly into tighter engagement with the valve member 25; therefore, during the operation of the valve mechanism a tight seal is assured during the periods in which pressure exists within the cylinder 13.

As shown in Figs. 4 and 5, the exhaust

port 24 is joined with a recess 71 which receives a sealing member 55a having the same characteristics as the sealing member 55, but serving to seal between the exhaust port 24 and the valve member 25. The sealing member 55a has an exhaust opening 59a therein and is equipped with a circular web or diaphragm 61, the periphery 62 of which is held between a shim 64 and gasket rings 63 which are held in place by a clamping ring 72 secured in place by bolts or studs 73. It is not thought necessary to provide a sealing means in the intake port 23 for the reason that in an internal-combustion engine such as that with which the invention is illustrated the intake port is not under pressure; therefore there is no tendency for leakage between the inner end of the intake port 23 and the valve member 25. In addition to this, the sealing means 55 and 55a seal off one or more openings of the passages 41 and 42 when either of these passages 41 or 42 is disposed in position communicating with the cylinder or exhaust ports.

The valve member 25 may be rotated, or moved, either continuously or intermittently, as desired. In Fig. 1 we have shown the gear 39 engaged by a pinion 75 which is located on the upper end of a timing shaft 76, it being understood that this timing shaft 76 has a definite movement relative to the cycles of the movement of the movable parts of the engine 12. In Fig. 3 the valve member 25 is shown in such position that the valve passage 41 communicates between the intake port 23 and the opening 59 which the sealing member 55 provides through the cylinder port 21. This position of the valve member 25 occurs during the intake stroke of the piston. During the compression and power strokes of the piston the intermediate wall portion 78 of the valve member 25 is in position to close the opening 59 which communicates with the cylinder 13 through the cylinder port 21. In Figs. 2, 4 and 5, the exhaust passage 42 of the valve member 25 is shown in a position communicating between the opening 59 of the sealing member 55 and the opening 59a of the sealing member 55a. This position of the exhaust passage 42 occurs during the exhaust stroke of the piston and permits the combustion products to escape freely into the open atmosphere or into such exhaust piping as may be provided. It will be perceived that the sealing members 55 and 55a tightly close both ends of the exhaust passage 42 so as to prevent leakage of combustion products or burnt gases through the small space existing between the exterior of the valve member 25 and the bore 26 of the valve casing into the intake port 23 and the intake passage 41, thereby preventing contamination of the fuel mixture by burnt gases.

Although we have shown two sealing members of the type specifically described at 55, it is to be understood that in the practice of the invention one or more sealing members of this character may be employed, as desired.

By supporting the valve member 25 so that it rotates in a definite axial position within the bore 26 of the valve casing 16 without pressure contact with the wall forming such bore, friction between the valve member 25 and the stationary parts is maintained at a minimum, but this freedom of rotation which is given the valve member 25 does not in any way sacrifice the efficiency of the seal between the valve member, its valve passages 41 and 42, and the ports with which such valve passages communicate, for the reason that an efficient and positive seal is at all times provided by the resiliently applied sealing members 55 and 55a. We have previously described the sealing members 55 and 55a as integrally formed from a durable metal such as steel, but it is to be understood that in the practice of the invention it is not necessary to construct the sealing members integral, as these sealing members may be conveniently assembled from cooperative parts.

In Fig. 10 we show a sealing member 80 including a semi-cylindrical body 81 adapted to engage a rotary valve member such as indicated at 25. The body 81 may be made of a metal such as gunite the composition of which is, iron 95.2%, silicon 2%, carbon 2.8%, in other words gunite is a trade name of a graphitic steel having exceptional wearing qualities. Into a threaded opening 82 in the member 81 is screwed a diaphragm member 83 consisting of a body 84 having a central opening 85 therethrough and a laterally extending web or diaphragm wall 86. The member 83 may be made of a metal of resilient characteristics, such as steel. In the inner circular face of the body portion 84 we show notches 87 which may be engaged by a wrench for the purpose of screwing the member 83 into tight engagement with the member 81.

We have herein shown our invention in simple and practical form, but it is recognized that certain parts or elements thereof are representative of other parts, elements, or mechanisms which may be employed in substantially the same manner to accomplish substantially the same results; therefore, it is to be understood that the invention shall not be

limited to the details disclosed but shall have the scope of the following claims.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A rotary valve for internal combustion and other engines of the type described wherein said sealing element comprises a tubular member having a curved face at one end adapted to bear against the periphery of the valve member and provided with a laterally projecting flexible flange or diaphragm.

2. A rotary valve for internal combustion and other engines as claimed in claim 1, wherein said element is held in position by means which engages the marginal portion of the flange or diaphragm so that the latter is in a permanently flexed condition.

3. A rotary valve for internal combustion and other engines as claimed in any of the preceding claims in which the rotary valve member is provided with separate channels opening at one end in ports in a zone in which a port leading into the engine cylinder is arranged and at their other ends in ports lying in zones spaced from each other and adapted to register with inlet and exhaust ports formed in the valve casing.

4. A rotary valve for internal combustion and other engines as claimed in any of the preceding claims in which the sealing means are arranged to engage the rotary valve member adjacent the port communicating with the engine cylinder and adjacent the exhaust port from the valve casing.

5. A rotary valve for internal combustion and other engines as claimed in any of the preceding claims in which the rotary valve is cylindrical and is supported for rotation about its longitudinal axis by anti-friction means mounted in the valve casing.

6. A rotary valve for internal combustion and other engines as claimed in claim 5, in which the sealing members are provided with a body portion having a curved surface adapted to engage against the surface of the rotary valve, said body portion being formed separately from a second portion provided with said peripheral flange.

7. A rotary valve for internal combustion and other engines having a sealing member as claimed in claim 6 in which the resilient flange is adapted to be clamped between a shoulder formed on the valve casing and pressure applying members.

8. A rotary valve for internal combustion and other engines as claimed in any of the preceding claims comprising a sealing member comprising a body member having a curved surface or sealing face of sufficient area and so disposed as to cover completely that portion of the valve port not in communication with the cooperating opening in said sealing member, when said port is at least partly in communication with said opening.

9. A rotary valve for internal combustion and other engines as claimed in claim 6 in which the resilient flange of the sealing member at the engine inlet is exposed to the cylinder pressure.

10. A rotary valve for internal combustion and other engines as claimed in any of claims 3 to 9 in which the body of the sealing member at the cylinder inlet is spaced from the cylinder wall around said port forming a chamber between the flange portion of the sealing member which is clamped peripherally between the casing and the cylinder wall, and the top of the cylinder said chamber being open to the gas under cylinder pressure whereby said pressure acts to force the sealing face of the chamber against the rotary valve.

11. A rotary valve for internal combustion and other engines as claimed in any of the preceding claims in which the sealing member comprises a body portion adapted to extend into the openings in the valve casing or cylinder wall, said portion being movable in said openings, the flange portions of the sealing members being the only support of said members.

12. A rotary valve for internal combustion and other engines as claimed in any of the preceding claims in which the flange portion of the sealing members is clamped against shoulders formed on the valve casing by suitable clamping means, adjustment being provided by the provision of shims in the clamped joint whereby wear of the sealing face may be compensated.

13. A rotary valve for internal combustion and other engines as claimed in the preceding claims in which the valve is cylindrical in form and is arranged across the top of the engine cylinder in a casing completely enclosing said valve, said casing being closed at one end and bored at the other end for the passage of a stem by which said valve may be actuated, packing means being provided to seal the bore against the passage of air or gases.

14. Rotary valves for internal combustion and other engines substantially as described with reference to or as shown in the accompanying drawings.

15. A sealing member for a valve mech-

anism substantially as described or as shown with reference to the accompanying drawings.

Dated this 20th day of May, 1930.

MARKS & CLERK.

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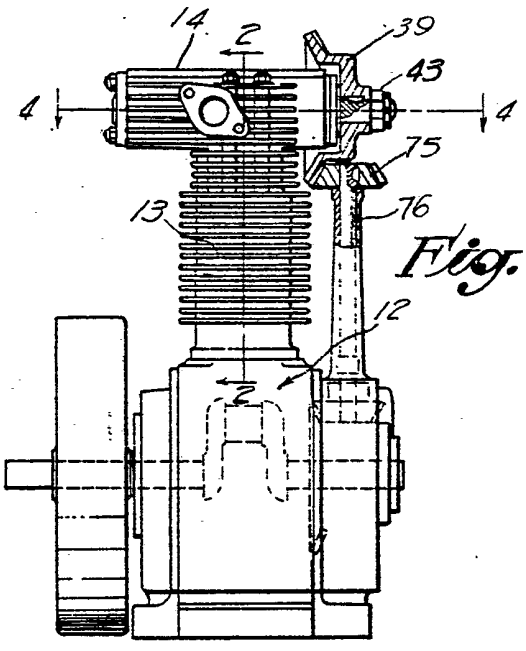


Fig. 1.

Fig. 2.

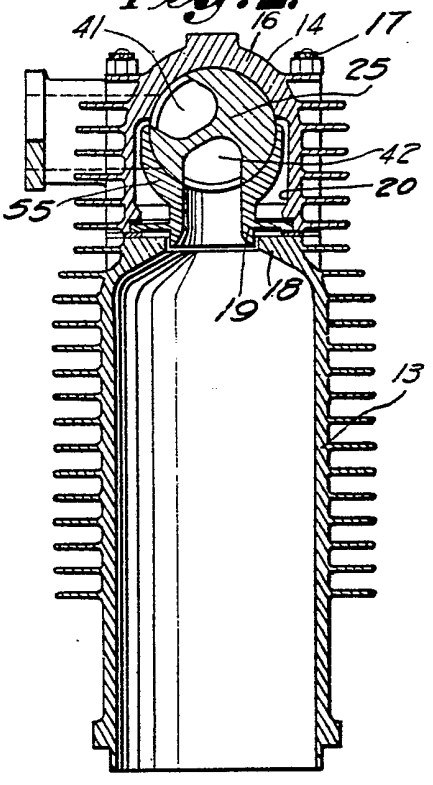
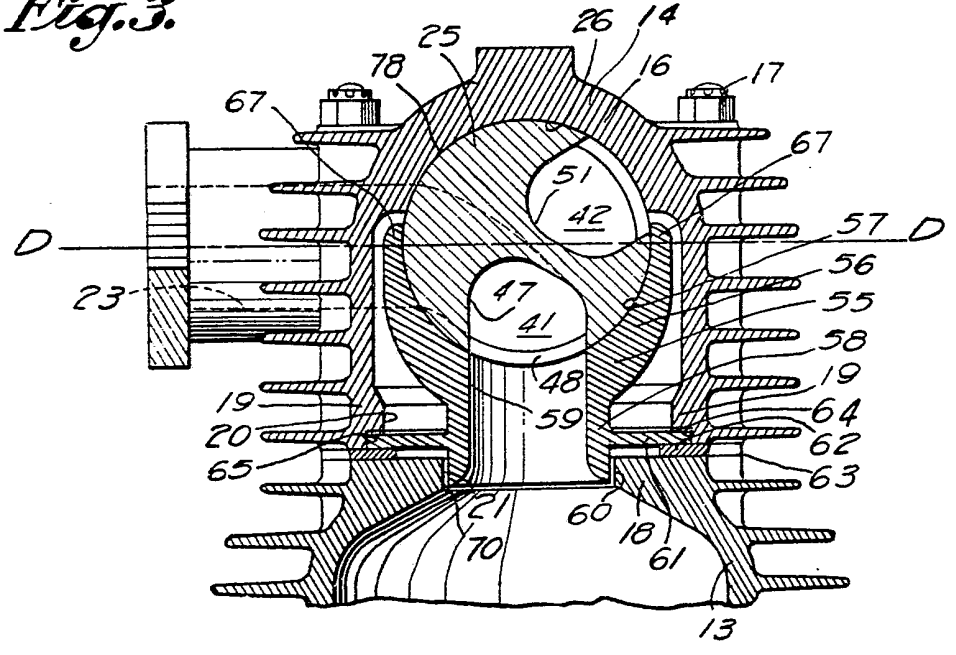


Fig. 3.



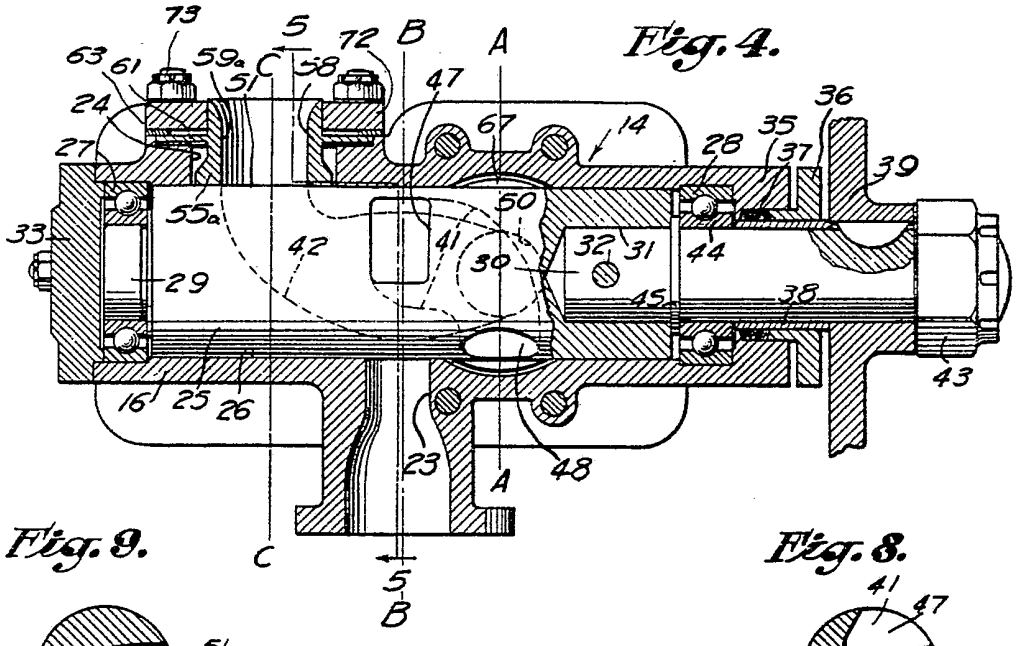


Fig. 4.

Fig. 9.

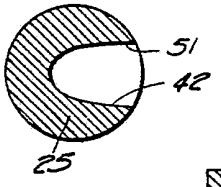


Fig. 8.

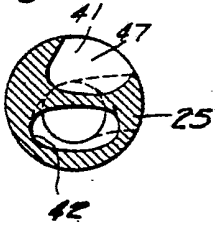


Fig. 5.

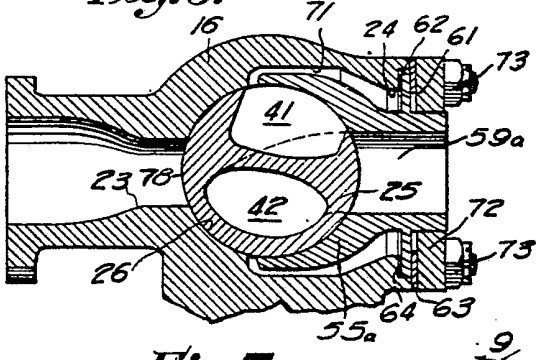


Fig. 6.

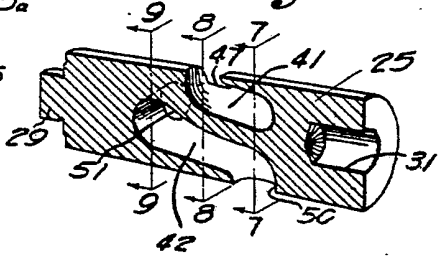


Fig. 7.

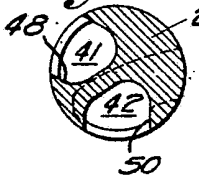


Fig. 10.

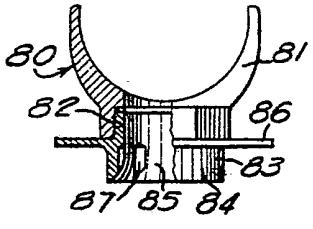


Fig. 1.

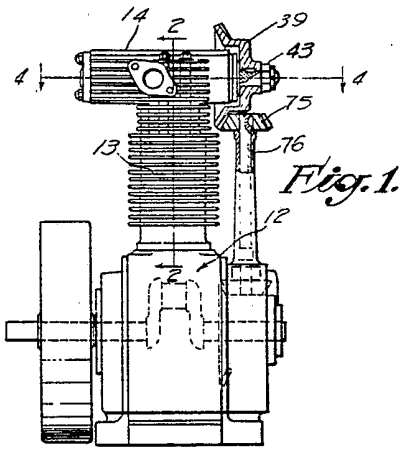


Fig. 2.

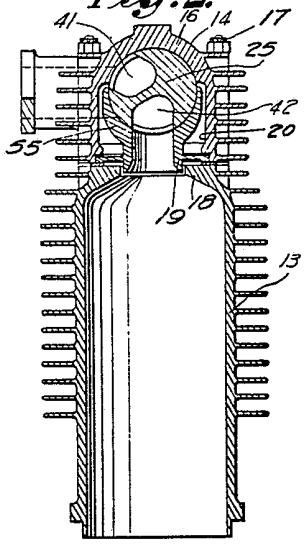


Fig. 3.

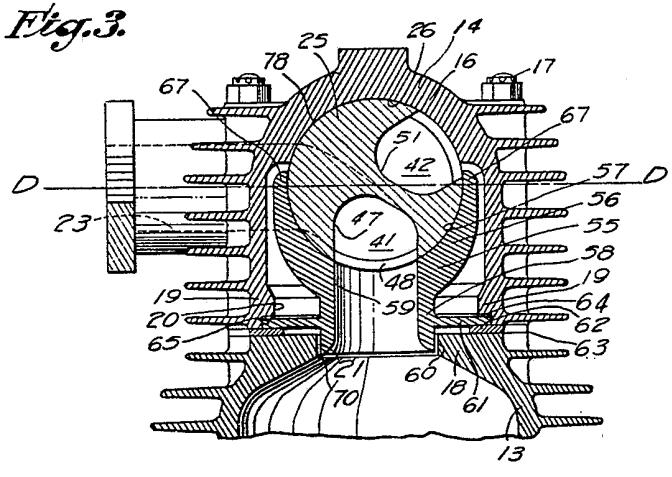
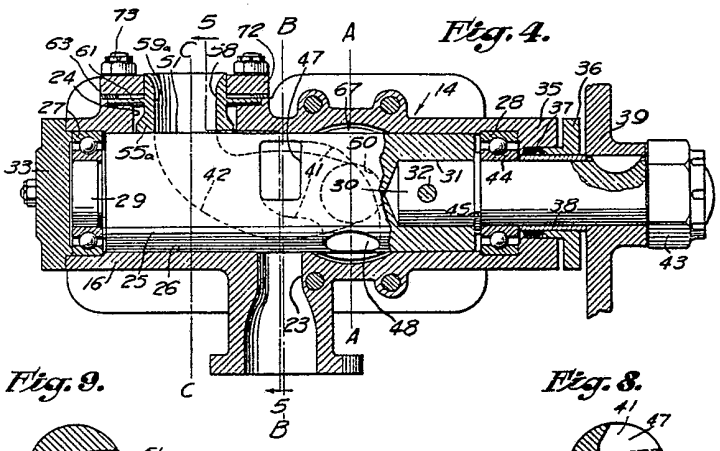


Fig. 4.



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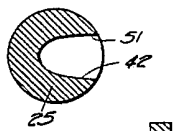

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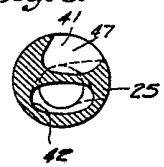


Fig. 5.

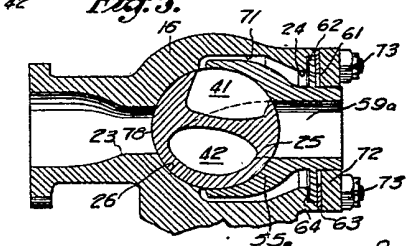
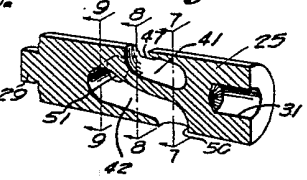


Fig. 6.



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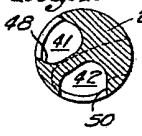
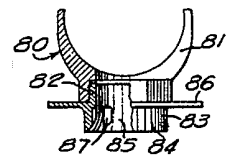


Fig. 10.



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