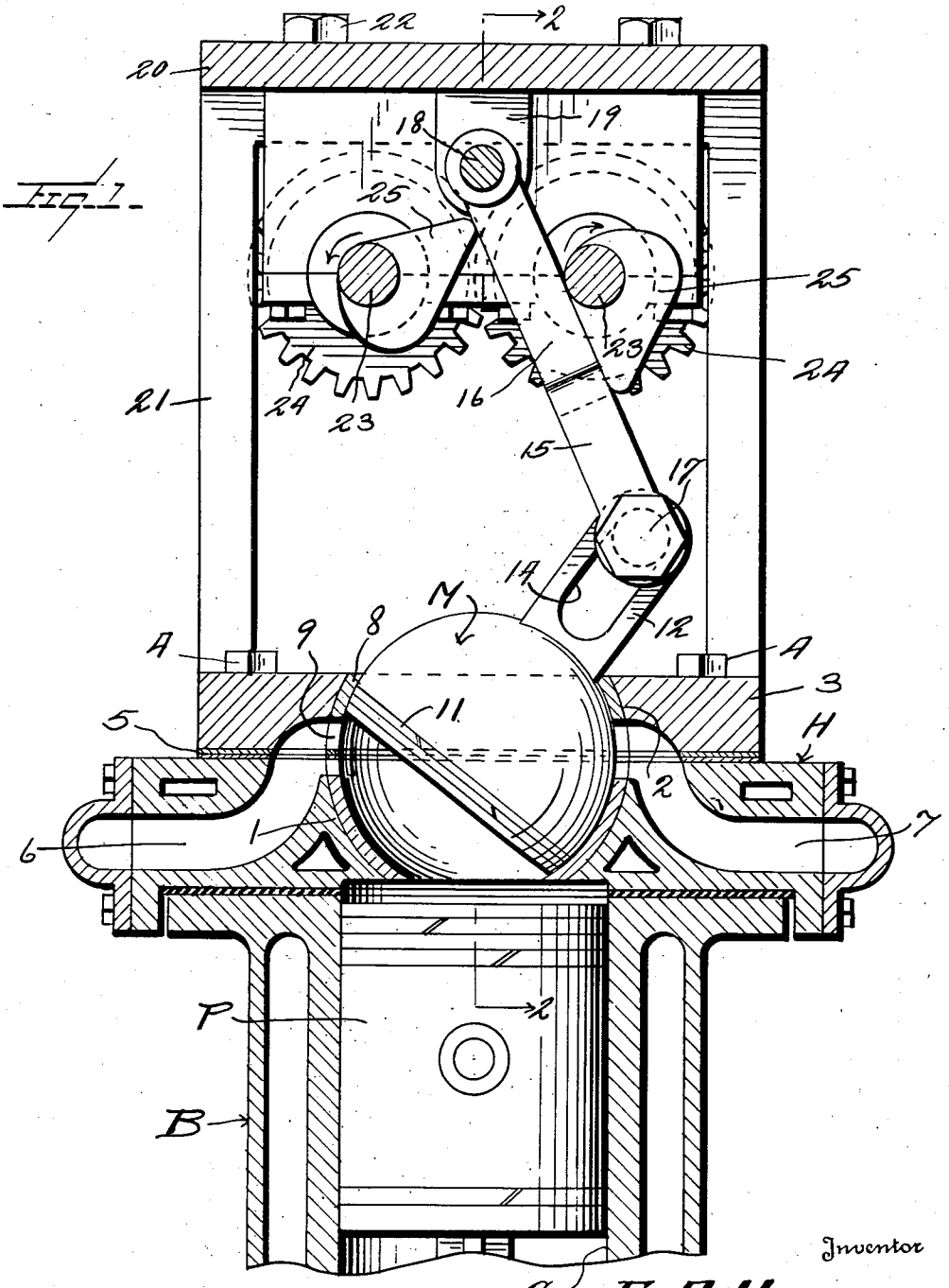
April 2, 1935. E. A. HAGAN 1,996,675

VALVE STRUCTURE

Filed Sept. 22, 1932 2 Sheets-Sheet 1

Fig. 1

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VALVE STRUCTURE

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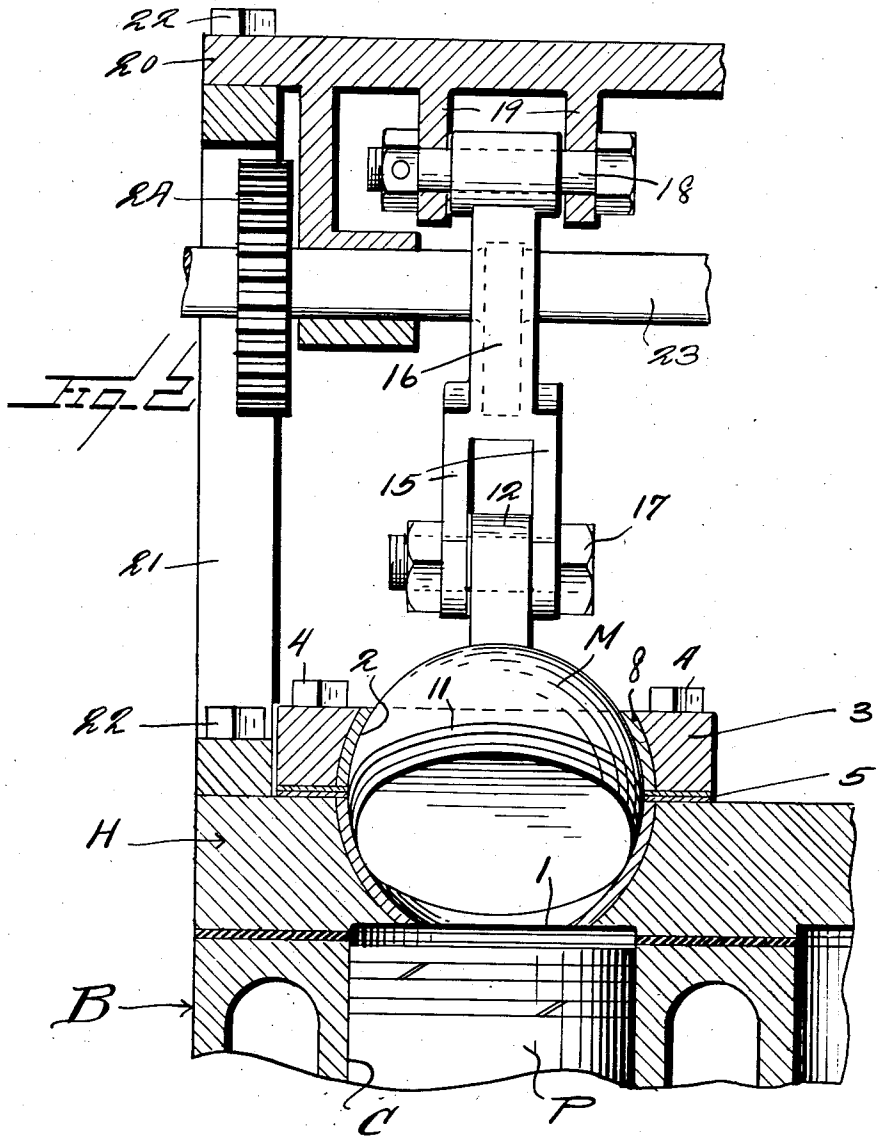


Fig. 2

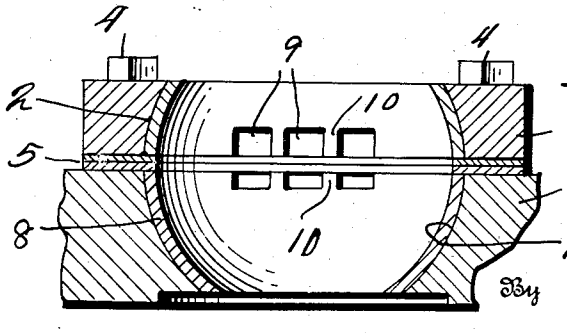


Fig. 3

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# UNITED STATES PATENT OFFICE

1,996,675

## VALVE STRUCTURE

Edward A. Hagan, Butler, Pa.

Application September 22, 1932, Serial No. 634,433

1 Claim. (Cl. 74—54)

This invention relates to a valve structure for internal combustion engines and has relation more particularly to a structure of this kind wherein the valve member is parti-spherical and which is employed in connection with a seat allowing an effective mounting of the valve member without the necessity of trunnions or the like.

It is an object of the invention to provide a valve structure wherein means are provided to compensate for wear of the valve member or its seat.

An additional object of the invention is to provide a mechanism of this kind wherein the valve member is parti-spherical and wherein a valve lever and coacting cams are employed to effect the desired timed adjustment of the valve member.

The invention consists in the details of construction and in the combination and arrangement of the several parts of my improved valve structure whereby certain important advantages are attained and the device rendered simpler, less expensive and otherwise more convenient and advantageous for use, as will be hereinafter more fully set forth.

The novel features of my invention will hereinafter be definitely claimed.

In order that my invention may be the better understood, I will now proceed to describe the same with reference to the accompanying drawings, wherein:—

Figure 1 is a view partly in section and partly in elevation illustrating a valve mechanism constructed in accordance with an embodiment of my invention;

Figure 2 is a sectional view taken substantially on the line 2—2 of Figure 1 with certain of the parts in elevation;

Figure 3 is a fragmentary sectional view illustrating in detail the valve seat as herein disclosed.

As disclosed in the accompanying drawings, B denotes a cylinder block with which is associated in a conventional manner a head H. The head H has in communication with each of the cylinders C of the block B a port 1 which is continued, as at 2, through a superimposed plate 3 bolted, as at 4, or otherwise anchored to the head H. Interposed between the applied plate 3 and the head H are the shims 5 for a purpose to be hereinafter more particularly set forth and through which the port 1, 2 is also continued.

The port 1, 2 is parti-spherical in form or, in other words, has its wall in cross section curved on a radius concentric to an axis at a desired distance above the end of the port 1 discharging within a cylinder C and coincident to the axis of such discharge end of the port.

At diametrically opposed points the port 1, 2 has opening therein an intake port 6 and an exhaust port 7 and each of these ports at its inner end is relatively broad. Snugly engaged within the port 1, 2 are the upper and lower liners 8 of cast iron or other desired material, the opposed margins of which being provided with registering recesses 9 providing slots affording communication with either the intake port 6 or the exhaust port 7. These recesses 9 provide intermediate ribs 10 for a purpose to be hereinafter more particularly referred to and it is to be noted that the shims 5 are so formed as to also be received between the ribs 10 of the liners 8.

Snugly engaged within the port 1, 2 for oscillation therein is a valve member M. This member M is parti-spherical in form and in excess of a semi-sphere. The inserted or marginal portion of the valve member M also carries the surrounding compression rings 11 of a conventional type for coaction with the liners 8. As the valve member M is oscillated the ribs 10 hold the rings 11 against tendency to spring too far outwardly with the liability to project sufficiently within the adjacent portions of the ports 6 and 7 to interfere with the efficient operation of the member M. The outer rounded portion of the member M is provided with the outstanding and radially disposed post 12 provided with a longitudinally disposed slot 14. The free end portion of the post 12 is received between the spaced arms 15 carried by one end portion of a valve lever 16 and freely disposed through the slot 14 is a bolt 17 carried by and bridging the space between the outer extremities of the arms 15.

The opposite end portion of the lever 16 is pivotally mounted, as at 18, between a pair of depending lugs 19 carried by a bracket frame 20. This frame 20 extends along the engine block B at a desired distance thereabove and each end portion of the bracket frame 20 is supported by a frame 21 interposed between the adjacent end portions of the bracket frame 20 and block B or more particularly the head H. Each of the frames 21 is bolted, as at 22, or otherwise secured to the bracket frame 20 and the head H.

Rotatably supported by the bracket frame 20 and positioned therebelow and equidistantly spaced at opposite sides from the pivotal mounting 18 for the lever 16 are the cam shafts 23

geared together, as at 24, for unitary rotation in opposite directions at the same speed and adapted to be driven at desired speed by any suitable timing assembly. The cam shafts 23 carry the cam members 25 each coacting with the lever 16 and operating to oscillate said lever 16 at required speed as to cause the valve member M to close the ports 6 and 7 and to open such ports in required timed sequence.

As is particularly illustrated in Figure 1 the cam members 25 are of duplicate construction and each is substantially right triangular in form with its side margin merging with the periphery of its associated shaft 23. The base margin of each of the cam members 25 is disposed on an outward curvature and said base portion extends a material distance to one side of the shaft 23 remote from the side margin of the cam member. The hypotenuse margin of the cam member is disposed on such an angle with respect to the side margin of the cam member that when the side margin of one of the cam members is in contact from end to end with the lever 16, the hypotenuse margins of the cam members are in parallelism and when said hypotenuse margins are in such parallel relation, the side margins of the cam members are substantially at right angles. The vertex of each of the cam members is rounded.

When the post 12 is in a central position the valve member M is in an adjustment to close both of the ports 6 and 7 and such ports will be maintained closed of course during the compression and firing strokes of the piston P operating in the cylinder C. At this time the rings 11 will be below the ports 6 and 7 and operate to effectively seal the compression.

In proper timed sequence the valve member M will be moved to the position illustrated in Figure 1 to afford communication with the intake port 6 or in the required further position to afford communication with the exhaust port 7.

In the operation of the valve member M the cam members 25 are at all times in contact with the lever 16 and it is to be noted that the formation of the cam members is such as to permit the desired oscillation of the lever. By this coaction of the cam members 25 with the lever 16, the valve member M is effectively maintained in its various positions and is caused to have its desired movements without the necessity of using springs or the like. Upon undue wear of the valve member M or the liners 8 a shim 5 can be readily removed as required to compensate for such wear. It is also to be noted that the valve member M aside from the port 1, 2 requires no mounting and that the resultant simulation of a ball and socket arrangement afforded by the valve member M and its seat facilitates lubrication and also assures at all times an effective functioning of the valve member.

The formation of the member M provides an inner or inserted closed flat face substantially at right angles to the longitudinal axis of the post 12. This flat face facilitates the desired flow into or out of the cylinder C.

While I have described and illustrated my invention as particularly employed in connection with an internal combustion engine, it is to be stated that with slight modifications it can be employed to the same advantage in connection with a steam engine.

From the foregoing description it is thought to be obvious that a valve structure constructed in accordance with my invention is particularly well adapted for use by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification without departing from the principles and spirit thereof and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice except as hereinafter claimed.

I claim:—

An operating mechanism comprising a lever supported for swinging movement, revolving cam members constantly contacting with the lever at opposite sides, each of said cam members being substantially right triangular in form with its base margin disposed on an outward curvature, the hypotenuse margins being substantially parallel and the side margins being substantially at right angles when the side margin of one of the cam members is in contact from end to end with the lever, and means for simultaneously rotating the cam members one in a clockwise direction and the other in an anti-clockwise direction, said last named means including a shaft for each of the cam members, the side margin and the base margin of each of the cam members merging with the periphery of the shaft.

EDWARD A. HAGAN.