July 18, 1933. A. MOORHOUSE 1,918,481

INTERNAL COMBUSTION ENGINE

Filed Sept. 5, 1930

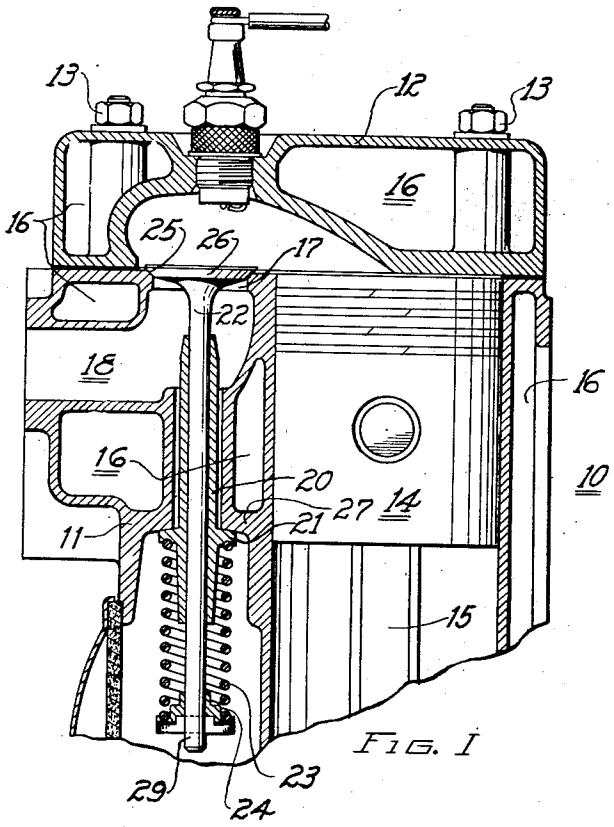


FIG. 1

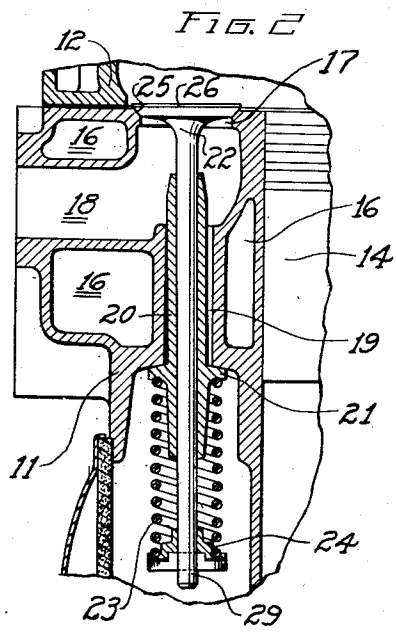


FIG. 2

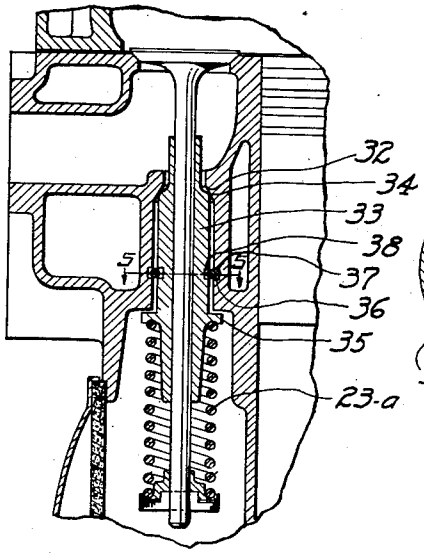


FIG. 3

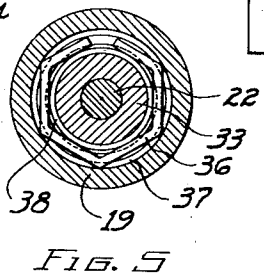


FIG. 5

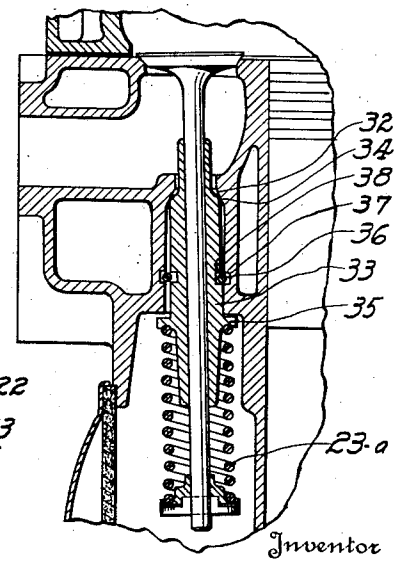


FIG. 4

Inventor

ALFRED MOORHOUSE

By Mullen & Mullen

Attorney

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UNITED STATES PATENT OFFICE

ALFRED MOORHOUSE, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN

INTERNAL COMBUSTION ENGINE

Application filed September 5, 1930. Serial No. 479,957.

My invention relates to internal combustion engines and has particular relation to the valve and valve guide structures of such engines.

Difficulty is sometimes encountered because of improper seating of the valves and sticking and undue wear of the valves and valve stems of internal combustion engines. In investigating the causes of these difficulties the conclusion has been reached that the greater proportion of trouble is caused by warpage of the cylinder block because of seasoning or by unequal expansion and contraction of the portions of the cylinder block surrounding, and adjacent to, the intake and exhaust passages. I have, therefore, provided a means for overcoming these valve difficulties.

An object of my invention is to provide means for insuring proper seating of the valves of an engine or the like under all the conditions met with in operation.

Another object of my invention is to provide a valve and valve guide structure which prevents sticking and unequal or undue wear of the valve and valve guide parts.

Another object of my invention is to provide a structure of the above description which will permit self-alignment of the valves and valve guides.

Another object of my invention is to provide a structure of the above description which shall permit ready assembly and disassembly of the valves and valve guides within the motor and permit also ready replacement of worn or injured guides and valves.

Other objects of my invention will appear from the following description taken in connection with the drawing which forms a part of this specification and in which:

Figure 1 is a view in section of a portion of an internal combustion engine showing my new device incorporated therein;

Fig. 2 is a view in section of the engine shown in Fig. 1 under conditions of unequal expansion of the parts of the cylinder block. The displacement resulting has been greatly exaggerated for the purpose of a better explanation;

Fig. 3 is a view in section of another embodiment of my invention;

Fig. 4 is a sectional view of the structure shown in Fig. 3 under conditions of unequal expansion of the parts, the displacement being greatly exaggerated, and

Fig. 5 is a view in section of the valve guide holding means shown in Figs. 3 and 4 and taken on the line 5—5 of Fig. 3. The view is enlarged for better illustration.

Referring more particularly to Fig. 1, my device is particularly suitable for use with an internal combustion engine including a cylinder structure 10 which includes an intake and exhaust manifold 11 to which is attached a cylinder head 12 by means of bolts 13. The usual piston 14 and connecting rod 15 have been shown in position in the cylinder block. The usual cooling chambers 16 are employed for cooling the block and head. The manifold is provided with the usual poppet valves 22, valve ports 17 and intake and exhaust passageways 18.

In one of the preferred embodiments of my invention, the valve guide passage or opening 19 is provided at its lower end with a wall or flange 27 which may be concave in cross section, having its center of curvature preferably at the lower end of the valve stem 29. The valve guide 20, contrary to the usual practice, is of such a diameter that it is loosely engaged in the valve guide opening, and a shoulder 21 which is convex at its upper surface to cooperate with the concave lower surface of the flange 27, permits the valve guide to move to a limited extent within the opening and the valve guide 20 and valve 22 to move laterally, gyrate or pivot about a center or to move bodily to secure proper seating of the valve 22.

The valve guide is held in position against the flange 27 by reason of the action of the spring 23 which is disposed between the washer 24 and the shoulder 21 on the valve guide.

If movement of the valve port 17 with relation to the valve guide 20 occurs, by reason of unequal expansion or warpage of the cylinder structure or the like, so that

the valve port occupies some new position, as shown in Fig. 2, (in which the displacement has been greatly exaggerated) it can readily be understood that, because of the biasing action of spring 23, the shoulder of the valve guide will slide with relation to the face of the flange 27 by reason of the self centering effect of the sloping circular face of the valve head 26 upon the sloping circular face of the valve seat 25 and the loosely held guide will shift bodily to a position such that the valve 22 seats properly in the port 17.

Since the valve and valve stem are free to move with respect to the cylinder structure it follows that they will not bind in any way on or within the valve stem or port. It is apparent also that after the head 12 has been removed the valve guide and the valve may quickly be removed from the manifold by removing the washer 24, which has been engaged on the valve stem in the usual manner, thus permitting removal of the spring 23 and the valve and valve guide. The whole assembly is preferably held in place by spring 23 and may be assembled by reversing the process just described.

In another embodiment of my invention shown more particularly in Figs. 3, 4 and 5 I prefer to employ a valve stem passageway or opening which is constricted at its upper portion to constitute a circular seat 32, the wall of which slopes at an angle with the horizontal. The valve guide 33 is loosely engaged within the valve passage and is provided with a convex shoulder portion 34 which is adapted to coact with the sloping portion of the constriction in the valve passage to constitute a bearing for the valve guide about which the guide may move freely in all directions. The shoulder 35 acts as a seat for the spring 23*a* which holds or assists in holding the guide in place. The valve guide may be held within the valve passageway in the same manner as the guide is held in the embodiment illustrated in Figs. 1 and 2 or may be locked in position by means of an irregularly shaped ring 36 provided with outwardly projecting portions adapted to engage a suitable groove 37 in the valve passageway and provided also with flattened portions adapted to engage a registering groove 38 in the valve guide. This construction secures the same result, in substantially the same manner, as that shown in Figs. 1 and 2. The valve guide seat is adjacent the heated passageways 18 and the port 17 so that the effect of differential expansion is minimized.

Both constructions are operative to compensate for misalignment of the valve guide and valve port in any direction and from any cause, as for instance unequal expansion and contraction, warpage and the like. The valve heads always seat properly. There is no lateral pressure on the valve and valve stem to cause sticking and undue wear. The valve and its parts may be readily assembled and disassembled in the cylinder.

Although I have described certain preferred embodiments of my invention, it is apparent that modifications may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim as my invention:

1. In an internal combustion engine, a cylinder structure having a port and valve seat and having an opening for a valve guide opposite the port, the opening being constricted at one portion thereof, a poppet valve for said port cooperating with said seat and having a stem extending through said opening, a valve stem guide having a rounded shoulder adapted to engage the constriction but otherwise loosely engaged within the opening and means for holding the guide within the opening.

2. In an internal combustion engine, a cylinder structure having a port and an opening for a valve guide therein, the opening being provided between its ends with an inwardly projecting seat, a valve, and a valve guide loosely engaged within the opening provided with a shoulder coacting with the inwardly projecting seat to provide for universal lateral movement of the guide in the opening to permit the valve to properly seat on the port.

3. In an internal combustion engine, a cylinder structure having a port and an opening for a valve guide therein, the valve guide opening being constricted at its upper portion, a valve for the port, a valve guide loosely disposed in the passage having a reduced upper end portion and a shoulder adapted to engage the wall of the passage, the shoulder and passage wall being disposed to provide for seating of the guide to permit movement of the valve guide to in turn permit proper seating of the valve on the port.

4. In an internal combustion engine, a cylinder structure having an opening for a valve guide therein, the walls of said opening being provided with an annular groove, a valve guide loosely engaged within the opening having a peripheral groove registering with the groove in the walls of the opening, and means between the valve guide and the walls of the opening and registering with said grooves adapted to maintain the valve guide in position within the opening.

5. In an internal combustion engine, a cylinder structure having an opening for a valve guide therein, the walls of said opening being provided with an annular groove, a valve guide loosely engaged with-

in the opening having a peripheral groove registering with the groove in the walls of the opening, and a ring of irregular shape encircling the valve guide and interposed between the walls of the opening and the valve guide, said ring having projections thereon engaging the groove in the walls of the opening and flattened portions engaging the groove on the valve guide, said parts coacting to provide for universal lateral movement of the guide in the opening.

6. In an internal combustion engine, a cylinder structure having a port, a valve seat and an opening for a valve guide therein, the opening being constricted and the walls thereof being provided with an annular groove, a poppet valve for said port cooperating with said seat and having a stem extending through said opening, a valve stem guide having a rounded shoulder adapted to engage the constricted portion of the opening but otherwise loosely engaged within the opening, said valve stem guide also having a peripheral groove registering with the groove in the walls of the opening, and means between the valve guide and the walls of the opening and registering with both of said grooves adapted to maintain the valve guide in position within the opening.

7. In an internal combusion engine, a cylinder structure having a port, a valve seat and an opening for a valve guide therein, the opening being constricted and the walls thereof being provided with an annular groove, a poppet valve for said port cooperating with said seat and having a stem extending through said opening, a valve stem guide having a rounded shoulder adapted to engage the constriction but otherwise loosely engaged within the opening, said valve stem guide also having a peripheral groove registering with the groove in the walls of the opening, and a ring of irregular shape encircling the valve guide and interposed between the walls of the opening and the valve guide, said ring having projections thereon engaging the groove in the walls of the opening and flattened portions engaging the groove on the valve guide, said parts coacting to provide for universal lateral movement of the guide in the opening to permit the valve to properly seat on the port.

8. In an internal combustion engine, a cylinder structure having a port, a valve, a valve stem guide passage, the wall portion of said passage having a concave surface, and a valve guide having a convex surface loosely engaged with the concave surface, the radii of the convex and concave surfaces being equal to the length of the valve between its end and the intersection of said surfaces with the valve stem.

9. In an internal combustion engine, a cylinder structure having a port, a valve, a valve stem guide passage, the wall portion of said passage having a concave surface, and a valve guide having a convex surface loosely engaged with the concave surface, said surfaces, when the valve is closed, lying on the surface of a sphere the center of which is at that end of the valve stem which is opposite to the port.

10. In an internal combustion engine, a valve port, a valve having a stem, a valve stem guide for piloting the stem, and supporting means for said guide, said supporting means including a wall curved about a point coinciding with the end of the valve stem opposite from the port.

11. In an internal combustion engine having a valve comprising connected head and stem portions, a yieldable support for said stem including surfaces curved on a radius drawn from the end of the stem opposite from the head.

ALFRED MOORHOUSE.