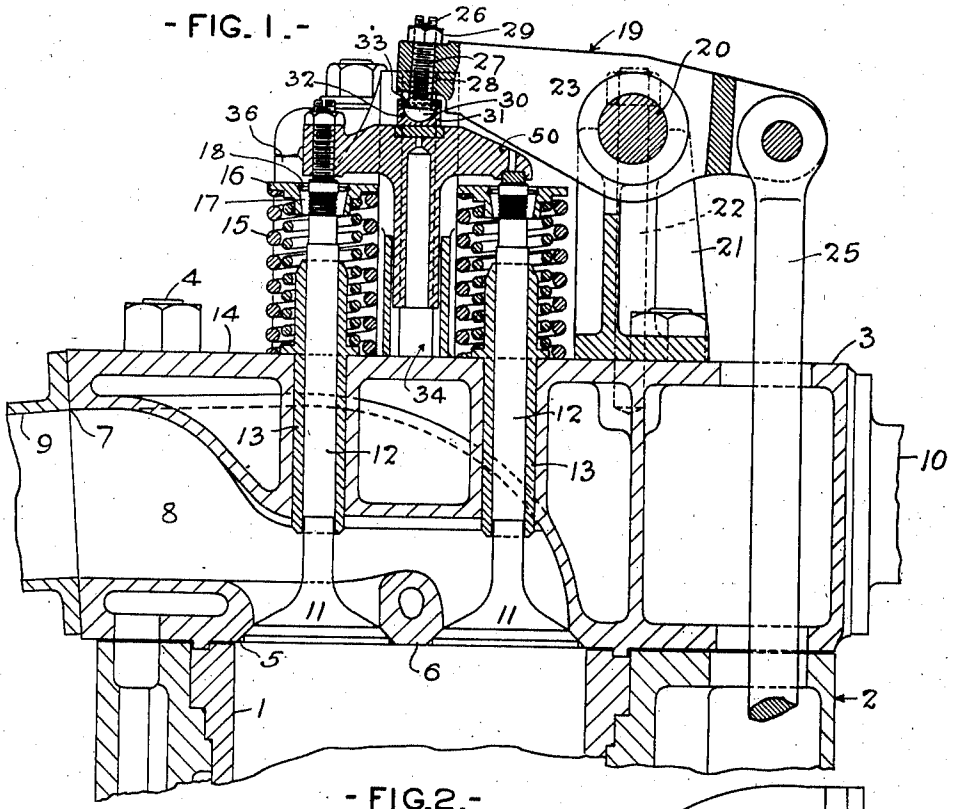
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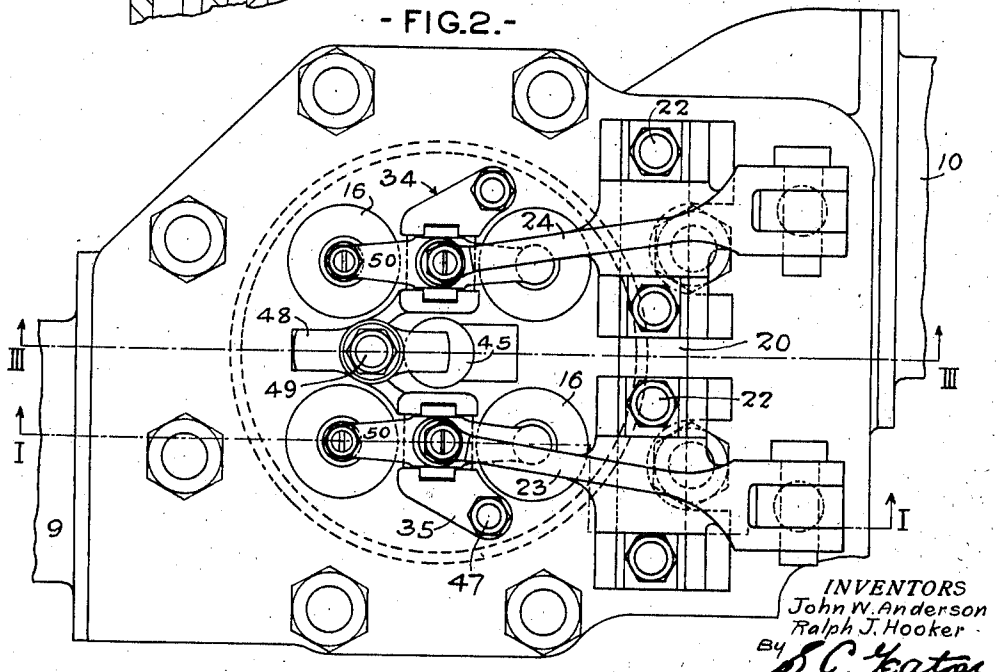
INTERNAL COMBUSTION ENGINE

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- FIG. 1 .-



- FIG. 2.-



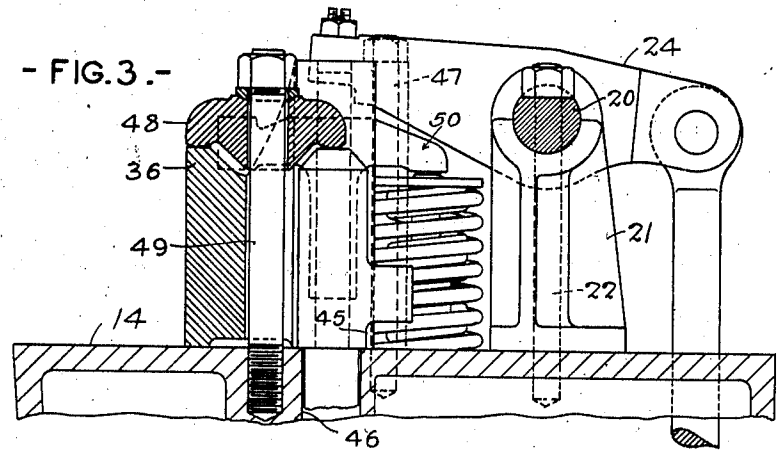
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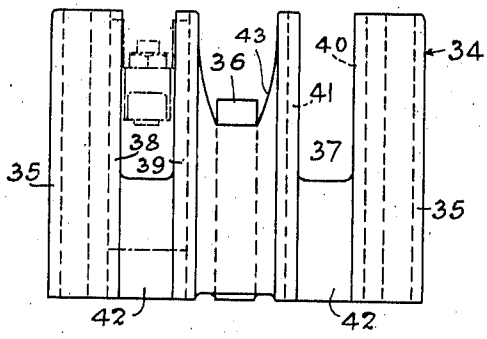
INTERNAL COMBUSTION ENGINE

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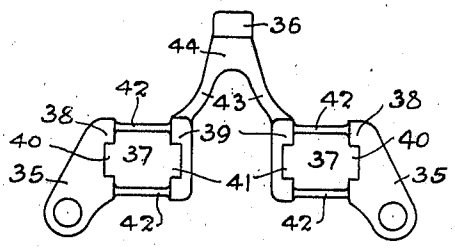
- FIG. 3 .-



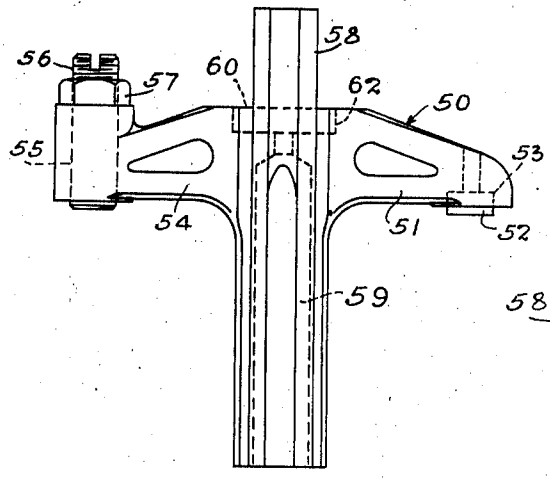
- FIG. 4.-



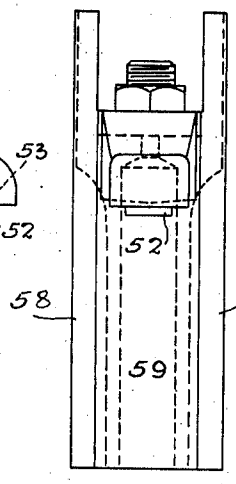
- FIG. 5.-



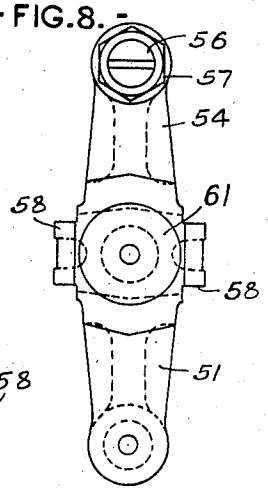
- FIG. 6.-



- FIG. 7.-



- FIG. 8. -



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Patented Jan. 26, 1943

2,309,291

UNITED STATES PATENT OFFICE

2,309,291

INTERNAL COMBUSTION ENGINE

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Application October 10, 1941, Serial No. 414,434

5 Claims. (Cl. 123—90)

This invention relates to internal combustion engines, and more particularly to valve-operating mechanism therefor.

An object of the present invention is to provide a valve-operating mechanism including a device having improved crosshead guides, the device having a three-point bearing on the cylinder head.

A further object is to provide in a valve-operating mechanism, simplified means of securing the crosshead guide and fuel injector nozzle to the cylinder head.

Other and further objects of this invention will appear from the following description, the accompanying drawings and the appended claims.

Referring to the drawings forming a part of this application, Figure 1 is a sectional view taken on the line I—I of Fig. 2, showing a portion of an internal combustion engine including the valve-operating mechanism of the present invention, parts being shown in full; Fig. 2 is a plan view of the structure shown in Fig. 1; Fig. 3 is a section on the line III—III of Fig. 2, parts being shown in full and parts being broken away; Fig. 4 is a side elevation of a crosshead guide forming part of the valve-operating mechanism, a crosshead being indicated in dot and dash lines; Fig. 5 is a plan view of the crosshead guide of Fig. 4; Fig. 6 is an enlarged front elevation of a crosshead of the valve-operating mechanism; Fig. 7 is an end view of the crosshead shown in Fig. 6, viewed from the right thereof; and Fig. 8 is a plan view of the crosshead of Fig. 6.

Referring to the drawings, only one cylinder 1 of the internal combustion engine 2 is shown. However it will be understood that the present invention will ordinarily be employed in a multi-cylinder engine and that the structure shown in the drawings will be similar for each cylinder of the engine. The cylinder 1 is closed at its upper end by cylinder head 3 secured to the cylinder by bolts 4. Four valve ports 5 are formed in the bottom wall 6 of the cylinder head above the cylinder, there being two similar inlet ports and two similar exhaust ports. The inlet ports are transversely aligned and the exhaust ports are transversely aligned. One pair of similar ports is connected to an opening 7 in one side of the cylinder head by a common passageway 8, and the other pair of similar ports is connected to a substantially similar opening on the opposite side of the cylinder head by a substantially similar common passageway. A manifold 9 is secured to the cylinder head in communication with passageway 8 and a manifold 10 is secured to the cylinder head in communication with the other passageway.

The ports are controlled by valves 11. For the purpose of understanding the present invention it is immaterial which valves are inlet valves and which valves are exhaust valves. However, for the purpose of the present description, the valves shown in Fig. 1 will be considered the inlet valves.

As the two inlet valves are simultaneously operated in the same direction they are known as dual inlet valves. They perform the function of a single large inlet valve controlling a single large inlet port. Similarly the exhaust valves are known as dual exhaust valves.

The valves 11 each have a stem 12 sliding in a guide 13 and extending above the top wall 14 of the cylinder head. They are held in port-closed position by springs 15 disposed around the valve stems, seated at their bottoms on the top wall 14, and pressing at their tops against valve spring washers 16, secured to the valve stems in a well-known manner by conical nuts 17 and nut-retaining split rings 18. The valve stems project slightly above the top faces of the washers.

The valve-operating mechanism is indicated generally by the reference numeral 19. It includes a rocker shaft 20, which is mounted in four posts 21 secured to the cylinder head by stud bolts 22. The particular mounting of the rocker shaft forms no part of the present invention. In the present instance it is secured in the posts against rotation relative thereto by the bolts 22 which pass through the shaft and posts, the shafts having flat portions upon which the nuts of the bolts seat. The posts may be made separately or may be connected in pairs by webs as shown in Fig. 2. Referring to Fig. 2 it will be seen that the two posts opposite the inlet valves are formed as a single casting. The other two posts are similarly constructed.

Shaft 20 extends longitudinally of the cylinder head, as is shown in Fig. 2, at one side of an inlet and an exhaust valve. A rocker arm 23 extends to the inlet valves and a rocker arm 24 extends to the exhaust valves, the rocker arms being mounted at intermediate portions on the rocker shaft for rocking relative thereto. The rocker arms fit between adjacent posts, longitudinal movement of the rocker arms relative to the shaft thereby being prevented.

A push rod 25 is pivotally connected to the outer end of each rocker arm and depends to the cam shaft (not known) in the usual manner, the push rods passing through the cylinder head and cylinder block.

An adjustable part or screw 26 is secured to the inner end of each rocker arm. Each adjusting screw consists of a threaded body portion 27 engaging a threaded orifice 28 in the rocker arm, a lock nut 29 engaging the top face of the rocker arm, and a convexly curved head 30 formed integrally on the lower end of the body portion 27. The top face of the body portion 27 is slotted for application of a screw driver to effect adjustment. A separate part serving as a slide block 31 is formed with a concave recess 32 which engages the convex head 30 and a split retaining ring 33 holds the block and head together. The slide block is thus mounted on the head for universal movement relative thereto. It may be made of wear-resistant metal insuring long life.

A crosshead guide device 34 is disposed between the valve stems and valve springs in such a way that the valve stems and valve springs are all exterior to the guide device and thus accessible for inspection as is clearly shown in Fig. 2.

The device 34 is best shown in Figs. 2, 4 and 5. It is designed to provide a three-point support, such support giving stability to the device. Two of the supports are provided by the orificed parts 35 and the third support, which is intermediate the two parts 35 and spaced laterally therefrom, is provided by a solid part 36. Two crosshead guides 37 are formed in the device 34, one disposed between the inlet valves and one disposed between the exhaust valves. The device 34 is an integral structure and the crosshead guides are therefor formed with the parts 35 and 36 as one piece. Each guide includes an outer guideway 38 and an inner guideway 39. The guideways 38 and 39 are of block formation having vertical channels 40 and 41 respectively. The guideways 39 are connected to their respective opposite guideways 38 by two webs 42.

Guideways 39 are connected to the part 36 by legs 43 of a V-shaped yoke 44, and are sufficiently spaced to provide room for a fuel injector nozzle 45 which is disposed over the center of the cylinder and extends, through an orifice 46 in the cylinder head, to the cylinder in the usual manner, and projects upwardly from the top wall 14, the projecting portion having a shoulder for seating it upon the wall 14 and a pipe connection extending from one side thereof. Part 36 is shorter than parts 35, extending upwardly from the top wall 14 of the cylinder head the same distance that the injector nozzle extends thereabove.

Stud bolts 47 secure the parts 35 to the cylinder head, and a clamp 48, seating at its outer end on the part 36 and at its inner end on the injector nozzle 45, secures both the part 36 and the injector nozzle 45 to the cylinder head, the clamp 48 being secured to the cylinder head by a stud bolt 49 which is disposed between its ends and extends through the apex of the V-shaped yoke 44.

The device 34 provides a simple way of securing the injector nozzle to the cylinder head, that is to say, it is only necessary to remove one bolt, the bolt 49, in order to remove the injector nozzle, and this in no way involves the disassemblage of any other part of the valve gear mechanism from the cylinder head. By the removal of only two additional bolts the entire crosshead guide device can be removed, and this may be accomplished without disturbing the valves or valve springs.

A crosshead 50 slides in each crosshead guide, and as the crossheads are similar only one will be described, namely the crosshead shown in Fig. 1 and enlarged in Figs. 6 to 8.

The crosshead 50 includes an arm 51 extending to one inlet valve 11. A wear disc 52 is secured in a socket 53 formed in this arm, and this wear disc operably engages the top of the adjacent valve 11. Another arm 54 extends in the opposite direction to the other inlet valve 11 of the same set of dual valves. A threaded orifice 55 is formed in the outer end of arm 54 and an adjustable part or screw 56 is threaded in this orifice and secured at an adjusted position therein by the lock nut 57, the lower end of the screw 56 projecting below the bottom face of the arm 54 and operably engaging the top of the adjacent inlet valve 11. The top face of the screw 56 is slotted for application of a screw driver to effect adjustment.

Crosshead 50 further includes vertical shoes 58 extending at right angles to the arms 51 and 54. The shoes slidably engage the channels 40 and 41 of the crosshead guide adjacent the inlet valves 11, adapting the crosshead to move vertically in the guide. Each shoe is similar to a rectangular bar in shape, grooved somewhat to reduce the weight thereof. The shoes are connected to the arms by an integral hollow body portion 59, the shoes having portions integral with the body portion 59 and portions extending upwardly above the arms 51 and 54, the cross head being T-shaped in elevation, as is shown in Fig. 6.

A seat 60 is formed in the crosshead by a circular insert 61 disposed in a recess 62 in the top face of the body portion 59 between the shoes, the seat being even with the top of the arms 51 and 54. Thus the seat is disposed intermediate the ends of the shoes. Seat 60 is operably engageable by slide block 31. The crosshead rests due to gravity on top of the valve stems and preferably a slight clearance is provided between the slide block 31 and the seat 60 when the valves are closed, permitting expansion of the valves due to heat. The adjustment of screw 26 insures proper operation of the valves by the rocker arm and further permits a suitable clearance to be obtained.

The sides of the shoes closely fit in their channels with only a working clearance, thereby preventing lateral movement of the crosshead, and the sliding engagement of the rocker arm with the crosshead minimizes any tendency to tilt the crosshead and to cause binding of the shoes in their channels during the vertical movement. The tendency to produce the tilting is further minimized by continuing the shoes and their channels above the surface of engagement between the crosshead and rocker arm, thereby insuring a smooth and free vertical movement of the crosshead.

In the raised position of the crosshead, the body portion is sufficiently spaced from the wall 14, and the arms from the webs 42, to allow full downward movement of the crosshead.

When the crosshead is inserted in the guide during the assemblage of the engine, if its axis does not coincide with the axis of the guide, true alignment can be obtained by adjusting screw 56. This insures perfectly free sliding of the crosshead in the guides and allows for differences in valve stem lengths and other irregularities.

Slide block 31 is free to rest evenly on the seat 60 due to the universal connection between the slide block and adjusting screw head 30 aforedescribed.

The valve-operating mechanism, as will be seen from the foregoing description, provides for simultaneous opening of the dual valves by the rocker arm and simultaneous closing of the valves

by the springs, the springs securing full closing of the valves, the rocker arm in this position of the valves being free from pressure engagement upon the crosshead.

While the exhaust valves and their associated parts are not completely shown in the drawings, it will be understood that they will be ordinarily similar to the inlet valves and their corresponding parts.

While there has been hereinbefore described an approved embodiment of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof may be made without departing from the spirit of the invention and that all such changes and modifications as fall within the scope of the appended claims are contemplated as a part of this invention.

The invention claimed and desired to be secured by Letters Patent is:

1. An internal combustion engine comprising a cylinder; a cylinder head having a fuel injector nozzle orifice in the central portion thereof and two inlet ports and two exhaust ports for said cylinder disposed around said orifice; a fuel injector nozzle disposed in said orifice and having a part extending outwardly from said head; a common inlet passageway for said inlet ports; a common exhaust passageway for said exhaust ports; dual inlet valves, each controlling one of said inlet ports; dual exhaust valves, each controlling one of said exhaust ports, each of said valves having a stem extending outwardly from said head, said stems being spaced from each other; a device secured to said head and supported thereon at three points of said device, said device having a crosshead guide between said inlet valve stems and a part extending outwardly therefrom providing one of said supports; a crosshead slidably mounted in said guide, having two arms operably engageable each with one of said inlet valve stems, said device further having another crosshead guide between said exhaust valve stems, another part extending outwardly from said other crosshead guide, providing another of said supports, and a part connecting said guides and extending outwardly therefrom between an inlet valve stem and the exhaust valve stem adjacent thereto providing the other of said supports; another crosshead slidably mounted in said other guide, having two arms operably engageable each with one of said exhaust valve stems; separate means for operating each of said crossheads; a clamp engaging at one end said injector nozzle and at its other end said guide-connecting part; and means disposed between said clamp ends securing said clamp to said head.

2. An internal combustion engine comprising a cylinder; a cylinder head having a fuel injector nozzle orifice in the central portion thereof and two inlet ports and two exhaust ports for said cylinder, disposed around said orifice; a fuel injector nozzle disposed in said orifice and having a part extending outwardly from said head; a common inlet passageway for said inlet ports; a common exhaust passageway for said exhaust ports; dual inlet valves, each controlling one of said inlet ports; dual exhaust values, each controlling one of said exhaust ports, each of said valves having a stem extending outwardly from said head, said stems being spaced from each other; a device secured to said head and supported thereon at three points of said device, said device having a crosshead guide between said inlet valve stems and a part extending outwardly therefrom providing one of said supports; means at said support securing said device at said part to said head; a crosshead slidably mounted in said guide, having two arms operably engageable each with one of said inlet valve stems, said device further having another crosshead guide between said exhaust valve stems, and another part extending outwardly from said other crosshead guide, providing another of said supports; means at said other support securing said device at said other part to said head, said device further having a part connecting said guides and extending outwardly therefrom between an inlet valve stem and the exhaust valve stem adjacent thereto providing at its outer end the other of said supports; another crosshead slidably mounted in said other guide, having two arms operably engageable each with one of said exhaust valve stems; separate means for operating each of said crossheads; a clamp engaging at one end said injector nozzle and at its other end said guide-connecting part; and means disposed between said clamp ends securing said clamp to said head for securing said injector nozzle and said device at said last mentioned part to said head.

3. An internal combustion engine comprising a cylinder; a cylinder head; dual inlet and dual exhaust valves in said head having their stems extending therebeyond in spaced relation about the center of said head; a fuel injector nozzle disposed at said center, having a pipe connection extending from one side directed toward the space between an inlet valve stem and an exhaust valve stem adjacent thereto; a crosshead for the inlet valves; a crosshead for the exhaust valves; a unitary crosshead guide device having a yoke between the other of said inlet and exhaust valve stems, and at the side of said nozzle opposite said pipe connection side, a crosshead guide within the space between said inlet valve stems for said inlet valve crosshead, formed integral with one branch of said yoke, and another crosshead guide within the space between said exhaust valve stems for said exhaust valve crosshead, formed integral with the other branch of said yoke, said crosshead guides being disposed respectively opposite the other sides of said nozzle; and means securing said device to said head.

4. An internal combustion engine comprising a cylinder; a cylinder head; dual valves in said head having their stems extending therebeyond; a crosshead for said valves having a body disposed between the valve stems and arms resting on the outer ends of said stems; and a crosshead guide, said guide and said body having adjacent faces at opposite sides of said body, one of each of said adjacent faces being provided with a longitudinal groove and the other adjacent face with a longitudinal tongue slidably engaging said groove, permitting said crosshead to move in a direction axially of said body and confining it against axial rotative movement about its axis.

5. An internal combustion engine comprising a cylinder; a cylinder head; dual inlet and dual exhaust valves in said head having their stems extending therebeyond in spaced relation about the center of said head; a crosshead for the inlet valves; a crosshead for the exhaust valves; a unitary crosshead guide device having a yoke disposed between one of said inlet valve stems and an adjacent exhaust valve stem, a crosshead guide within the space between said inlet valve stems for said inlet valve crosshead, formed integral with one branch of said yoke, and another cross-

head guide within the space between said exhaust valve stems for said exhaust valve crosshead, formed integral with the other branch of said yoke, said crosshead guides each having guideways provided with rectangular channels, and said crossheads having corresponding rectangular shoes disposed in said channels preventing rotative movement of said crossheads about their axes; and means securing said device to said head.

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