United States Patent

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[54] **OVERHEAD VALVE ACTION AND AIR POLLUTANT DEVICE**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **123/90.41,** 123/90.48, 123/188
[51] **Int. Cl.** **F01l 1/14,** F01l 1/18, F01l 3/24
[50] **Field of Search** ..... 123/90, 188 P. 188 GCL. 188 A. 188 AA. 189

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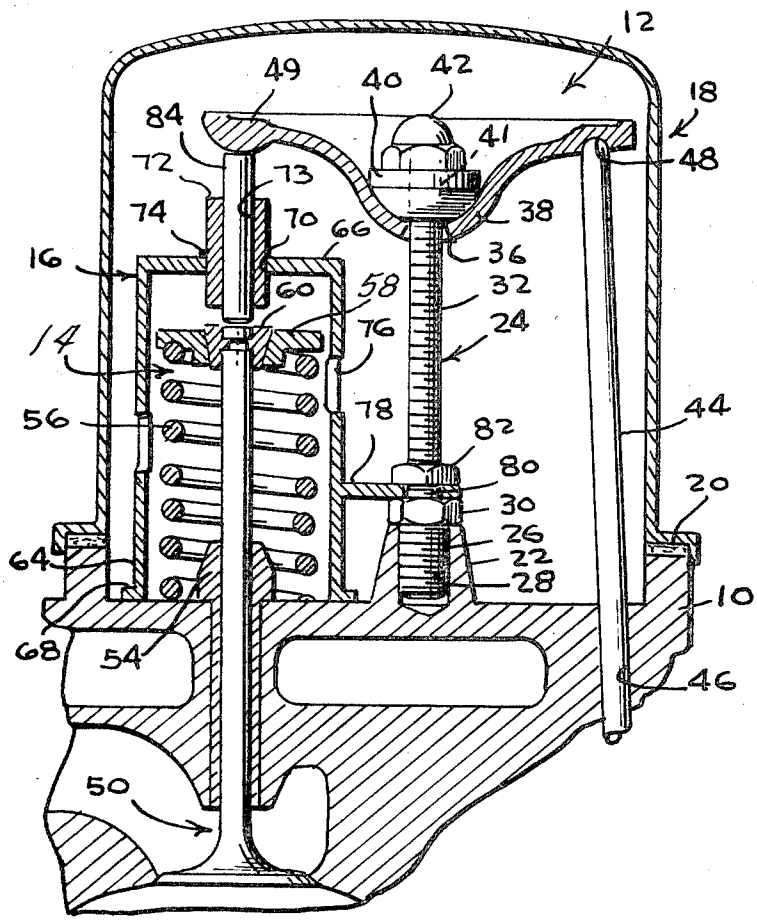
ABSTRACT: A motion-transmitting guide for overhead valve actuating systems for internal combustion engines to take up any horizontal force normally transmitted to the valve stem by the pivoting of the rocker arm assembly.



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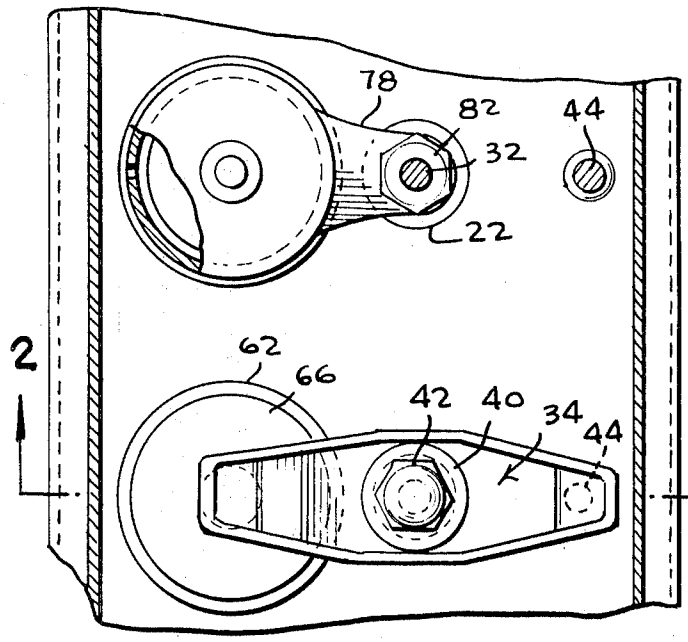

Fig-1

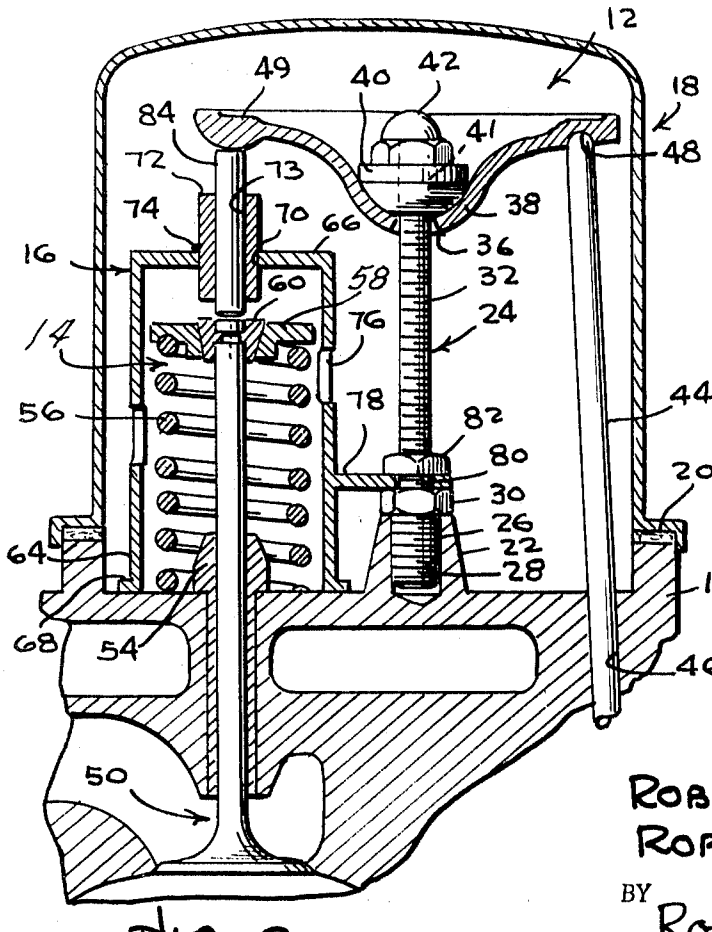

Fig-2

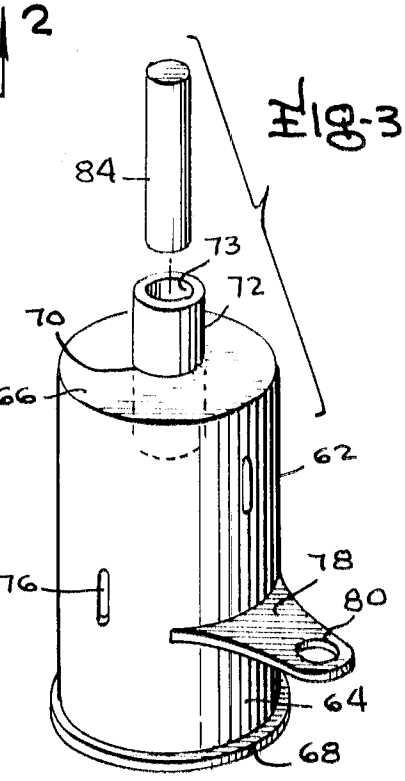

Fig-3

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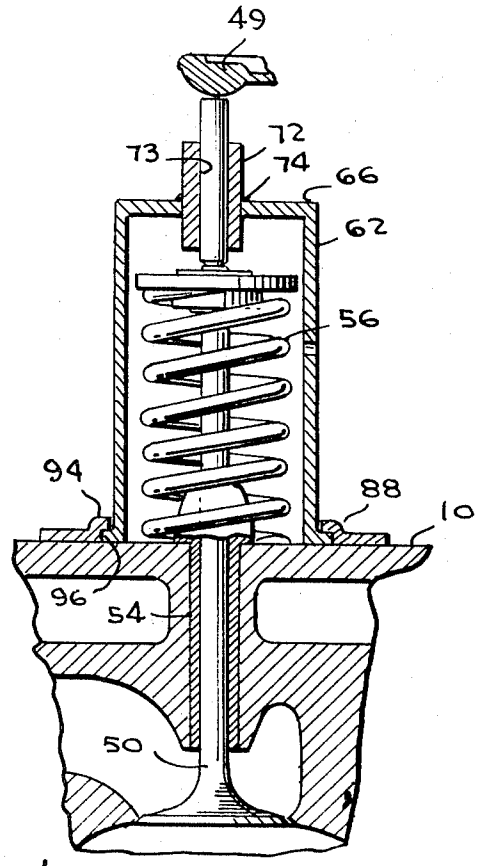

FIG-5

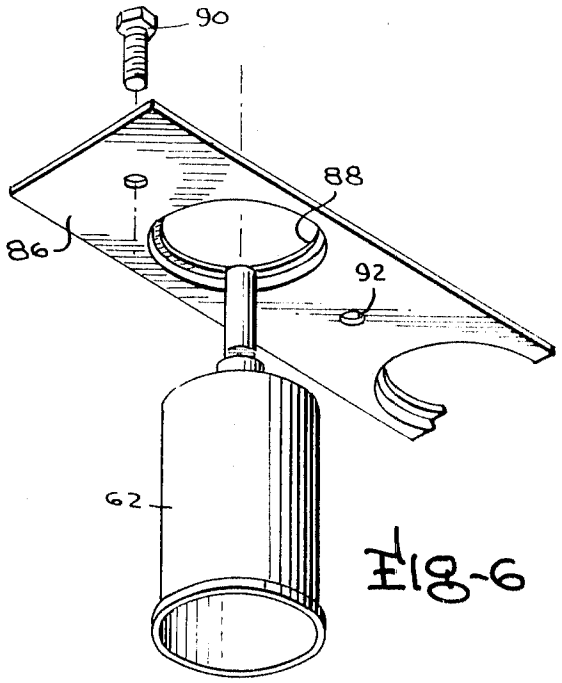

FIG-6

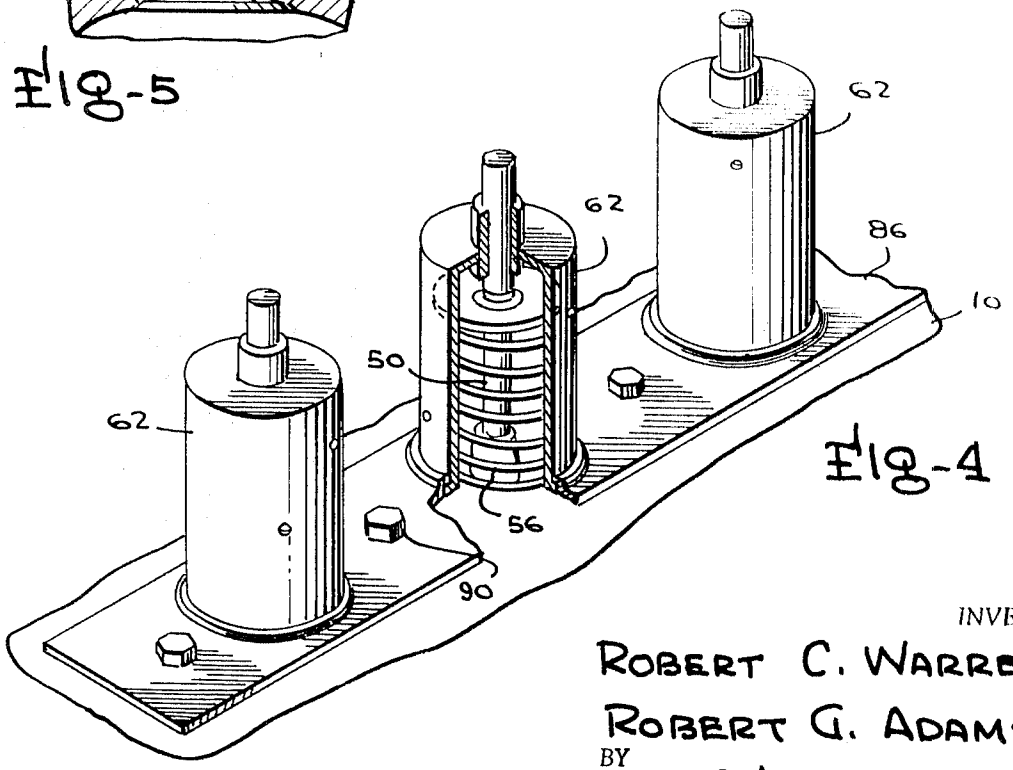

FIG-4

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OVERHEAD VALVE ACTION AND AIR POLLUTANT DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the valve-actuating mechanism of an overhead valve type internal combustion engine, wherein the rocker arm of the actuating system imparts a lateral or horizontal load on the valve stem.

2. Description of the Prior Art

Currently, all of the internal combustion engines used in motor vehicles are of the type that utilize a series of poppet valves to permit entrance of a fuel-air mixture into a cylinder and exhaust of the combustion products from the cylinder following ignition. The most efficient design for such valves and their actuating mechanism is to have the valve situated over the pistons in the head with the valves being pushed downwardly into the cylinder during opening. The poppet valves have elongated stems which are guided in the head by finely machined holes or cylindrical guide inserts in the head. This engagement of the valve stem and its cylindrical guide are one of the critical wear points in the overhead valve actuating mechanism and does not lend itself to quick and economical replacement or repair. The poppet valve is pushed downwardly by a horizontally extending rocker arm which imparts the downward motion from a vertically extending pushrod which extends perpendicular to the valve stem and is urged upwardly by the camshaft acting through a tappet. At the point of contact of the end of the valve stem and the rocker arm, where the vertically downward motion is transferred, a horizontal force component occurs, as the end of the rocker arm engaging the valve stem pivots toward the vertical axis of the pivot point of the rocker arm. This creates a horizontal load in the valve stem which bears against the cylindrical valve stem guide at a point aligned with the aforementioned vertical axis of the rocker arm pivot point thereby creating an area of wear. Where this concentration of wear occurs along the cylindrical valve stem guide, the guide tends to wear into an oval or noncircular shape thereby destroying the sealing relationship between the valve stem and the guide. This condition affects the efficiency and performance of the internal combustion engine as well as creating an air pollution problem. The efficiency of the engine is affected since on the intake stroke the suction created thereby can draw oil-laden air from the area within the rocker arm cover, which is not the chemically correct mixture being drawn in through the intake manifold, into the combustion chamber. On the exhaust stroke the pressure created in exhausting the combustion products will force some of the combustion gases past the valve guide and into the aforementioned area within the rocker arm cover. This situation compounds the air pollution problem since the burning of a nonchemically correct mixture in the cylinders will cause a greater quantity of hydrocarbons to be exhausted by the engine into the atmosphere.

Heretofore, attempts to remedy the wear situation occurring between the valve stem and its guide have been extremely complicated and expansive or not altogether effective. One of the common methods of combating this wear is to provide a roller mounted on the end of the valve stem so that the end of the rocker arm contacting the roller cannot transmit a horizontal force thereto. This mounting of a roller on the end of the valve stem increases the reciprocating weight of he valve member, as well as providing an assembly problem as the roller would not fit through the valve stem guide but must be assembled thereon after insertion and mounting of the valve with its associated spring structure. Another method of combating this war problem has been to convert the valve-actuating mechanism to a pull system as opposed to the more efficient and economical pushrod and rocker arm system. The pull system requires a complete redesign of the valve-actuating mechanism min that the camshaft must push a lever downwardly which in turn will pull a rod downwardly which rod will usually be connected to an enlarged sliding block which replaces the rocker arm assembly. This sliding block usually rides on a shaft mounted parallel to the valve stem in the cylinder head to thereby allow the valve-actuating motion to be perpendicularly downward and axially of the valve stem. While this complicated system has improved the wear characteristics of the valve stem and the valve stem guide, it has produced a complicated and expensive valve-actuating system with extremely large weights which have to be accelerated and stopped and returned to an at rest position in the normal valve-actuating cycle.

SUMMARY OF THE INVENTION

This invention involves a motion-transmitting guide which is installed concentric with the regular valve spring and stem with a cover and pushrod therein mounted coaxially with the valve stem to transmit the motion of the rocker arm to the valve stem. This cover member, which includes a guide and pushrod, is an economical and easily replaceable unit which is mounted on the cylinder head and does not substantially add to the reciprocating weight of the valve-actuating mechanism.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of the subject invention installed on a conventional overhead valve engine;

FIG. 2 is a sectional view taken substantially along the line 2–2 of FIG. 1;

FIG. 3 is an exploded perspective view of the subject invention;

FIG. 4 is a perspective view of another embodiment of the subject invention shown installed on a conventional overhead valve engine;

FIG. 5 is an elevational view in section of the modified form of the subject invention as shown in FIG. 4, and

FIG. 6 is an exploded perspective view of the mounting means for the modification shown in FIGS. 4 and 5.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawing, numeral 10 indicates a conventional cylinder head of an internal combustion engine, with a rocker arm assembly 12 and a valve and spring assembly 14 mounted thereon. The subject valve guide mechanism is indicated by numeral 16 and is shown mounted in its conventional position wherein it overlies and is concentric with the valve and spring assembly 14. A conventional rocker arm cover 18 is shown mounted on the cylinder head 10 in sealing relation therewith by means of a gasket 20.

The cylinder head 10 has a conventional raised boss 22, in which is received, the rocker arm mounting stud 24. The rocker arm stud 24 has a lower threaded end 26 which is received in a threaded opening 28 in the boss 22. A nut 30 formed on the rocker arm stud 24 provides a locking means to lock the stud to the head and provides a point at which an upper threaded end 32 of the stud begins. A conventional hollow rocker arm 34 is received over the upper threaded end 32 of the stud through an opening 36 therethrough. The hollow rocker arm 34 is of conventional design with a lower spherical-shaped pivot point 38 surrounding the opening 36. A spherical-shaped fulcrum bearing 40 with an opening 41 therethrough is received over the upper threaded end of the rocker arm stud to cooperate with the spherical-shaped pivot point 38 of the rocker arm. A locknut 42 is threaded onto the end 32 of the rocker arm stud to hold the rocker arm and spherical fulcrum bearing 40 thereon. The rocker arm is actuated by a pushrod 44 which extends through a pushrod guide opening 46, which maintains the upper end of the pushrod 44 in engagement with a recess 48 in one end of the rocker arm. The other end of the rocker arm has an abutment 49 thereon to engage the valve and spring assembly 14.

The valve and spring assembly 14 employs a conventional poppet-type valve 50, with the stem 52 thereof extending upwardly through a valve guide insert 54 in the head 10. The

valve and spring assembly includes a conventional valve spring 56 installed around the valve stem 52 in concentric relation thereto, with a spring retaining washer 58 received on the free end of the valve spring 56 with the washer 58 being keyed to the valve stem by the conventional pair of semicircular lock washers 60. The herein-referred-to engine components associated with the cylinder head and valve-actuating mechanism are conventional and do not form a part of the invention but are recited and set forth to show the environment within which the subject invention is to be used.

The subject valve guide mechanism 16 comprises a cylindrical housing 62 which is open at one end 64 thereof and is closed at the other end by a disc-shaped member 66. The open end 64 of the cylindrical housing 62 has a laterally extending, annular flange 68 which is adapted to seat on the upper surface of the cylinder head and provide additional stability for the cylindrical hosing 62. The disc-shaped member 66 has an opening 70 in the center thereof in which is received a cylindrical bearing 72 with an opening 73 therethrough and is fixed with the opening 70 by welding or brazing, as shown at 74. The cylindrical housing 62 has openings 76 cut into the sides thereof to prevent the formation of a partial vacuum and pressure buildup behind and in front of the spring-retaining washer 58, respectively, as the valve is opened and closed. A mounting tab 78 is fixed to the outer surface of the cylindrical housing 62 in radially extending relationship therefrom. The mounting tab 78 has an opening 80 through the free end thereof which is adapted to fit on the upper threaded end 32 of the rocker arm stud 24 to position the cylindrical housing 62 in concentric relation over the valve and spring assembly and to fit it relative thereto. When the subject valve guide 130 126 is installed, an additional nut 82 can be installed along the upper threaded portion 32 of the stud so as to fixedly retain the mounting tab 78 between the nut 30 formed on the lower end of the stud and the aforementioned additional nut 82. A pushrod 84 is received in the opening 73 through the bearing 72 in sliding relationship therewith. The pushrod 84 is of a length to extend between the upper end of the valve stem 50 and the end of the rocker arm 49 normally engaged therewith. Thus it can be seen that the pushrod 84, in being axially aligned with the stem of the valve 50, effectively forms an extension of the valve stem. Thus the bearing 72, within which the pushrod 84 reciprocates, will receive the wear normally imparted to the valve guide insert 54 by the lateral movement caused by the pivoting of the rocker arm 34 about the fulcrum bearing 40.

In operation, the pushrod 44 will be urged upwardly by the camshaft with the pushrod engaged in the spherical recess 48 on one end of the rocker arm 34. This upward movement of the pushrod will cause the rocker arm 34 to pivot about the fulcrum bearing 40 thereby urging the other end 49 of the rocker arm downwardly and generally inwardly towards the rocker arm stud 24. This downward and inward movement of the end of the rocker arm 49 will be translated by the pushrod 84 into a purely vertical downward force with the bearing insert 72 absorbing the inward or lateral force caused by the pivoting of the rocker arm. From this it can be seen that the bearing insert 72 will absorb all of the nonvertical loads that would normally be absorbed by the valve stem guide insert 54. With the wear being absorbed by the bearing 72, the performance of the engine will not be affected by an eccentric wearing of the bearing surface 73, which would ordinarily destroy the integrity of the seal between the valve stem 50 and the guide 54. With the wear thus absorbed at this point in the valve-actuating mechanism, the integrity of the sliding seal between the valve stem 50 and the inset 54 is retained and the fuel-air mixture will not be affected by a drawing in or oil-laden air through the valve guide insert 54. With the efficiency of the engine not affected, complete combustion is more likely to occur with a resultant drop in air pollution which is normally associated with the aging and wearing out of an internal combustion engine.

The modification of the invention shown in FIGS. 4 through 6 is essentially the same as the aforedescribed modification but is adapted to cylinder heads which do not support the rocker arm on a stud fixed to the cylinder head. The difference in this modification is the means by which the valve guide mechanism 16 is secured in place on the cylinder head 10. For purposes of clarification, like numerals will be used to represent like parts in this modification.

In some internal combustion engines having overhead valves, the rocker arms are mounted on a shaft extending longitudinally of the cylinder head so that a series of bosses 22 an studs 24 are not available adjacent each valve and spring assembly 14 to perit the mounting thereto of the valve guide mechanism 16. In such cases, an elongated plate 86 is provided with apertures 88 therethrough to coincide with the spacing of the valve and spring assemblies 14. The plate 86 is adapted to be secured to the cylinder head by a series of bolts 90 which pass through openings 92 in the plate and are received in threaded openings in the cylinder heads. With the plates 86 thus secured to the cylinder heads, the apertures 88 therethrough are secured in concentric relationship with the valve and spring assemblies 14. The apertures 88 are formed with an upwardly and inwardly extending flange 94 around the inner circumference thereof which forms an annular recess 96 on the underside thereof. The diameter of the aperture 88 is slightly larger than the circumference of the cylindrical housing 62 so that the housing may be received therethrough, and the annular recess 96 is of a size and dimension to receive the laterally extending annular flange 68 at the open end of the cylindrical housing 62. Thus, in this modification, when it is desired to secure a series of valve guide mechanisms 16 in position, the mechanisms are inserted in concentric relationship over the valve and spring assemblies 14 in concentric relationship therewith and an elongated plate 86 is dropped down over each of the cylindrical housings 62 and secured to the cylinder head 10 by the bolts 90 thus clamping the annular flanges 68 of each of the cylindrical housings 62 between the plate 86 and the cylinder head 10. The other details of this modification are identical to the first embodiment, wherein the abutment valve 49 at one end of the rocker arm engages the pushrod 84 to actuate the valve and receive any loads and wear attendant therefrom that are not perpendicular or coaxial with the valve stem.

From the above-disclosed invention, it can be seen that a simple and economical valve guide mechanism has been provided that will absorb substantially all of the wear that is normally attributed between the valve stem and the guides therefor installed in the cylinder heads. Substantially all of the wear associated at this point is occasioned by the nonaxial loads imposed on the valve stem by a pivoting rocker arm. With all of these nonaxial loads being absorbed by a valve guide mechanism, the only forces still acting between the valve stem and its guide are purely frictional forces normally attributed to the reciprocal movement of the valve stem within the guide. With this elimination of the wear that normally destroys the integrity of the seal between the valve stem and its guide there will be no drawing in, during the intake stroke, of oil-laden air from the area surrounding the rocker arms and springs with a resultant change in the normally chemically correct fuel-air mixture being ingested into the cylinders. From this it can be seen that a complete combustion of the fuel-air mixture ingested into the cylinders will be assured and release of unburned hydrocarbons into the atmosphere will be prevented. Thus the invention not only provides a reduction in wear on a normally expensive-to-repair item on an internal combustion engine, but also enhances the air pollution control of the engine.

As can be seen from the relative simplicity of the subject invention, it can be easily incorporated into the new manufacture of internal combustion engines of the overhead valve type. Also, this simplicity of the invention allows it to be back fitted to existing internal combustion engines with a relative minimum of replacement of existing parts. Thus, when the

device is to be back fitted to an existing engine it is only necessary to replace the existing pushrods and rocker arm studs with a longer variety to account for the extra length of the pushrod **84**. It is also understood that a rocker arm cover **18** with more clearance is required by the additional height of the rocker arm mechanism when this invention is installed.

While the invention has been particularly shown and described with reference to a preferred embodiment, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What we claim is:

1. In an internal combustion engine of the overhead valve variety having a cylinder head and having a series of valves with valve stems extending through the cylinder head, the valve stems being upwardly biased by valve springs, rocker arms, and pushrods for the rocker arms, a mounting stud for each rocker arm, a valve guide mechanism for each valve stem, the valve guide mechanism comprising:

a support about each valve stem, each support having a base secured to the cylinder head and having a top;

a mounting tab projecting laterally from each of the supports and engaged with the respective mounting studs of the rocker arms;

a bearing mounted in the top of each support;

the bearings being vertically aligned with the respective valve stems;

a pushrod mounted in each bearing for vertical movement, each pushrod having an upper end and a lower end; and

the pushrod upper ends being engaged against the rocker arms, and the pushrod lower ends being engaged against the valve stems.

2. The invention of claim **1**, wherein:

the support has openings formed therein to prevent formation of a partial vacuum upon reciprocation of the valves.

3. The invention of claim **1**, wherein:

the mounting tabs have openings formed therein; and

the mounting studs extend through said openings.

4. The invention of claim **3**, wherein:

the support base has an annular flange thereabout; and

a plate having an opening therein about the support clamps the flange to the cylinder head.