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[54] **SELF-CLEANING ENGINE POPPET VALVE**

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[52] **U.S. Cl.** **137/242,** 251/84, 251/87

[51] **Int. Cl.** **F16k 51/00**

[58] **Field of Search** 137/242; 251/84, 87, 85

[56] **References Cited**

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[57] **ABSTRACT**

A poppet type valve controlling the flow of engine exhaust carbon containing gases from one passage to another has a valve head loosely connected to the valve stem in a manner to provide an axial sliding movement of the head as well as a wobble action to reduce the tendency of carbon deposit build-up; an angled backstop member projecting into the path of opening movement of the valve head cants it in a direction opposite to that in which the valve head initially is canted by the pressure of the flow of exhaust gas against it, thereby dislodging carbon deposits between the valve head and stem.

11 Claims, 3 Drawing Figures

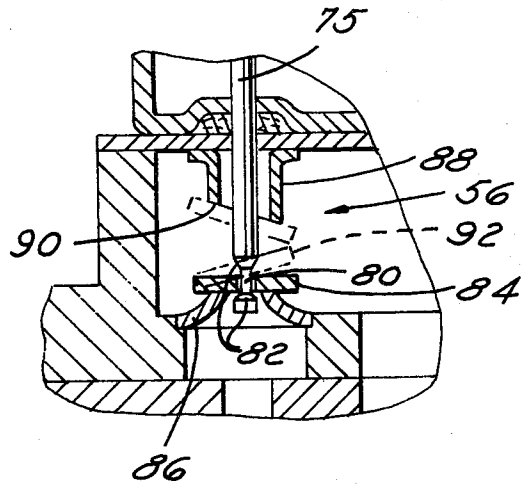


FIG. 1

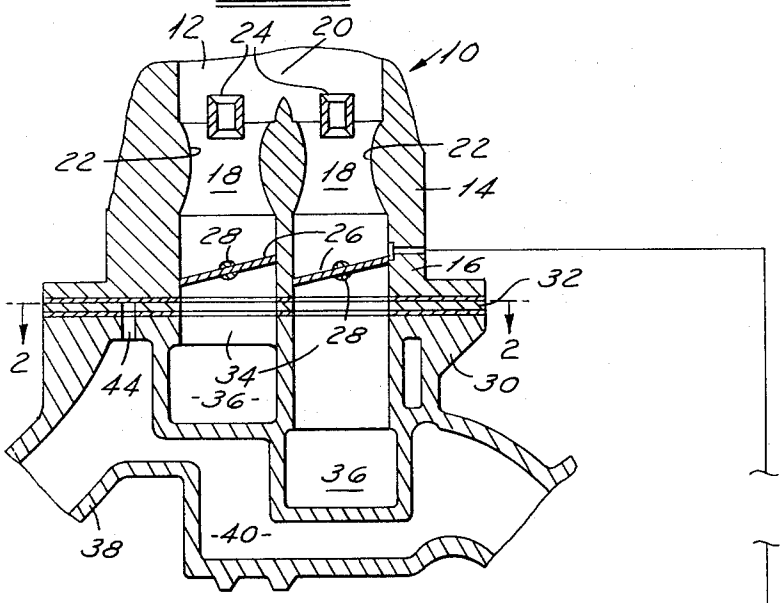


FIG. 2

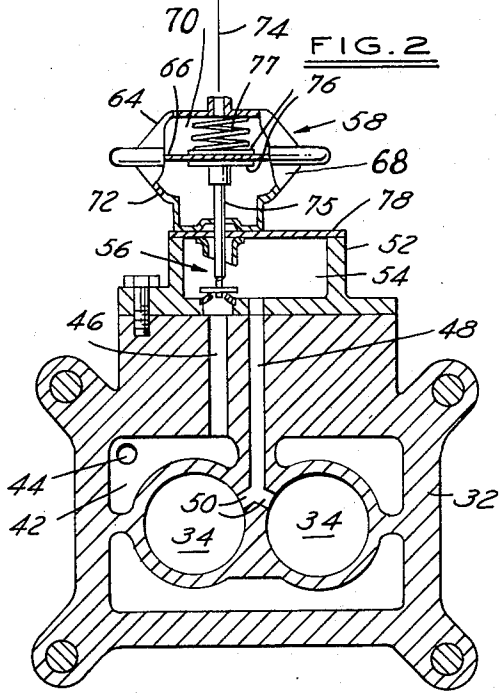
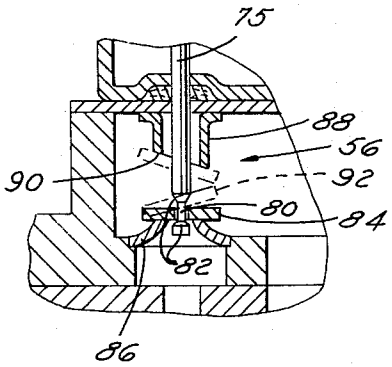


FIG. 3



SELF-CLEANING ENGINE POPPET VALVE

This invention relates, in general, to internal combustion engine valve constructions. More particularly, it relates to a self-cleaning poppet type valve construction.

The recirculation of engine exhaust gases back into the engine to reduce output of oxides of nitrogen is known. Such a system may consist of, for example, a passage between the engine exhaust gas crossover passage and the engine intake manifold controlled by an engine vacuum servo operated valve. Since the exhaust gases may contain carbon particles, the practice is known to loosely connect the valve head or disc to the stem for a slight flutter action to minimize the build-up of carbon deposits between the stem and valve head. With this type of construction, however, when the valve is moved to an open position, the pressure of exhaust gas flowing past the valve generally cants the valve to a diagonal position against a shoulder on the stem. Depending upon the duration and frequency of flow past the valve, particulate deposits in the area between the angled valve head and the stem portion may cause the valve head to stick in the angled position and therefore cause valve failure.

Accordingly, it is a primary object of the invention to provide a self-cleaning poppet type valve that will shear off or dislodge carbon deposits from the stem of the valve during its opening and closing movements.

It is a further object of the invention to provide an engine exhaust gas control valve that has a stem connected to the valve head in a manner providing a relative axial movement btween the two as well as a limited wobble action between, the head cooperating with an angled backstop member during movement of the valve in an opening direction to cant the valve head in a direction opposite to that in which it is canted by gas pressure to thereby dislodge any carbon deposit build-up between the valve head and stem and thus provide a self-cleaning action.

Other objects, features and advantages of the invention will become more apparent upon reference to the succeeding detailed description thereof, and to the drawings illustrating a preferred embodiment thereof; wherein,

FIG. 1 is a schematic illustration of an internal combustion engine emission control embodying the invention;

FIG. 2 is a cross-sectional view taken on a plane indicated by and viewed in the direction of the arrows 2—2 of FIG. 1; and,

FIG. 3 is an enlarged view of a detail of FIG. 2.

FIG. 1 illustrates a portion 10 of one-half of a carburetor of a known downdraft type. It has an air horn section 12, a main body portion 14, and a throttle body 16, joined by suitable means not shown. The carburetor has the usual air/fuel induction passages 18 open at their upper ends 20 to fresh air from the conventional air cleaner, not shown. The passages 18 have the usual fixed area venturies 22 cooperating with booster venturies 24 through which the main supply of fuel is inducted, by means not shown.

Flow of air and fuel through induction passages 18 is controlled by a pair of throttle valve plates 26 each fixed on a shaft 28 rotatably mounted in the side walls of the carburetor body.

The throttle body 16 is flanged as indicated for bolting to the top of the engine intake manifold 30, with a spacer element 32 located between. Manifold 30 has a number of vertical risers or bores 34 that are aligned for cooperation with the discharge end of the carburetor induction passages 18. The risers 34 at their lower ends 36 extend at right angles for passage of the mixture out of the plane of the figure to the intake valves of the engine.

The exhaust manifolding part of the engine cylinder head is indicated partially at 38, and includes an exhaust gas crossover passage 40. The gases pass from the exhaust manifold, not shown, on one side of the engine to the opposite side beneath the manifold trunks 36 to provide the usual "hot spot" beneath the carburetor to better vaporize the air/fuel mixture.

As best seen in FIG. 2, the spacer 32 is provided with a worm-like recess 42 that is connected directly to crossover passage 40 in FIG. 1 by a bore 44. Also connected to recess 42 is a passage 46 alternately blocked or connected to a central passage 48 communicating with the risers 34 through a pair of ports 50. Mounted to one side of the spacer is a cup shaped boss 52 forming a chamber 54 through which passages 46 and 48 are interconnected.

As described above, it is desirable to provide some sort of control to prevent the recirculation of exhaust gases at undesirable times. For this purpose, passage 46 normally is closed by a valve 56 that is moved to an open position by a servo 58. The servo includes a hollow outer shell 64 containing an annular flexible diaphragm 66. The latter divides the interior into an air chamber 68 and a signal vacuum chamber 70. Chamber 68 is connected to atmospheric pressure through a vent 72, while chamber 70 is connected to a vacuum signal force through a line 74.

Line 74 is connected to the carburetor induction passage at a point just above the closed position of the throttle blade edge, as shown. The port will be traversed by the edge of the throttle blade or valve during its opening part throttle movements. This will change the vacuum level in line 74 as a function of the rotative position of the throttle valve. Essentially atmospheric pressure is reflected in the port upon closure of the throttle valve.

The upper portion of stem 75 of valve 56 is fixed to a pair of retainers 76 that are secured to diaphragm 66. The retainers serve as a seat for a compression spring 77 that normally biases the valve to its closed position. The stem slidably and sealingly projects through a plate 78 closing chamber 54.

Turning now more particularly to FIG. 3, the lower end of valve stem 75 has a reduced diameter neck portion 80, with beveled or tapered end portions 82 connecting it to the unreduced diameter stem portion. One way of providing this construction would be to swage the lowermost end of stem 75 after the valve head has been assembled to it.

The valve head 84 consists of a flat disc having a central aperture of greater diameter than the diameter of neck portion 80 and of lesser diameter than that of the main portion of stem 75. It also has a thickness less than the axial length of neck portion 80 to permit a limited axial sliding movement of the disc or valve head on the neck portion. Typical dimensions would provide a radial clearance between the disc and stem of say 0.010 inch – 0.018 inch, for example, and a free axial move-

ment of the disc relative to the neck portion of say 0.03 inch – 0.04 inch, for example.

The above construction will permit a wobble or flutter action of the valve head **84** relative to the valve stem **75**, by axial and/or tilting movements of the valve head by gas pressure or by engagement with the tapered or beveled end portions of the stem neck portion.

The port in boss **52** communicating with the upper end of passage **46** in this case has a raised washer like insert **86** that serves as a seat for valve head **84**. At the opposite side of chamber **54**, the stem **75** projects loosely through a tubular or other suitably shaped backstop member **88** secured to cover plate **78**. The backstop has a planar ramp like surface **90** that is canted at an angle both to the longitudinal and radial axes of stem **75**.

It will be clear that normal valve closing movement of servo **58** by spring **77** will move the valve head **84** to the seated full line position shown in FIG. **3**, to close passage **46**. When the vacuum in line **74** is sufficient to overcome the preload of spring **77**, upon opening movement of throttle valve **26**, valve head **84** will be moved upwardly to open passage **46**. The resultant arcuate path of flow of exhaust gases from passage **46** to passage **48** will immediately impinge against one edge of valve head **84** to pivot it about the stem neck portion **80** to the canted dotted line position **92**. With continued upward movement of the stem **75**, the valve head **84** will then engage an edge portion of backstop member **88** to be pivoted in the opposite direction until it lies flat or essentially so against the diagonal surface **90**. This wobble action, first tilting in one direction and then the other, will dislodge any carbon deposited between the valve head and stem and either permit it to drop off or be sheared off, so that the valve maintains its self-cleaning action.

While the invention has been shown and described in its preferred embodiment, it will be clear to those skilled in the art to which it pertains that many changes and modifications may be made thereto without departing from the scope of the invention.

We claim:

1. A self-cleaning poppet type valve movable to close or open a port containing a fluid under pressure containing particulate matter, the valve having a stem, and a valve port closing head, means interconnecting the head to the stem for movement together and for a limited wobble action of the head relative to the stem, means moving the valve in opposite directions, and means engagable with the valve head for tilting the valve head successively in a plurality of different directions in response to movement of the valve in a port opening direction to dislodge any particulate build-up between the valve head and stem deposited thereon by fluid contact therewith.

2. A self-cleaning poppet type valve movable to close or open a port containing a fluid under pressure containing particulate matter, the valve having a stem, and a valve port closing head, means interconnecting the head to the stem for movement together and for a limited axial-relative movement and wobble action of the head relative to the stem, means for moving the valve and stem, the head being canted in one direction by pressure thereagainst of the fluid in the port upon port opening movement of the valve, and other means engagable with the valve head for subsequently canting the valve in the opposite direction to dislodge any particulate build-up between the stem and head deposited thereon by the contact of the fluid therewith.

3. A valve as in claim **2**, the other means comprising an angled surface projecting into the path of movement of the valve head in a port opening direction.

4. A valve as in claim **2**, the stem having a reduced diameter neck portion of an axial length greater than the thickness of the valve head, the neck portion projecting slidably through an aperture in the valve head, the aperture being of a diameter greater than the thickness of the neck portion and less than the thickness of the unreduced portion of the stem to provide a loose connection therebetween permitting a controlled axial movement therebetween.

5. A valve as in claim **4**, the other means comprising a stop member projecting into the path of movement of the valve head, the stop member having an angled surface engagable by the head for tilting the head in the opposite direction.

6. A valve as in claim **4**, the other means comprising a hollow cylindrical stop member projecting into the path of movement of the valve head, the stem being mounted for movement through the member, the member having a surface located at an angle to the axes of the stem and engagable by the valve head whereby engagement of the head against the surface followed by axial movement of the head against an axial end portion of the stem neck portion effects a tilting movement of the head against the surface, return movement of the valve to a port closing position again canting the valve upon engagement with the port.

7. A valve as in claim **4**, the neck portion having beveled axial end portions blending with the larger diameter stem, the beveled end portions camming the valve head at an angle.

8. A self-cleaning poppet type valve for controlling the flow of carbon containing internal combustion engine exhaust gases from one passage to another through a port, the valve comprising a flat disc valve head having a central aperture, a valve stem having a reduced diameter neck portion projecting slidably through the aperture, the aperture and neck portion diameters and the axial extent of the stem and thickness of the head being such as to provide a loose connection between the valve head and stem affording a limited axial sliding and tilting therebetween, the impingement of exhaust gas flow against the valve head upon opening the valve canting the valve head in one direction, and tilt means in the path of movement of the valve head in a port opening direction to cant the valve head in the opposite direction to permit the drop-off of carbon deposit build-ups between the valve head and stem.

9. A valve as in claim **8**, the tilt means comprising an angled backstop member in the path of movement of the valve head engagable with the valve head to cam the head in the opposite direction.

10. A valve as in claim **9**, the backstop member comprising a tubular member through which the stem slidably projects, the member having a surface inclined to both the axis of the stem and a radius thereof.

11. A valve as in claim **8**, the connections between the axial end portions of the neck portion and the unreduced diameter contiguous portions of the stem being flared to aid in tilting the head upon engagement thereof with an end portion.

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