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CONTROL VALVE FOR FUEL SYSTEMS

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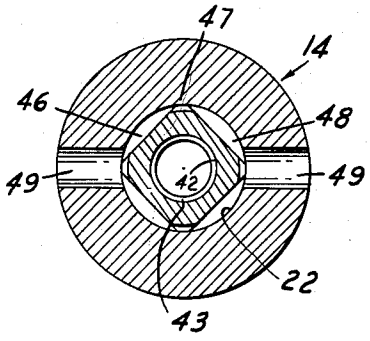


FIG. 3

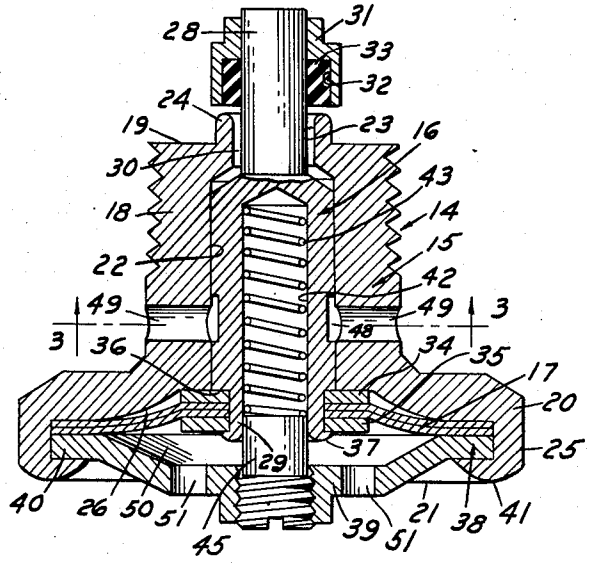


FIG. 2

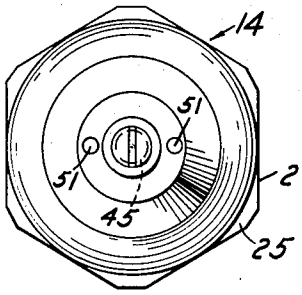


FIG. 4

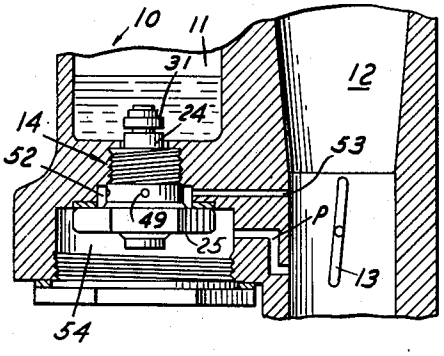


FIG. 1

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CONTROL VALVE FOR FUEL SYSTEMS

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2 Claims. (Cl. 137—688)

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This invention relates generally to fuel supply systems for internal combustion engines and refers more particularly to valve assemblies of the type employed to control the power jet in the carburetor of a fuel supply system.

In certain types of fuel supply systems it is customary to control the flow of fuel through the power jet of the carburetor with a vacuum operated valve assembly commonly known to the trade as an economizer valve. Valves of this general type are ordinarily urged by a spring to a position wherein communication through the power jet is open, and are closed against the action of the spring by a diaphragm in response to the vacuum existing in the intake manifold of the engine. The arrangement is such that when the engine is being operated at constant speed or part throttle the vacuum in the intake manifold is sufficient to draw the diaphragm to a position wherein the power jet is closed. However, when the throttle valve is suddenly opened, for example, the intake manifold vacuum decreases sufficiently to enable the spring to open the valve and thereby supply the required additional amount of fuel through the power jet into the carburetor mixing chamber.

The above principle of operation has been found highly satisfactory in obtaining economical operation without sacrificing engine performance. However, the particular economizer valves used in the past for the above purpose have not been entirely satisfactory. The design of these valves materially complicates assembly of the various parts involved and in addition results in an unstable unit which has the effect of reducing the performance efficiency of the fuel system.

With the above in view, it is an object of this invention to provide an economizer valve composed of a relatively few simple parts capable of being inexpensively manufactured, assembled and installed in a fuel supply system or carburetor.

It is another object of this invention to provide an economizer valve assembly wherein the valve plunger has a sliding bearing contact of substantial length with the surrounding supporting casing to thereby avoid any possibility of lateral displacement of the plunger during operation and at the same time affords free passage of fuel through the casing along the plunger.

The manner in which the design of the economizer valve forming the subject matter of this invention facilitates assembly and promotes stability will be apparent from the following description, especially when considered in connection with the accompanying drawing wherein:

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Figure 1 is a diagrammatic sectional view showing a part of a carburetor equipped with an economizer valve forming the subject matter of this invention.

Figure 2 is a vertical sectional view through the valve.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2; and

Figure 4 is a plan view of the valve shown in Figure 2.

In order to simplify the disclosure, only those parts of the carburetor having a bearing on the operation of the economizer valve are diagrammatically illustrated. With this in view, reference is made to Figure 1 of the drawing, wherein the numeral 10 designates a carburetor having a fuel supply chamber 11 and having an additional chamber 12 in which fuel from the supply chamber 11 is mixed with air to provide a combustible mixture of gases. The chamber 12 is connected to the intake manifold (not shown) of an internal combustion engine, and in accordance with conventional practice the flow of fuel mixture through the chamber 12 to the intake manifold is controlled by a throttle valve 13 suitably pivotally supported within the mixing chamber.

The fuel from the supply chamber 11 is metered to the mixing chamber through suitable jets, and in certain designs of carburetors provision is made to supplement the quantity of fuel admitted to the mixing chamber 12 when the throttle approaches wide-open position to increase the engine power. This feature is commonly known to the trade as a power fuel system and embodies a valve controlled passage P between the fuel supply chamber 11 and the mixing chamber 12.

The valve assembly controlling communication through the passage P is commonly known as an economizer valve and is indicated generally in the several figures of the drawing by the numeral 14. In detail, the valve assembly 14 comprises a casing 15, a plunger 16 slidably supported by the casing 15 and a diaphragm 17 for operating the plunger. The casing 15 has a tubular body part 18 externally threaded at the end 19 for attachment to the carburetor and has an annular enlargement 20 at the opposite end 21. As shown particularly in Figure 2 of the drawing, the casing 15 is formed with a central bore 22 having a portion 23 at the end 19 of the casing reduced in diameter and opening through the end 19 of the casing. A valve seat 24 in the form of an annular

flange projects from the end 19 of the casing 15 in concentric relation to the reduced portion 23 of the bore 22. It will also be noted from Figure 2 of the drawing that a flange 25 projects outwardly from the periphery of the enlargement 20 and provides a circular recess 26 at the end 21 of the body part 18. Referring now to Figure 4 of the drawing, it will be noted that the exterior surface of the flange 25 is formed with a plurality of flats 27 to enable effectively engaging the enlargement with a suitable wrench or tool for securing the casing in place on the carburetor.

The plunger 16 is shown in Figure 2 of the drawing as having reduced portions 28 and 29 at opposite ends. The reduced end portion 28 extends axially through the reduced portion 23 of the bore 20 and has an external diameter substantially less than the internal diameter of the reduced portion 23 to provide an annular fuel passage 30. A valve member 31 is secured to the reduced portion 28 of the plunger and assumes a position outwardly upon the end 19 of the body part 18. The end of the valve member 31 adjacent the body part 18 is formed with a recess 32 which surrounds the reduced end 28 and serves to retain a resilient ring 33 in place on the valve member. The ring 33 is formed of a resilient material which is impervious to the fuel, such for example as synthetic rubber, and is adapted to engage the annular valve seat 24 to close the annular passage 30.

The reduced end 29 of the valve plunger projects into the recess 26 and extends through a central opening formed in the diaphragm 17. The diaphragm 17 comprises juxtapositioned sheets of flexible material, and the central portion is clamped to the reduced end 29 between a pair of washers 34 and 35. The washer 34 abuts the annular shoulder 36 formed on the plunger by the reduced portion 29, and the washer 35 is clamped in place by peening the extremity of the reduced portion 29 over the outer surface of the washer 35 in the manner indicated by the numeral 37 in Figure 2 of the drawings.

The periphery of the diaphragm 17 is clamped to the base of the recess 26 adjacent the annular flange 25 by a plate 38 having an outwardly bowed central portion 39 and having an annular clamping portion 40 at the periphery positioned in engagement with the outer edge of the diaphragm. The plate 38 is clamped in place against the diaphragm 17 by crimping the outer edge of the flange 25 over the outer surface of the annular portion 40 on the plate in the manner indicated by the numeral 41 in Figure 2 of the drawing. It follows from the above that the central portion of the diaphragm is effectively clamped to the plunger 16 and the periphery of the diaphragm is firmly clamped to the enlargement 19 at the end 21 of the body part 18.

A bore 42 extends axially of the plunger and is closed adjacent the reduced end 28. The opposite end of the bore 42 is open, and a coil spring 43 is positioned in the bore 42. One end of the coil spring abuts the closed end of the bore and the other end of the coil spring engages an adjusting screw 45. The adjusting screw 45 is threadably supported by the central portion of the plate 38 and is adjustable to vary the degree of compression of the spring 43. Inasmuch as one end of the spring engages the plunger and the other end of the spring engages the adjusting screw 45 carried by the casing 15, it follows that the spring normally urges the plunger to the position shown in Figure 2 of the drawing, wherein the valve member 31 is in its open position with respect to the annular passage 30.

The body portion of the plunger between the two reduced portions 28 and 29 is polygonally shaped in cross-section, as shown in Figure 3 of the drawing. The corner portions, or in other words, the points of intersection of adjacent sides 46 of the plunger are rounded as at 47 and have a sliding contact with the inner surface of the bore 22. This construction not only provides clearance spaces 48 of substantial area in the bore 20 but in addition slidably supports the plunger 16 throughout substantially the full length of the body portion thereof. This is highly desirable in that it prevents any possibility of the plunger from shifting laterally relative to the casing during operation and assures effective performance of the valve over long periods of use. The clearance spaces 48 communicate with the annular intake passage 30 and with radially extending ports 49 formed in the body part 18 adjacent the enlargement 20. Since the clearance spaces 48 are of substantial cross-section area due to the shape of the plunger, it will be understood that free, unobstructed flow of fuel is provided between the passage 30 and the ports 49.

It has previously been stated that the central portions of the diaphragm 17 is secured to the plunger 16 and the peripheral portion is clamped to the body part 18 of the casing 15. This diaphragm cooperates with the plate 38 to form a chamber 50 and the portion 39 of the plate has openings 51 providing access to the interior of the chamber 50. As will be presently described, the openings 51 communicate with the intake manifold so that the pressure within the chamber 50 corresponds to the manifold pressure. When the vacuum in the intake manifold is relatively high, the valve 31 is held by the diaphragm 17 in engagement with the seat 24 to close the passage 30. However, when the vacuum in the intake manifold decreases by sudden opening of the throttle valve 13, for example, the spring 43 collapses the diaphragm 17 and moves the valve member 31 away from the seat 24.

In the present instance the economizer valve assembly 14 is shown as installed with the passage 30 in communication with the supply chamber 11 in the carburetor, as indicated diagrammatically in Figure 1 of the drawing. It will also be noted from Figure 1 that the portions 49 communicate with an annular chamber 52 in the carburetor, and this chamber is connected to the interior of the mixing chamber 12 by a power jet 53. The openings 51 through the plate 38 communicate with the chamber 54 in the carburetor, and this chamber is connected to the manifold of the internal combustion engine by the passage P.

It follows from the above that when the valve 31 is in its open position fuel from the supply chamber 11 flows downwardly through the annular passage 30 and through the clearance space 48 to the ports 49. From the ports 49 the fuel enters the annular chamber 52 and is discharged into the mixing chamber 12 through the power jet 53. As the fuel is discharged through the jet 53 it is broken up into minute particles so that it will mix more readily with the air in the mixing chamber 12. The above condition exists only in instances when the vacuum in the manifold or chamber 50 is suddenly decreased by fully or substantially fully opening the throttle valve 13 and supplies the additional fuel required for the increased power demand. During normal

operation of the engine the vacuum in the chamber 50 is sufficient to counteract the spring 43 and thereby hold the valve member 31 against the seat 24.

It will be noted from the design of the economizer valve that the several parts of this valve may be readily assembled. One of the first steps in the assembly is to sleeve the central portion of the diaphragm 17 and associated washers 34, 35 on the reduced end 29 of the plunger. This end is then peened over the washer 35 as indicated by the numeral 37 in Figure 2 of the drawing. The plunger 16 may then be readily inserted into the bore 20 in the body part 18 of the casing, and as a result of this operation the diaphragm 17 assumes its desired position within the recess 26. The plate 38 is then sleeved into the recess 26 and the outer extremity of the flange 25 is crimped over the peripheral portion 40 of the plate 38 in the manner indicated by the numeral 41 to clamp the diaphragm in place. Upon completion of this operation the spring is inserted into the bore 42 through the open end of the latter and the adjusting screw 45 is assembled on the plate 38. The valve member 31 is then secured to the reduced end 28 of the plunger in a manner such that the resilient ring 33 occupies a position adjacent the annular seat 24.

In view of the above, it will be understood that I have provided a relatively simple, compact economizer valve which lends itself to easy assembly and assures effectively supporting the sliding plunger against lateral displacement. In addition it will be noted that the resilient seating ring 33 assures a tight seal with the annular valve seat 24 in the closed position of the valve, regardless of irregularities in manufacture, and even though some dirt or foreign matter accumulates on the seat.

What I claim as my invention is:

1. A pressure responsive valve structure comprising a body having an elongated bore terminating at one end in a valve seat surrounding said bore and terminating at its other end in a laterally enlarged recess, a valve movable toward and away from said valve seat and including an elongated portion slidable in said bore and shaped to define a longitudinally extending fluid passage therewith and an end portion located in said recess, said valve having a longitudinal bore opening at the end thereof in said recess and having a closed inner end, a diaphragm in said recess connecting said valve to said body, a spring in the bore of said valve having one end seated at the closed inner end of the bore in said valve, an apertured closure plate covering said recess and defining a diaphragm chamber therewith, a screw carried by said plate, said screw having an end portion received in the end of the bore in said valve engaging the other end of said spring therein and slidably engaging said valve to guide the same for longitudinal movement in the elongated bore of said body.

2. Pressure responsive valve structure comprising an elongated body having a passage extending therethrough, an outwardly facing valve seat at one end of said body surrounding said passage, the opposite end of said body being laterally enlarged and provided with a laterally enlarged outwardly facing recess including a longitudinally extending peripheral flange, an elongated member slidable in said passage and shaped to define a longitudinally extending fluid passage therewith, said member including a first end portion extending beyond said one end of said body, a valve on said first portion cooperable with said valve seat, said member having a second end portion extending beyond the end of said passage at the other end of said body and located within said recess, a flexible diaphragm in said recess having its periphery connected to said flange and its central portion connected to the end of said member within said recess, a plate having its periphery located within said recess and clampingly engaging the periphery of said diaphragm, said plate having an opening therethrough, said member having an elongated recess extending therein from the end of said member located within said laterally enlarged recess, a spring received in said elongated recess, said plate having a threaded aperture, a screw in said aperture having a reduced portion slidably received in the open end of said elongated recess bearing against the end of said spring and providing a guide for longitudinal movement of said member.

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