United States Patent [19]

Rogerson

[11] **3,782,351**

[45] **Jan. 1, 1974**

[54] **FUEL VAPOR-LOSS CONTROL VALVE AND SYSTEM**

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[22] Filed: **Oct. 2, 1972**

[21] Appl. No.: **294,047**

Related U.S. Application Data

[62] Division of Ser. No. 191,266, Oct. 21, 1971.

[52] **U.S. Cl.** **123/136**
[51] **Int. Cl.** **F02d 19/00**
[58] **Field of Search** 123/136; 261/DIG. 67

[56] **References Cited**

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Assistant Examiner—Cort R. Flint
Attorney—Keith L. Zerschling et al.

[57] **ABSTRACT**

Described is a valve and a system employing such valve to control fuel vapor-loss from the bowl of a carburetor. In the fuel vapor-loss control system, the valve is positioned between the fuel bowl of the carburetor and the air cleaner attached to it. In the preferred form, the valve has a valve body including three passages. The first passage extends from the carburetor fuel bowl to a point within the air cleaner. The second passage is located in part within the first passage, but includes a second part extending to a point outside of the first passage. A third passage is connected with the carburetor fuel bowl and with a canister for the storage of fuel vapor. The second passage in the valve body has a movable member for preventing flow of vapor from the fuel bowl of the carburetor to the air cleaner when the movable member is in contact with a valve seat. Movement of the movable member is controlled by engine manifold vacuum attached to one end of the second passage in the valve body.

3 Claims, 5 Drawing Figures

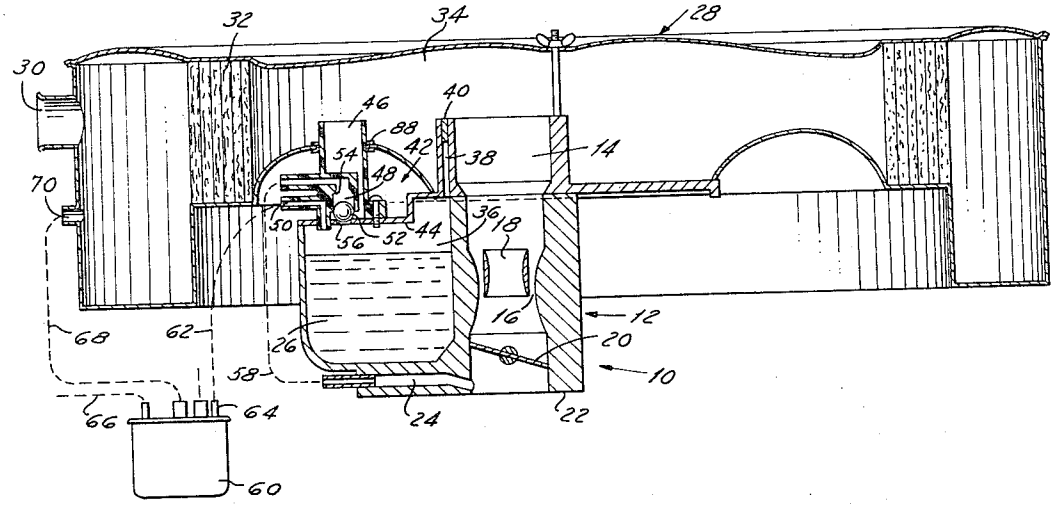


FIG. 1

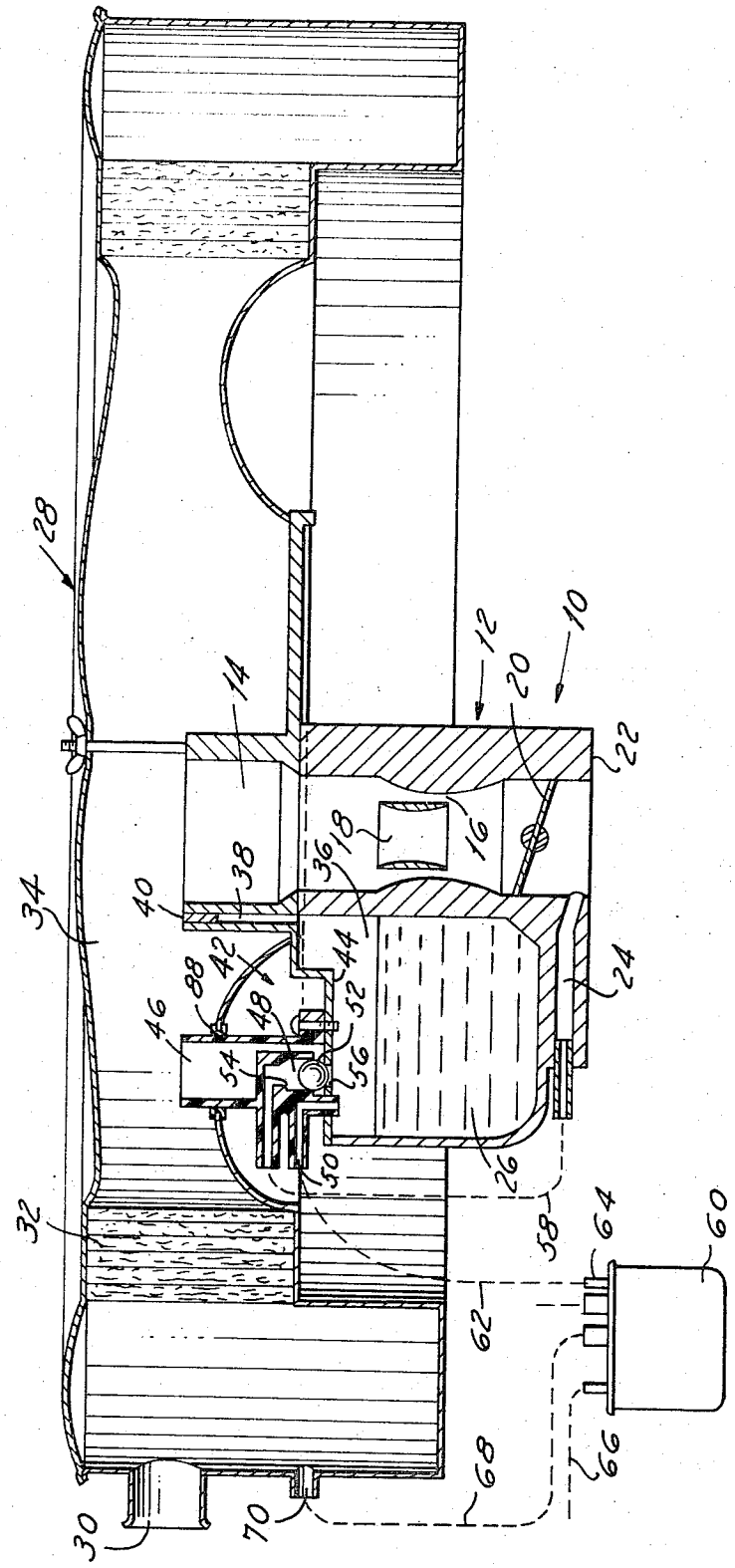

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FIG. 2

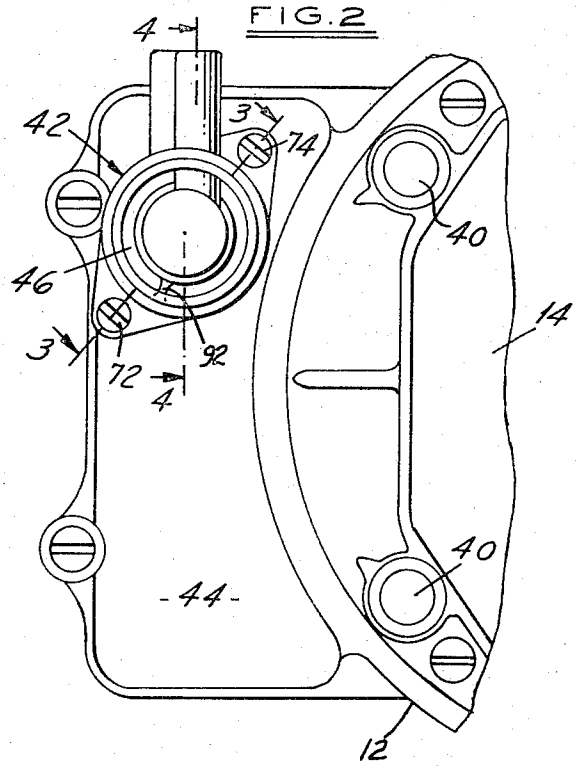


FIG. 3

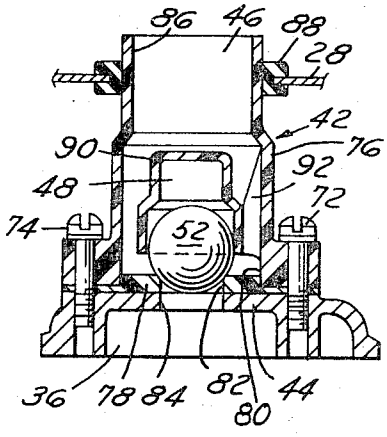


FIG. 4

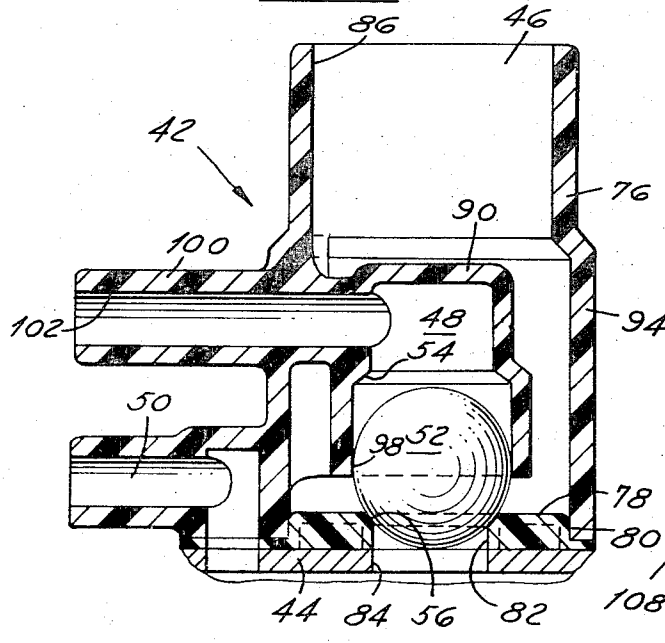
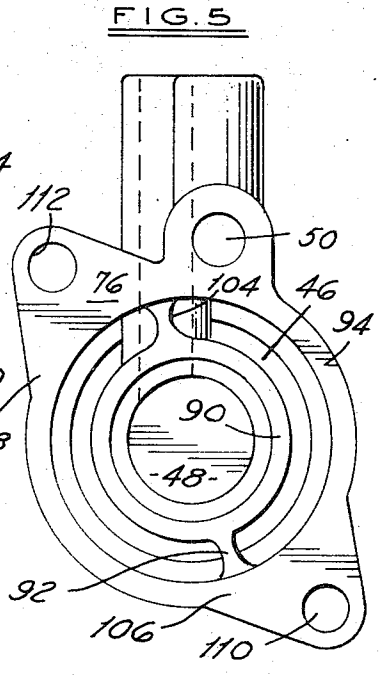


FIG. 5



FUEL VAPOR-LOSS CONTROL VALVE AND SYSTEM

This is a division of application Ser. No. 191,266, filed Oct. 21, 1971.

BACKGROUND OF THE INVENTION

This invention relates to a fuel vapor-loss control valve for use with an internal combustion engine and also to a system employing such valve to control fuel vapor emissions from the fuel bowl of a carburetor for such engine.

Considerable effort has been expended in recent times to reduce or eliminate atmospheric emissions from motor vehicles. Some of these efforts have been directed toward the elimination of fuel vapor emissions from internal combustion engines. These fuel vapor emissions may occur from evaporation of fuel contained in a fuel tank and in the engine's carburetor fuel bowl. Examples of prior art systems which may be used to reduce or prevent the emission of fuel vapors into the atmosphere may be seen in U.S. Pat. Nos. 3,001,519, issued to H. H. Dietrich and C. J. Brady on Sept. 26, 1961, and 3,460,522, issued to M.J. Kittler and P. J. Clarke on Aug. 12, 1969.

SUMMARY OF THE INVENTION

The fuel vapor-loss control system of the invention bears a resemblance to the systems described in the aforementioned patents, but differs therefrom in its essential features. In particular, the fuel vapor-loss control system of the invention employs a novel valve structure which is advantageous in its functional characteristics, its cost of manufacture, and in its application within the fuel vapor-loss control system.

The novel valve of the invention includes a valve body that preferably is made from a plastic material, such as glass-reinforced nylon. The valve body includes a first passage having an inlet opening and an outlet opening, and it also includes a second passage that is located at least in part within the first passage. The second passage has two openings, one of which openings is located within the first passage a fixed distance from its inlet opening. The second passage in the valve body may also include a tapered portion that forms a first valve seat. A second valve seat is formed, preferably in a separate valve member such as a valve seat insert, and this second valve seat is located proximate the first passage inlet opening and preferably in alignment with the second passage opening that is located in the first passage.

Movable valve means are provided in the second passage of the valve body. The movable valve means, which may take the form of a ball or a cylinder, is movable between the first and second valve seats for the purpose of preventing fluid flow from the first passage inlet opening to the first passage outlet opening when the movable means is in contact with the second valve seat.

The novel valve structure described above can be employed in a fuel vapor-loss control system for an internal combustion engine having a carburetor and a fuel bowl associated with the carburetor. In such case, the system comprises an air cleaner for cleaning air entering the carburetor, the air cleaner having a conduit connected with the air intake portion of the carburetor, and a canister for the storage of fuel vapor. The system also includes a valve, preferably having the structure

described above, wherein the valve body is attached to the carburetor fuel bowl. The valve body extends from the carburetor fuel bowl to a point located within the air cleaner conduit. Thus, for example, the first passage inlet opening of the valve of the invention may be connected to the carburetor fuel bowl, and the outlet opening thereof may be positioned within the air cleaner conduit. The movable valve means then prevents the passage of fuel vapors from the carburetor fuel bowl to the air cleaner conduit when the movable valve means is in contact with the aforementioned second valve seat. This second valve seat may be located within a valve seat insert separate from the valve body and the carburetor fuel bowl or, in the alternative, the second valve seat may be formed in a cover for the carburetor fuel bowl.

The valve of the invention, together with its attendant advantages when employed in a fuel vapor-loss control system, may be better understood by reference to the detailed description which follows and to the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a fuel vapor-loss control system constructed in accordance with one aspect of the invention;

FIG. 2 is a partial plan view of a carburetor having a valve constructed in accordance with the invention attached to the carburetor fuel bowl cover plate;

FIG. 3 is a sectional elevational view of this valve, the section being taken along the line 3—3 in FIG. 2;

FIG. 4 is an enlarged sectional elevational view of this valve, the section being taken along the line 4—4 in FIG. 2; and

FIG. 5 is an enlarged bottom plan view of the valve body shown in FIGS. 2 through 4.

DETAILED DESCRIPTION OF THE INVENTION

With reference now to the drawings, in which like numerals refer to like parts, there is shown in FIG. 1 a sectional elevational view of a fuel vapor-loss control system. The system, generally designated by the numeral 10, comprises a carburetor 12 having an air intake passage 14 and a venturi 16, which may include a boost venturi 18. Positioned below the carburetor venturi 16 is a throttle plate 20. The bottom portion 22 of the carburetor 12 is normally connected to an intake manifold (not shown) of an internal combustion engine. A passage 24, which may be in the carburetor 12 or the intake manifold of the engine, provides a source of engine manifold vacuum. The carburetor 12 also includes a fuel bowl 26.

An air cleaner 28 is positioned above the carburetor 12 and covers the air intake portion 14 thereof. The air cleaner 28 preferably is of conventional design and includes an air inlet 30 and an annular air filter 32 positioned in the air cleaner conduit 34 between the air inlet 30 and the carburetor intake portion 14.

It has been the practice in the past to provide the upper portion 36 of the carburetor fuel bowl 26 with a passage 38 leading to a point in the air cleaner adjacent the air intake portion of the carburetor. This internal vent passage 38 permitted fuel vapor in the carburetor bowl to enter the air cleaner and then to descend into the engine intake manifold through the carburetor. In FIG. 1, this internal vent passage 38 is shown with a plug 40 to prevent fuel vapor passage therethrough.

An improved fuel vapor-loss control system results from the use of a valve, generally designated by the numeral 42, positioned between the carburetor fuel bowl 26 and the conduit 34 in the air cleaner 28. The valve 42 is attached to the cover plate 44 of the fuel bowl and it extends into the air cleaner 28.

The valve 42 in its preferred form has a first passage 46, a second passage 48 that is in part positioned within the first passage 46, and a third passage 50. Movable valve means 52, which preferably has the form of a ball or a cylinder or other member having a circular cross-section, is positioned and movable within the part of the second passage 48 located within the first passage 46. The movable valve means 52 is movable between a first valve seat 54 and a second valve seat 56. When the means 52 is in contact with the second valve seat 56, it prevents the passage of fuel vapor from the upper portion 36 of the fuel bowl, through the first passage 46, to the conduit 34 in the air cleaner 28.

The second passage 48 in the valve 42 is connected at one end by the line 58 to a source of manifold vacuum, such as the passage 24. Thus, when the engine is running and manifold vacuum exists, the movable means 52 in the valve is drawn in an upward direction as viewed in FIG. 1. This permits fuel vapor to pass from the upper portion 36 of the fuel bowl 26, through the first passage 46 of the valve 42, and into the conduit 34 in the air cleaner 28.

Preferably, the fuel vapor-loss control system depicted in FIG. 1 also includes a fuel vapor storage canister 60. The storage canister may have a carbon element for the adsorption of fuel vapor. Preferably, the third passage 50 in the valve 52 permits fuel vapor to pass at all times from the upper portion 36 of the fuel bowl 26, through the passage 50, into a line 62, and from there into the storage caister 60 through an inlet 64. Another inlet of the storage canister 60 may be connected, by a line 66, with the motor vehicle fuel tank to permit vapor therefrom to enter the canister. During operation of the engine, fuel vapor in the storage canister 60 is purged through a line 68 connected to an inlet 70 in the air cleaner 28.

In summary, it may be observed that when the engine is operating, fuel vapor from the fuel bowl 26 enters the air cleaner through the first passage 46 in the valve 42. When the engine is not operating, the movable valve means 52 in the valve 42 prevents the passage of fuel vapor into the air cleaner in this manner. However, fuel vapor may pass into the storage canister 60 through the third passage 50 in the valve 42 and the line 62.

With reference now to FIG. 2, there is shown a partial plan view of the carburetor 12 having the valve 42 mounted on the fuel bowl cover plate 44, the air cleaner 28 having been removed. It may be seen in FIG. 2 that the valve 42 is attached to the fuel bowl cover plate 44 with screws 72 and 74.

FIG. 3 illustrates the detailed construction of a practical form of the valve 42 and shows the manner for its attachment to the cover plate 44 and also the manner in which it may be positioned within the air cleaner 28. The valve 42 shown in FIG. 3 includes a valve body 76 and a valve seat insert 78. The first passage 46 in the valve body 76 has an inlet opening 80 in which the valve seat insert 78 is positioned. The insert 78 has a valve seat opening 82 which is in alignment with an opening 84 in the fuel bowl cover plate 44. The valve body extends upwardly through an opening in the air cleaner 28 so that an outlet opening 86 of the first passage 46 is located at a point within the air cleaner. A rubber grommet 88 forms a seal between the air cleaner 28 and the valve body 76. The second passage 48 in the valve body 76 is formed in part by a cup-shaped portion 90 that is supported by a rib 92 connecting the cup-shaped portion with the outer part of the valve body 76.

Reference is now made to the enlarged sectional view of FIG. 4 which shows the detailed structure of the valve body 76 and the valve seat insert 78. The valve body 76 has a portion 94 that is of circular cross-section and of large diameter. This portion 94 of the valve body forms the first passage 46 therethrough and has the inlet opening 80 at its lower end and the outlet opening 86 at its upper end. The valve seat insert 78 is positioned within the inlet opening 80 to the first passage 46.

The second passage 48 in the valve body 76 has two openings and is formed in two connected parts. These are the cup-shaped portion 90, which has a first opening 98, and a tubularly-shaped second portion 100, which has a second opening 102. The cup-shaped portion 90 of the second passage extends away from its first opening 98 in a direction toward the outlet opening 86 of the first passage. Also, the cup-shaped first portion 90 of the second passage 48 is positioned within the first passage 46, and the first portion includes a tapered part 54 that forms a first valve seat. The second portion 100 of the second passage 48 extends from a point above the valve seat 54 to a location outside of the first passage 46. When employed in a fuel vapor-loss control system, the tubular second portion 100 is connected to a source of manifold vacuum.

The valve seat insert 78 also has a tapered portion 56 that forms a second valve seat. Movable valve means 52, which may be a ball as shown or a cylinder or other device preferably having a circular cross-section, is positioned to move between the first valve seat 54 and the second valve seat 56. When the ball 52 is positioned in contact with the second valve seat 56 as illustrated in FIG. 4, then fluid flow from the first passage inlet opening 80 to the first passage outlet opening 86 is prevented. However, upon the application of a partial vacuum to the tubular second portion 100 of the second passage 48, the ball 52 moves upwardly to seat against the valve seat 54 and to permit fluid flow from the first passage inlet opening 80 to the outlet opening 86. The fluid flows between the cup-shaped portion 90 and the portion 94 of the valve body.

The valve body 76 preferably also includes the third passage 50, which is always open to permit fluid to flow therethrough. When the valve 42 is employed in a fuel vapor-loss control system, the size of the third passage 50 should be no larger than is necessary to prevent an undesirably high pressure accumulation within the fuel bowl of the carburetor.

FIG. 5 shows the interior of the valve body 76 (valve seat insert 78 removed) as viewed from the bottom. The rib 92 and another rib 104 can be seen, as can extending portions 106 and 108 that contain holes 110 and 112 through which the screws 72 and 74, respectively, may pass.

Preferably, the entire valve 42 is made from a plastic material, such as glass-reinforced nylon. Alternative materials, such as zinc or aluminum castings, may also be used. Also, the valve body 76 preferably is made as

a single molded part. The movable valve means **52** of the valve **42** may be made from a plastic material, such as nylon., or it may be made from a metal, for example, brass or aluminum.

Various modifications may be made in the structure of the valve **42** without departing from the spirit and scope of the invention.

Based upon the foregoing description of the invention, what is claimed and desired to be protected by Letters Patent is:

1. A fuel vapor-loss control system for an internal combustion engine having a carburetor and a fuel bowl associated with said carburetor, said system comprising:

a. an air cleaner for cleaning air entering said carburetor, said air cleaner including a conduit connected with the air intake portion of said carburetor;

b. a canister for the storage of fuel vapor, said canister having an inlet and an outlet; and

c. a valve, said valve including a valve body, said valve body including a first passage having an inlet opening and an outlet opening, said inlet opening being connected with said carburetor fuel bowl and said outlet opening extending into said air cleaner, and said valve body also including a second passage, said second passage being located at least in part within said first passage, said second passage having two openings, one of said openings being located a fixed distance from said first passage inlet opening, said second passage including a tapered portion forming a first valve seat; a second valve seat proximate said first passage inlet opening and in alignment with said one of said second passage openings; and movable valve means located in said second passage, said movable valve means being movable between said first and second valve seats, for preventing fluid flow from said first passage inlet opening to said first passage outlet opening when said movable means is in contact with said second valve seat.

2. A fuel vapor-loss control system in accordance with claim **1**, wherein said valve body of said valve further includes a third passage, one of the ends of said third passage being connected with said carburetor fuel bowl and the other end of said third passage being connected to said canister inlet.

3. A fuel vapor-loss control system for an internal combustion engine having a carburetor and a fuel bowl associated with said carburetor, said system comprising:

a. an air cleaner for cleaning air entering said carburetor, said air cleaner including a conduit connected with the air intake portion of said carburetor;

b. a canister for the storage of fuel vapor, said canister having an inlet and an outlet;

c. and a valve, said valve comprising: a valve body, said valve body having a first passage of circular cross-section extending in one direction, said first passage having an inlet opening connected with said carburetor fuel bowl and an outlet opening extending into said air cleaner, and said valve body having a second passage, said second passage having a first opening associated therewith, said first portion being located within said first passage with said first opening being spaced from said first passage inlet opening and said first portion of said second passage extending therefrom toward said outlet opening of said first passage, and said second passage having a second portion and a second opening associated therewith, said second opening of said second passage being located outside of said first passage; a valve seat insert positioned in said first passage inlet opening in spaced relation with said first opening of said first portion of said second passage; and means movable within said first portion of said second passage for preventing flow of fluid from said first passage inlet opening to said first passage outlet opening when said movable means is in contact with said valve seat insert.

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