Feb. 15, 1944. J. H. CARPENTER 2,341,758

FUEL DRAIN VALVE FOR ENGINES

Filed April 17, 1943

Fig. 1

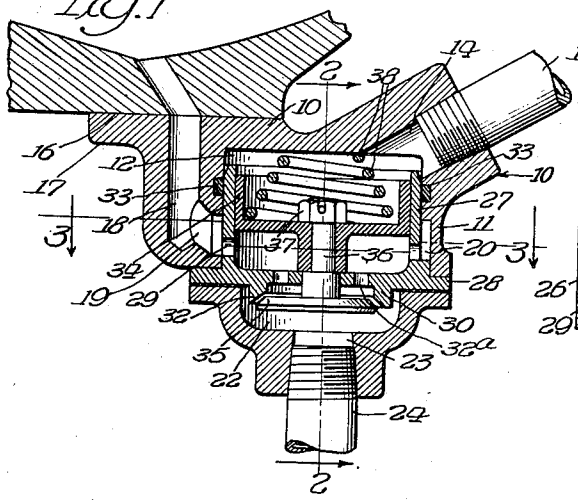


Fig. 2

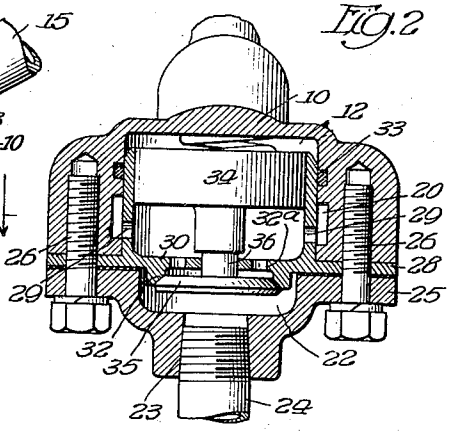


Fig. 4

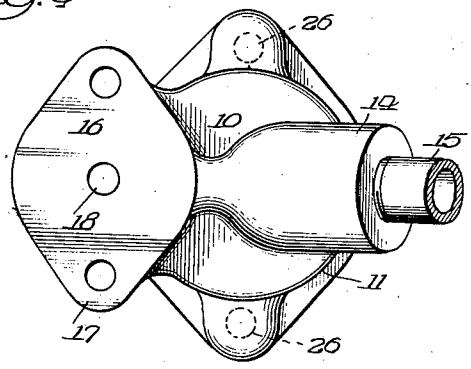


Fig. 3

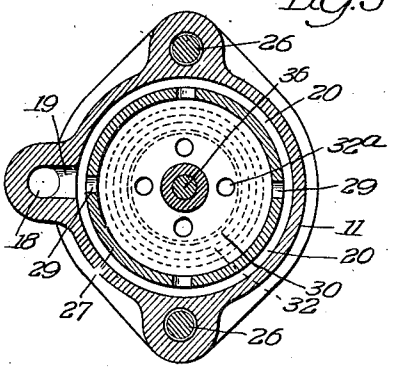


Fig. 6

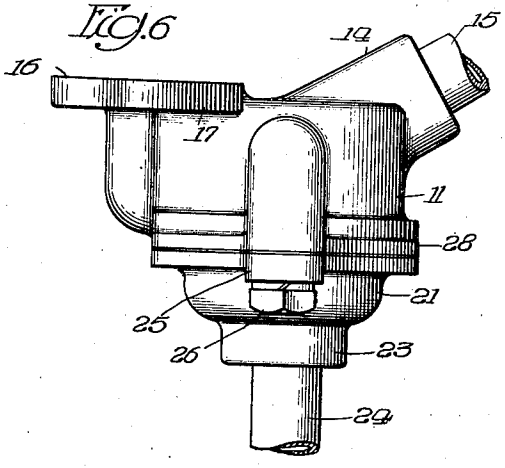
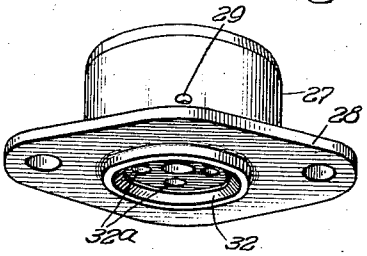


Fig. 5



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2,341,758

FUEL DRAIN VALVE FOR ENGINES

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Application April 17, 1943, Serial No. 483,513

16 Claims. (Cl. 137—153)

The invention relates to automatic fuel drain-valves for supercharged internal combustion engines.

One object of the invention is to improve the construction of automatic fuel drain-valves for use with supercharged engines, which insures the closing of the valves during the operation of the engine and its opening for draining the liquid fuel from the intake manifold when the engine is stopped.

Another object of the invention is to provide a valve of this type which comprises a casing which is composed of a body, cap and intermediate sections with the movable elements all mounted in the intermediate section to facilitate the assembly, inspection or repair of said elements.

Another object of the invention is to provide a valve of this type which is simple in construction, efficient in operation, and can be produced at a low cost.

Other objects of the invention will appear from the detail description.

The invention consists in the several novel features which are hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawing:

Fig. 1 is a section of a valve embodying the invention.

Fig. 2 is a section taken on the line 2—2 of Fig. 1.

Fig. 3 is a section taken on line 3—3 of Fig. 1.

Fig. 4 is a plan view of the valve.

Fig. 5 is a perspective of the intermediate casing-section in which the movable valve member and the piston for shifting said member are mounted.

Fig. 6 is a side elevation of the valve.

In the exemplification of the invention illustrated, the casing comprises a body-section, a cap-section, and an intermediate section which is removably secured between the cap and body sections and in which the operating parts of the valve are mounted. The body-section 10 is preferably made of aluminum or magnesium, is cup-shaped, and comprises a top wall 10a and an annular depending wall 11 in which is formed a cylindrical chamber 12 which extends through the lower end of wall 11. A duct 14 extends obliquely and laterally from the upper end of chamber 12 and communicates with a pipe 15 which is usually connected to the inlet to the impeller between the carburetor and the impeller of the fuel supercharging system of an internal combustion engine, so that suction will be applied to the upper end of chamber 12 at all times when the engine is in operation. The body-section 10 is provided with an integral pad 16 and laterally extending lugs 17 which are provided with holes for screws and are faced for attachment of the valve-casing to a face on the intake manifold through which the fuel is forced by the impeller or supercharger to the engine-cylinders, so that any liquid fuel in said intake and its connections after the engine is stopped will drain into a duct 18. The duct 18 extends to the face or pad 16 to receive the liquid fuel from said manifold and its lower end is extended as at 19 into communication with an annular groove 20 in the lower portion of the chamber 12. The duct 18, while the engine is running, is subjected to fluid pressure from the combustible mixture forced through the manifold by the impeller or supercharger (not shown). This exemplifies a chamber, the upper end of which is subjected to suction for closing the automatic drain valve and the lower end to pressure while the engine is running.

The cap-section 21 is also preferably made of aluminum or magnesium, forms a bottom for the casing, and is provided with a chamber 22 which receives the engine fuel drained through the body-section of the casing and an outlet duct 23 to which a pipe 24 is connected for delivering the drained fuel to a reservoir for re-use. Section 21 is provided with integral lugs or ears 25 which are provided with holes for screws 26 which are adapted to removably secure the cap-section to the body-section of the casing.

The intermediate casing-section, which is preferably made of steel or other wear-resistant material, comprises a cylinder 27 which fits in cylindrical chamber 12; an integral annular flange 28 which fits and is adapted to be clamped between cap-section 21 and the lower face on the annular wall 11 of the body-section and is provided with holes through which screws 26 extend; a cross-wall 30 which is provided with drain-holes 32a, and a downwardly facing conical valve-seat 32. Ports 29 are formed in the lower portion of cylinder 27 for the flow of fluid under pressure from duct 18 and groove 20 into the lower end of said cylinder. A ring of packing 33 in a groove in the inner periphery of wall 11 prevents leakage between the upper and lower ends of cylindrical chamber 12.

A piston 34 is slidable in the cylinder 27 above the pressure ports 29 and below the suction duct 14, so that the upper piston face is responsive to suction from duct 14 and the under face will be responsive to pressure from duct 18. A valve-

member 35 is adapted to close against seat 32 and is provided with a stem 36 which extends through and is slidable in the cross-wall 30. Piston 34 is fixedly secured on the upper end of valve-stem 36 between a shoulder on the stem 36 and a nut 37, so that said piston will shift the valve-member 35 to and from its seat 32. A coil-spring 38 between piston 34 and the wall 10a is adapted to shift piston 34 downwardly to unseat valve-member 35 and permit the fuel to drain through ports or holes 32a into chamber 22 when pressure and suction are not applied to the piston 34, which occurs when the engine is not running. This construction exemplifies one in which the piston and valve-member are mounted in and are removable when the cap-section 21 is removed with the intermediate casing-section.

The operation of the automatic drain-valve will be as follows: While the engine is running the suction in duct 14 from the inlet side of the impeller or between the carburetor and the impeller will be applied to the upper face of piston 34. Simultaneously, fluid under pressure from duct 18, which is connected to the inlet manifold through the combustible mixture is forced to the engine-cylinders by the impeller, will pass through branch duct 19, annular groove 20 and ports 29 into the lower end of cylinder 27 and against the under side of piston 34. This suction and pressure on the piston 34 will overcome the force of spring 38 and shift the piston upwardly and force the valve-member 35 against its seat 32 to cut off communication between the interior of cylinder 27 and the chamber 22 and duct 23 in the cap-section 21. When the engine is stopped, the pressure on the under side and the suction on its upper face will be released and the spring 38 will shift the piston 34 downwardly and the latter will unseat valve-member 35. Any residual liquid fuel or any condensate of the fuel will then drain from the manifold through duct 18, extension 19, groove 20, ports 29 into the cylinder 27 and thence through ports 32a, chamber 22 and ducts 23 to the drain pipe 24 which conducts the fuel to any suitable point for re-use, if desired. While the engine is not running, the valve remains open for draining the fuel. As soon as the engine is started, piston 34 will be shifted to close valve-member 35 and cut off communication between the chamber 22 and the inlet manifold.

The invention exemplifies a fuel drain valve for engines which is simple in construction and efficient and automatic in its operation. The construction is adapted for the use of an intermediate section of wear-resisting metal for carrying the operating parts and top and bottom casing sections of lighter metals. The operating parts are readily removable for replacement, inspection or repair, because they are all mounted in the intermediate casing-section. The valve-casing is small and is adapted for direct connection to the intake manifold.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to fluid pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower portion of said chamber, and a duct communicating with the upper portion of the chamber and connected for suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber and an outlet for the fuel; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct; a crosswall at the lower end of the cylinder provided with a valve-seat and a drain-opening; a piston slidable in the cylinder between the suction and pressure ducts with its faces adapted to be exposed to suction and pressure, respectively; a valve-member for engaging the seat and cutting off the flow through the opening in said wall; a connection between the piston and said valve-member and extending through the wall; and means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

2. A fuel drain valve for supercharged engines comprising a casing having a cup-shaped body section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to fluid pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower portion of said chamber, and a duct communicating with the upper portion of the chamber and connected for suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber and an outlet duct for the fuel; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct; a crosswall at the lower end of the cylinder provided with a downwardly facing valve-seat and with drain-ports; a piston slidable in the cylinder between the suction and pressure ducts with its faces adapted to be exposed to suction and pressure, respectively; a valve-member under and for engaging the seat and cutting off the flow through the drain-ports in said wall; a stem fixedly connecting the piston and said valve-member and extending through the wall; and means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

3. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to fluid pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the upper portion of the chamber and connected for suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber and an outlet duct for the fuel; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct; packing around the cylinder between the pressure and suction ducts; a crosswall at the lower end of the cylinder pro-

vided with a valve-seat and with a drain-opening; a piston slidable in the cylinder between the suction and pressure ducts, with its faces adapted to be exposed to suction and pressure, respectively; a valve-member for engaging the seat and cutting off the flow through the opening in said wall; a fixed connection between the piston and said valve-member, and extending through the wall; and spring means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

4. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to fluid pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower portion of said chamber, and a duct communicating with the upper portion of the chamber and connected for suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber and an outlet duct for the fuel; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct; a crosswall at the lower end of and integral with the cylinder, provided with a downwardly facing valve-seat and with drain-ports; a piston slidable in the cylinder between the suction and pressure ducts with its faces adapted to be exposed to suction and pressure, respectively; a valve-member under and for engaging the seat and cutting off the flow through the drain-ports in said wall; a stem fixed between the piston and said valve-member and extending through the wall; and spring means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

5. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to fluid pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower portion of said chamber, and a duct communicating with the upper portion of the chamber and connected for suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber and an outlet duct for the fuel; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is provided with ports in communication with the pressure and drain duct; a crosswall at the lower end of the cylinder provided with a downwardly facing valve-seat and with the drain-ports; a piston slidable in the cylinder between the suction and pressure ducts with its opposite faces adapted to be exposed to suction and pressure, respectively; a valve-member in the chamber in the cap-section, under and for engaging the seat and cutting off the flow through the drain-ports in said wall; a fixed connection between the piston and said valve-member extending through the wall; and a spring between the piston and the top of the body-section for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

6. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower end of said chamber, and a duct communicating with the upper portion of the chamber for connection to suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber for receiving liquid from the body-section, and an outlet duct for the liquid; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct, the cylinder being provided with a flange fitting between the body and cap sections; a cross wall on the lower end of the cylinder which is provided with a valve-seat and a drain-opening; screws extending through the cap-section and said flange, for detachably securing the cap-section and flange on the body-section; a piston slidable in the cylinder between suction and pressure ducts, with its opposite faces adapted to be exposed to suction and pressure, respectively; a valve-member for engaging the seat for cutting off the flow through the drain-ports in said wall; a connection between the piston and said valve-member extending through the wall for shifting the valve-member from the piston; and means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

7. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower end of said chamber, and a duct communicating with the upper portion of the chamber for connection to suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber for receiving liquid from the body-section and an outlet duct for the liquid; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct, the cylinder being provided with an integral flange fitting between the body and cap sections and an integral cross wall which is provided with a valve-seat and drain-ports, screws extending through the cap-section and said flange for detachably securing the cap-section and flange on the body-section; a piston slidable in the cylinder between suction and pressure ducts with its opposite faces adapted to be exposed to suction and pressure, respectively; a valve-member in the cap-section for engaging the seat for cutting off the flow through the drain-ports in said wall; a stem connecting the piston and said valve-member and extending through the wall for shifting the valve-member from the piston; and means for automatically shifting the piston to unseat said valve-member

when the piston is not subjected to suction and pressure.

8. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower end of said chamber, and a duct communicating with the upper portion of the chamber for connection to suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber for receiving liquid from the body-section and an outlet duct for the liquid; a cylinder in said cylindrical chamber, the upper end of which is open and in communication with the suction duct and the lower end of which is provided with a port in communication with the pressure and drain duct, the cylinder being provided with a flange fitting between the body and cap sections and a cross wall which is provided with a valve-seat and drain-ports; packing around the cylinder between its upper and lower ends; screws extending through the cap-section and said flange for detachably securing them on the body-section; a piston slidable in the cylinder between suction and pressure ducts, with its opposite faces adapted to be exposed to suction and pressure, respectively; a valve-member for engaging the seat for cutting off the flow through the drain-ports in said wall; a connection between the piston and said valve-member extending through the wall, for shifting the valve-member from the piston; and means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

9. A fuel drain valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with an integral pad adapted to fit and to be secured against a portion of an intake manifold, a cylindrical chamber, a duct having an end open at the pad for connection to pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped and communicating with the lower end of said chamber, and a duct communicating with the upper portion of the chamber for connection to suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber for receiving liquid from the body-section and an outlet duct for the liquid; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is in communication with the pressure and drain duct, the cylinder being provided with an integral flange fitting between the body and cap sections and an integral cross wall which is provided with a valve-seat and drain-ports; screws extending through the cap-section and said flange for detachably securing the cap-section and flange on the body-section; a piston slidable in the cylinder between suction and pressure ducts with its faces adapted to be exposed to suction and pressure, respectively; a valve-member for engaging the seat for cutting off the flow through the drain-ports in said wall; a connection between the piston and said valve-member extending through the wall for shifting the valve-member from the piston; and means for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

10. A fuel drain-valve for supercharged engines comprising a casing having a cup-shaped body-section and a separate cap-section; the body-section being provided with a cylindrical chamber, a duct having an open end for connection to pressure from the intake manifold when the engine is running and for draining liquid fuel from the manifold when the engine is stopped, an annular groove communicating with the lower end of said pressure and drain duct and a duct communicating with the upper portion of the chamber for connection to suction from the intake side of the impeller or supercharger; the cap-section being provided with a chamber for receiving liquid from the body-section and an outlet duct for liquid; a cylinder in said cylindrical chamber, the upper end of which is in communication with the suction duct and the lower end of which is provided with ports in communication with the groove in the body-section, the cylinder being provided with a flange fitting between the body and cap sections and a cross wall which is provided with a downwardly facing valve-seat and drain-ports; screws extending through the cap-section and said flange for detachably securing them on the body-section; a piston slidable in the cylinder between suction and pressure ducts with its opposite faces adapted to be exposed to suction and pressure, respectively; a valve-member for engaging the seat for cutting off the flow through the drain-ports in said wall; a fixed connection between the piston and said valve-member extending through the wall for shifting the valve-member from the piston; and a spring for automatically shifting the piston to unseat said valve-member when the piston is not subjected to suction and pressure.

11. A fuel drain-valve for supercharged engines comprising a casing having a body-section and a separate cap-section, said body-section having a chamber opening through one wall thereof, a duct having an open end for connection to fluid pressure from the intake manifold and for draining liquid fuel from the manifold, said duct opening into one end portion of said chamber, a duct communicating with the other end portion of said chamber and connected for suction from the intake side of the supercharger, said cap section having a chamber opening through one wall thereof and having an outlet opening through a second wall, said last-named outlet being communicatively connected to said cap-section chamber, a hollow member having oppositely extending open end portions and extending into said chamber, said hollow member having a valve seat at one open end portion thereof, a piston slidable in said hollow member, said hollow member having its other open end portion communicatively connected with said chamber other end portion, means communicatively connecting said chamber one end portion with said hollow member one end portion intermediate said piston and said seat, a valve member cooperable with said seat to control flow of fluid therethrough, means securing said cap-section to said body-section with said cap-section chamber registering with said hollow member one end portion, means operatively interconnecting said valve and said piston, and means urging said valve away from said seat.

12. A fuel drain-valve for supercharged en-

gines comprising a casing having a body-section and a separate cap-section, said body-section having a chamber opening through one wall thereof, a duct having an open end for connection to fluid pressure from the intake manifold and for draining liquid fuel from the manifold, said duct opening into one end portion of said chamber, a duct communicating with the other end portion of said chamber and connected for suction from the intake side of the supercharger, said cap section having a chamber opening through one wall thereof and having an outlet opening through a second wall, said last-named outlet being communicatively connected to said cap-section chamber, a hollow member having oppositely extending open end portions and extending into said chamber, said hollow member having a valve seat at one open end portion thereof, a piston slidable in said hollow member, said hollow member having its other open end portion communicatively connected with said chamber other end portion, means communicatively connecting said chamber one end portion with said hollow member one end portion intermediate said piston and said seat, a valve member cooperable with said seat to control flow of fluid therethrough, means securing said cap-section to said body-section with said cap-section chamber registering with said hollow member one end portion, means operatively interconnecting said valve and said piston, guide means for said interconnecting means, and means urging said valve away from said seat.

13. A fuel drain-valve for supercharged engines comprising a casing having a body-section and a separate cap-section, said body-section having a chamber opening through one wall thereof, a duct having an open end for connection to fluid pressure from the intake manifold and for draining liquid fuel from the manifold, said duct opening into one end portion of said chamber, a duct communicating with the other end portion of said chamber and connected for suction from the intake side of the supercharger, said cap section having a chamber opening through one wall thereof and having an outlet opening through a second wall, said last-named outlet being communicatively connected to said cap-section chamber, a hollow member having oppositely extending open end portions and extending into said chamber, said hollow member having a valve seat at one open end portion thereof, a piston slidable in said hollow member, said hollow member having its other open end portion communicatively connected with said chamber other end portion, means communicatively connecting said chamber one end portion with said hollow member one end portion intermediate said piston and said seat, a valve member cooperable with said seat to control flow of fluid therethrough, said hollow member having a flange portion, means securing said cap-section and said flange portion to said body-section with said cap-section chamber registering with said hollow member one end portion, means operatively interconnecting said valve and said piston, guide means for said interconnecting means, and means urging said valve away from said seat.

14. In a device of the character described, a body member having a chamber opening through one wall thereof, a duct opening into one end of said chamber away from said one wall, a duct opening into said chamber adjacent said one wall, a hollow member positioned in and having substantially a fluid tight fit with said chamber, a flange on said hollow member abutting said body one wall, a transverse wall closing the end of said hollow member adjacent said flange and having an aperture therethrough, a pressure responsive member positioned in said hollow member, means communicatively interconnecting said second named duct with the interior of said hollow member intermediate said pressure member and said transverse wall, a valve member cooperable with said wall aperture to control flow of fluid therethrough, means operatively connecting said pressure member and said valve member, a cap member having a chamber opening through one wall thereof, said cap member having an outlet passageway leading from said last-named chamber, said cap member one wall abutting said flange, said last-named chamber registering with said wall aperture, and means securing said cap member and said hollow member to said body member.

15. In a device of the character described, a body member having a chamber opening through one wall thereof, a duct opening into one end of said chamber away from said one wall, a duct opening into said chamber adjacent said one wall, a hollow member positioned in and having substantially a fluid tight fit with said chamber, a flange on said hollow member abutting said body one wall, a transverse wall closing the end of said hollow member adjacent said flange and having an aperture therethrough, a pressure responsive member positioned in said hollow member, means communicatively interconnecting said second named duct with the interior of said hollow member intermediate said pressure member and said transverse wall, a valve member cooperable with said wall aperture to control flow of fluid therethrough, means operatively connecting said pressure member and said valve member, guide means for said connecting means, a cap member having a chamber opening through one wall thereof, said cap member having an outlet passageway leading from said last-named chamber, said cap member one wall abutting said flange, said last-named chamber registering with said wall aperture, and means securing said cap member and said hollow member to said body member.

16. In a device of the character described, a body member having a chamber opening through one wall thereof, a duct opening into one end of said chamber away from said one wall, a duct opening into said chamber adjacent said one wall, a hollow member positioned in and having substantially a fluid tight fit with said chamber, a flange on said hollow member abutting said body one wall, a transverse wall closing the end of said hollow member adjacent said flange and having an aperture therethrough, a piston member positioned in said hollow member, means communicatively interconnecting said second named duct with the interior of said hollow member intermediate said piston member and said transverse wall, a valve member cooperable with said wall aperture to control flow of fluid therethrough, means operatively connecting said piston member and said valve member, a cap member having a chamber opening through one wall thereof, said cap member having an outlet passageway leading from said last-named chamber, said cap member one wall abutting said flange, said last-named chamber registering with said wall aperture, and means securing said cap member and said hollow member to said body member.

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