June 8, 1937. G. G. SEMANS 2,083,244

VALVE

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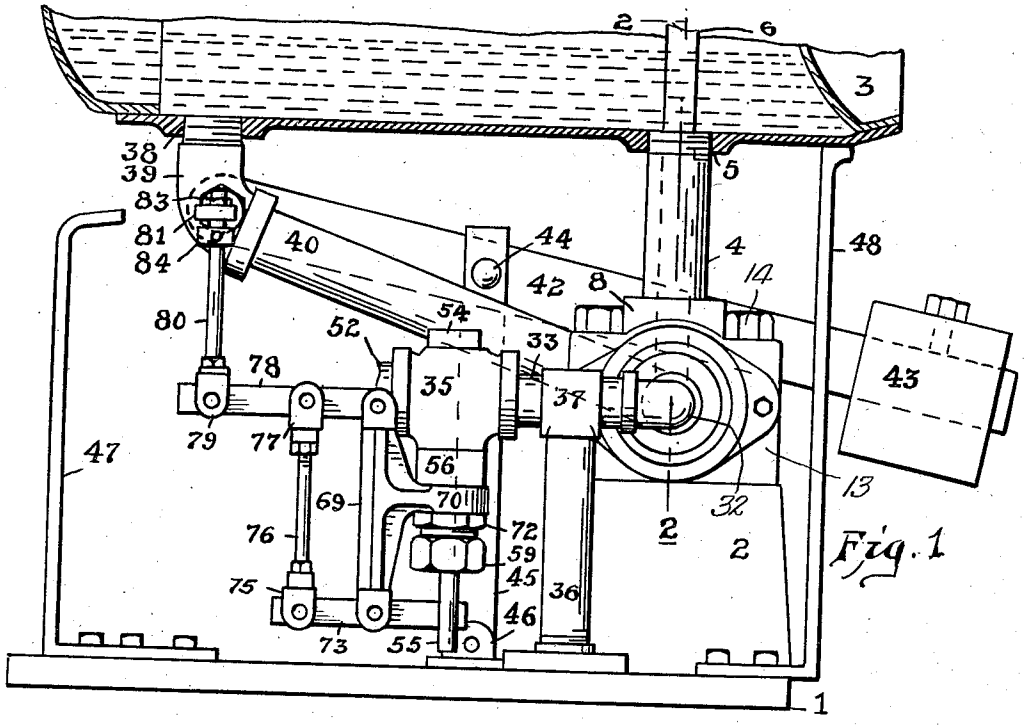


Fig. 1

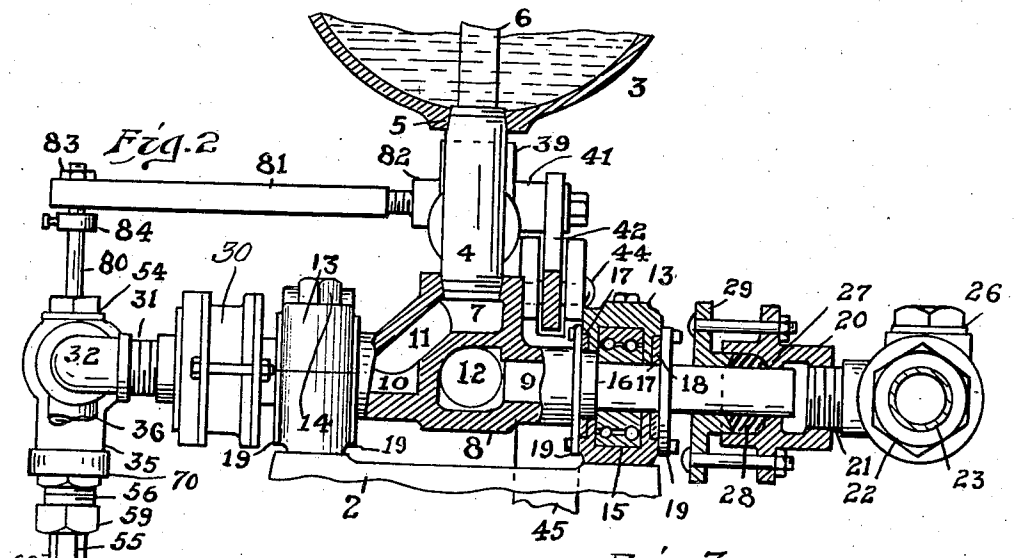


Fig. 2

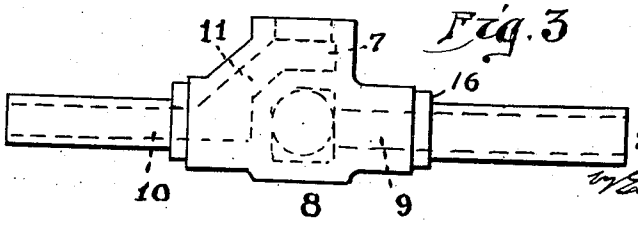


Fig. 3

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VALVE

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Fig. 4.

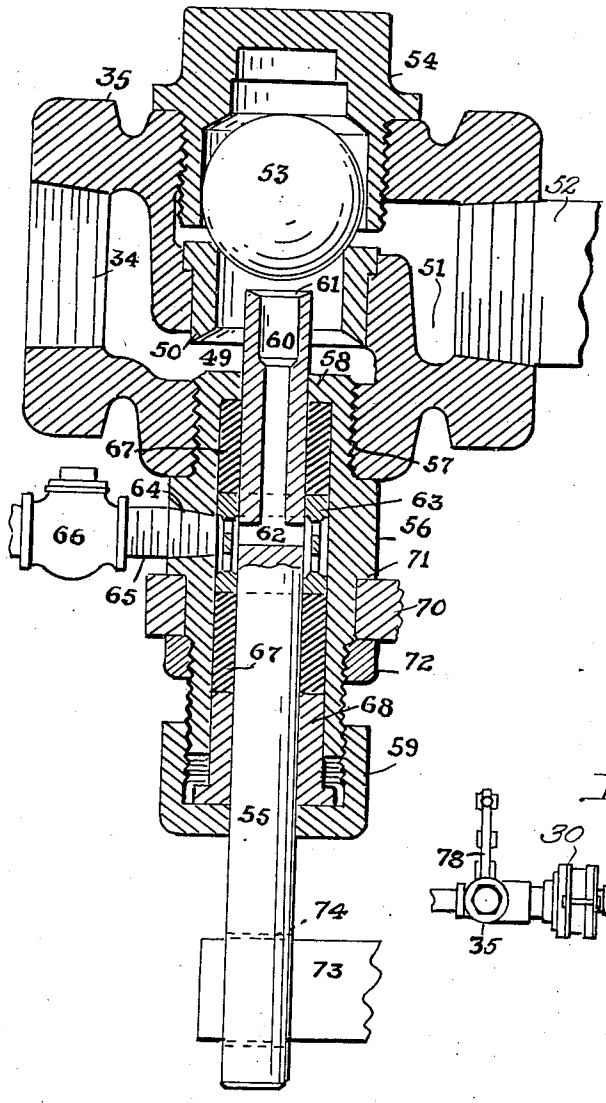


Fig. 7.

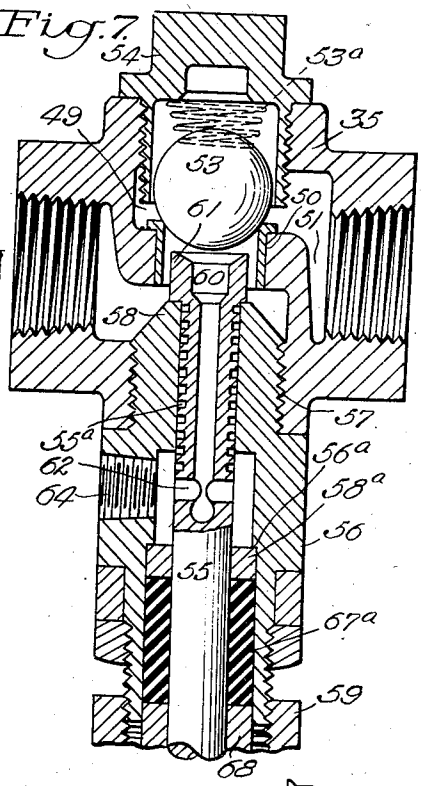


Fig. 6.

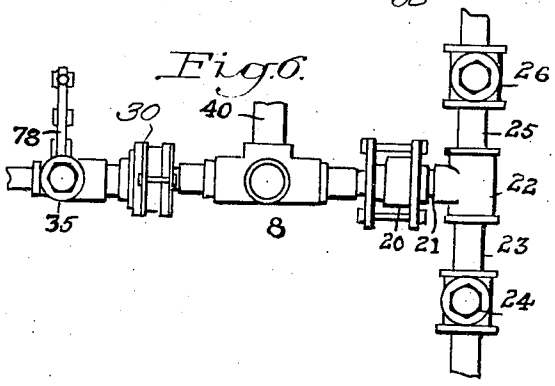
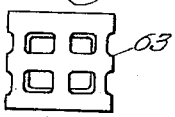


Fig. 5.



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VALVE

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3 Claims. (Cl. 277—42)

This invention relates generally to valves and more particularly to valve structures for use with return or non-return steam traps wherein a tank is mounted to oscillate on a horizontal axis and is counterbalanced so that as the water accumulates in the tank the latter is overbalanced, operating a valve which admits steam to the tank to eject the water either back to the boiler as in the case of a return trap or otherwise as in the case of a non-return trap.

A characteristic feature of my invention is the provision of a new and improved valve which is automatically operated by the tilting of the tank, for the purpose of admitting steam to the tank for the ejection of the accumulated water.

For this purpose I have provided a new and improved valve whose principles are hereinafter explained.

Again my improved valve is provided with means whereby when the valve is closed against the admission of steam to the tank, the tank pressure is vented to reduce resistance to the entrance of the water to the tank.

My improved valve, while especially designed for use with my improved steam trap, may be used for many other purposes, such, for instance, as a hydraulic valve for the control of pressure in connection with a working cylinder or the like.

Other novel features of construction and also of arrangement of parts, will appear from the following description.

In the accompanying drawings, wherein I have illustrated a practical embodiment of the principles of my present invention, Fig. 1 is a side elevation of the apparatus with the tank shown only in part and in vertical section.

Fig. 2 is a view partially in end elevation and partially in vertical section taken along the lines 2—2 in Fig. 1.

Fig. 3 is a view of my improved trunnion member.

Fig. 4 is a vertical section on enlarged scale of the steam-admission operative valve.

Fig. 5 is an elevation of the lantern gland used in connection therewith.

Fig. 6 is a view in plan and on reduced scale showing the assemblage of the trunnion member, the steam admission valve, and the pipes by means of which the water gains entrance to the tank and through which it is ejected from the tank.

Fig. 7 is an incomplete view similar to Fig. 4 but illustrating a modified form of valve.

Referring to Figs. 1 to 6 of the drawings, 1 represents the bed plate or base, and 2 a platform erected at one end thereof. 3 represents a normally horizontally disposed tank which is usually made of galvanized steel and which is provided with stout heads. The tank is supported by means of a stout tube 4 whose upper end is screwed into a threaded port 5 in the bottom of the tank but adjacent to one end thereof, the right end in Fig. 1. The bore of said tube 4 is continued upwardly within the tank by means of a pipe 6 to a point adjacent to the top wall of the tank. The lower end of the tube 4 is screwed into a threaded port 7 in a horizontally disposed trunnion member 8. The ends of the trunnion member are tubular and their bores are indicated at 9 and 10. The bore 10 is connected by a passage 11 with the port 7 and the lower end of the tube 4. The bore 9 is connected with the chamber 12 which is provided with a threaded port whose axis is disposed at an acute angle to the axis of the port 7.

The trunnion member 8 is journaled from the platform 2 in the two-part stands 13, the upper part or cap of the stands being detachably secured as by means of the bolts 14. Within the stands 13 are mounted the ball-bearing or anti-friction bearing assemblies 15, the inner raceways of which are driven on the trunnion member up against the annular shoulders 16 while the outer raceways are contained in the annular seats of the stands. The stands are provided with annular recesses 17 cut in their ends and in which are held the asbestos or other packing rings 18 held in place by the annular plates 19 which may be bolted to the sides of the stands. One end of the trunnion member, the right end in Fig. 2, beyond the anti-friction bearing, is inserted in the tubular gland member 20 which is connected as by a nipple 21 to the T-fitting 22.

One of the arms of said fitting, the arm shown at the bottom in Fig. 6, is connected to a pipe 23 by means of which the water or saturated steam is admitted to the trap. The pipe 23 is provided with a check valve 24 which opens towards the fitting 22.

The other arm of the fitting 22 is connected to a pipe 25 which in a return trap is connected to the boiler below the water line but which in a non-return trap may connect to waste. The pipe 25 is provided with a check valve 26 which opens away from the fitting 22 and which is normally held closed by boiler pressure. In the case of a non-return trap this valve may be normally held closed by spring or other pressure.

The gland member 20 is provided with an in-

ternal annular shoulder 27 which fits about the end of the trunnion member 8 but not tightly enough to cause appreciable wear. The trunnion end of the gland member 20 is provided with a packing cavity in which is placed the compressible packing 28 and 29 is a gland follower loosely encircling the trunnion and arranged to be tightened against the packing as by means of flanges and bolts.

The other end of the trunnion member 8, that having the bore 10, is in communication through a similar packing gland 30 with a pipe 31 which in turn is connected by an elbow 32 and a pipe 33 with the port 34 of the casing 35 of the operating valve.

The operating valve may be supported in any convenient manner, but for said purpose I have shown a post 36 having its upper end provided with a collar 37 through which the pipe 33 extends.

38 represents a threaded port in the bottom of the tank 3 adjacent to the opposite end of said tank from that of the port 5. 39 represents an elbow screwed into said port and connected at its other end to one end of a pipe 40, the other end of said pipe being screwed into the threaded port of the chamber 12 of the trunnion member 8.

One side of the elbow 39 at its angle, the right side in Fig. 2, is provided with a boss 41 to the end of which is pivotally attached a lever 42 which extends beneath the tank and whose other end is provided with an adjustable weight 43. Intermediate of its ends the lever 42 is pivotally supported as by a pin 44 between the forks of the upper end of a link 45 whose lower end is pivotally supported as at 46 from the bed plate 1.

The weight 43 is adjusted so that the tank 3 normally maintains the horizontal position indicated in Fig. 1, but when sufficient water has accumulated in the tank the weight is overbalanced and the tank swings counterclockwise in Fig. 1 until it comes into contact with the stop 47 extending upwardly from the plate 1. When the water is ejected from the tank, the weight again overbalances the tank and returns it to its horizontal position. Movement of the tank beyond the horizontal is prevented as by means of the stop 48 extending upwardly from the bed plate 1.

The admission of steam to the tank to eject the accumulated water is controlled by the steam inlet valve whose casing is indicated at 35.

Said valve is preferably disposed and is provided with a chamber 49 intermediate of which is removably mounted the ball seat 50. Below the ball seat said chamber is connected to the port 34, above referred to, and above the ball seat the chamber is connected to a port 51 to which is attached a steam supply pipe 52 which is connected in turn to the boiler or other source of steam under sufficient pressure.

Within the chamber 49 and working in relation to the seat 50 is a valve ball 53 whose upward or unseating movement is limited by the cap 54 which is screwed into a threaded port in the upper end of the chamber.

55 is a plunger which works in a tubular sleeve 56 whose upper end is threaded and screwed into a threaded port 57 in the lower end of the valve casing. The axis of the sleeve is alined with the axis of the ball seat 50. The upper end of the sleeve is provided with an inwardly extending annular flange 58 in which the plunger 55 has a loose sliding fit. The lower end of the sleeve 56 is threaded to receive an annular cap 59 whose bore has a loose sliding fit with the plunger 55. The upper portion of the plunger 55 is provided with a longitudinal bore 60 whose upper end is provided with a ball seat 61 arranged to be engaged and sealed by the ball 53. The lower end of the bore 60 connects with a diametric passage 62 in the plunger 55, which passage with the movement of the plunger 55 moves into and out of registration with the lantern gland 63 positioned in the bore of the sleeve 56.

Registering with said lantern gland is a threaded port 64 in the wall of the sleeve 56, which port is connected by a nipple 65 with a check valve 66 which opens outwardly or away from the nipple. The other side of the check valve may be opened to atmosphere.

Within the bore of the sleeve 56 and above and below the lantern gland 63 are the packing rings 67 which are compressed and tightened by means of the tubular follower 68 whose lower end is engaged by the cap 59. Thus the escape of water or steam along the plunger 55 or through its cap 59 when the plunger is raised from its position illustrated in Fig. 4 is prevented.

It will be noted that the upper portion of the bore 60 of the plunger 55 is counterbored or enlarged and that therefore the lower bore has less capacity. The purpose is to retard the travel of high pressure steam through the plunger bore when the ball 53 engages the seat 50, and thus reduce the cutting effect of the fluid on the surface of the ball seat at the upper end of said bore. Where the pressures are relatively low or subatmospheric the bore need not be enlarged at its upper end.

The relative position of the plunger 55 which is illustrated in Fig. 4 is that which it occupies while the tank is in its horizontal position.

69 represents a vertically disposed bracket having upper and lower yoke ends and which is provided with a horizontally disposed collar 70 which is slipped up on the sleeve 56 against a shoulder 71 on said stem and is held rigidly in place by means of a nut 72 screwed on the threaded portion of said sleeve. Thus the bracket is supported in proper position.

A lever 73 is pivoted intermediate of its ends in the lower yoke of the bracket 69 and one end of said lever extends through a loosely fitting and diametrically disposed slot 74 in the protruding lower end of the plunger 55.

The other end of the lever 73 is pivoted to a clevis 75 on the lower end of a connecting rod 76 whose upper end is provided with a second clevis 77 which is pivotally connected to a lever 78 intermediate of the ends of said lever. One end of the lever 78 is pivotally connected to the upper yoke of the bracket 69 while its other end is pivotally connected to a clevis 79 on the lower end of a rod 80. The rod 80 extends upwardly through a loosely fitting hole in a horizontally disposed arm 81 whose other end is screwed into a threaded socket 82 in the side of the elbow 39. The rod 80 is provided with a nut 83 on its upper end above the arm 81 and also a nut or fixable collar 84 below said arm. By adjusting the nut and collar, a suitable amount of lost motion may be provided for between the arm 81 and the rod 80.

With the tank in the horizontal position shown in Fig. 1, the water and/or saturated steam flow along the pipe 23 past the check valve 24 and through the trunnion bore 9 and the pipe 40 into the tank 3 and accumulates therein. The steam pressure above the water level in the tank is

vented down the pipe 6, the tube 4, trunnion 8, the valve port 34, the chamber 49 beneath the ball seat, the bore and passage in the plunger 55 and out through the port 64 and check valve 66.

When the predetermined quantity of water has accumulated in the tank, the influence of the weight 43 is overcome and the tank tilts counterclockwise from its position shown in Fig. 1 until its left end rests upon the stop 47.

This movement of the tank causes the levers 78 and 73 to be rocked counterclockwise from their positions shown in Fig. 1, thus moving the valve plunger 55 upwardly in its position illustrated in Fig. 4. The plunger first engages the ball 53 which seals the seat 61 on the upper end of the plunger, thus sealing off the vent. As the plunger continues to ascend, it raises the ball 53 off the seat 50, thus establishing open communication between the steam supply port 51 and the port 34 which is in communication with the lower end of the tube 4, thus admitting the high pressure steam into the upper portion of the tank and thereby ejecting the water content of the tank through the pipe 40 and the trunnion bore 9 into the pipe 25 which in the case of a return trap is connected to the boiler below its water level. The high pressure of the steam thus admitted to the trap causes the valve 26 to open against boiler pressure which holds it shut while the tank is filling.

It will be observed that there is no venting of steam or escape of pressure through the vent of the steam-inlet valve as the ball remains seated on the upper end of the plunger 55.

When the water has been ejected, the weight 43 overbalances the empty tank and returns it to the position shown in Fig. 1 with its right end supported by the stop 48.

This return movement of the tank results in the lowering of the plunger 55 of the steam-admission valve, the ball 53 however remaining seated on the upper end of the plunger until the former is lowered into seating relation with the valve seat 50 whereupon the plunger continues to descend until it assumes the relative position illustrated in Fig. 4 wherein its bore is open for venting tank pressure. However, until the communication between the steam supply pipe and the tank is fully interrupted the vent remains closed.

The lost motion in the connection between the outer end of the arm 81 and the upper end of the rod 80 causes the beginning of the operation of shifting the steam-inlet valve to lag slightly as the tank starts a movement.

In the case of a non-return trap I connect the port 51 of the valve casing to the tank while the port 34 is either open to atmosphere or connected to a receptacle having a pressure lower than the pressures of tank 3.

Thus when the tank tilts because of the accumulation of water therein the ball 53 is raised from the seat 50, thus emptying the tank, and when the emptied tank returns to its normal position the ball reseats on said seat. In such case the vent through the plunger may be omitted.

There is a decided advantage in employing a ball as the movable member of the valve. The ball in its movement continuously revolves and changes the axis of its rotation, and thus in a sense the ball grinds its seats and thereby maintains a perfect seal either with the seat 50 or with the seat in the upper end of the plunger.

It will be observed that a single, automatically operated valve is employed for admitting steam into the tilted tank for the ejection of the accumulated water and also to provide a pressure-vent for the tank during the water-accumulating periods. This is a much simpler and less expensive structure than that now employed as traps of this general type. Again the proper relative timing of the openings of the steam communication and of the pressure vent are permanently assured, and no steam is admitted through the valve while the pressure vent is open nor is the pressure vent open while steam is being admitted through the valve.

My improved trunnion structure comprises a very marked improvement over the present commercial art. It is now the practice to employ the packing glands, in which the ends of the trunnion member are received, as the bearings in which the trunnion oscillates. This renders the maintenance of steam pipe packing in these glands very difficult and such packing is subject to undue wear and rapid deterioration.

In my improved structure the bearings in which the trunnion member oscillates are separate from the packing glands and take and assume all thrusts and prevent vibration of the ends of the trunnion member within the glands. It also enables me to provide for the proper lubrication of the bearings without the admission of lubricant to the packing.

In Fig. 7 I show the operating valve designed for use with low pressures only, the plunger 55 being packed in the sleeve 56 below the port 64 only, the lower packing 67*a* abutting at its top against the annular washer 58*a* which bears upwardly against the internal shoulder 56*a* of the sleeve 56.

The upper portion of the plunger is not packed but is provided with a plurality of annular labyrinth grooves 55*a* which serve the purpose of packing where the pressure are relatively low. The lantern gland 63 is thus not required. Otherwise the structure and arrangement illustrated in Fig. 7 is similar to that of Fig. 4.

Usually the operating valve is vertically disposed and the ball 53 tends to close by gravity. However, it may be horizontally disposed and in such case a helical spring 53*a*, shown in dotted lines in Fig. 7 may be used to close the ball.

What I claim is:—

1. In a fluid valve, the combination with a valve casing having a valve seat and a vent spaced from said seat, a check valve arranged to engage said seat and to open away from the vent, and a valve-actuating plunger arranged to reciprocate longitudinally in the casing and provided with a longitudinal passage, one end of which passage is provided with a seat to engage the check valve to close the passage and to move the check valve out of engagement with the first mentioned seat, and the wall of said passage being provided with an opening arranged to register with the vent when the plunger is out of engagement with the check valve, of a lantern gland in the casing registering with the vent, and sealing means interposed between the wall of the casing and the plunger at either end of the lantern gland.

2. In a fluid valve, the combination with a valve casing having a valve seat and a vent spaced from said seat, a check valve arranged to engage said seat and to open away from the vent, and a valve-actuating plunger arranged to reciprocate longitudinally in the casing and provided with a longitudinal passage, one end of which passage is provided with a seat to engage the check valve to close the passage and to move the check valve out

of engagement with the first mentioned seat, and the wall of said passage being provided with an opening arranged to register with the vent when the plunger is out of engagement with the check valve, of packing interposed between the wall of the casing and the plunger at either side of the vent, a lantern gland interposed between the packing and registering with the vent, and means for compressing the packing into sealing engagement.

3. In a fluid valve, the combination of a valve casing having a valve seat and a vent spaced from said seat, a check valve arranged to engage said seat and to open away from the vent, and a valve-actuating plunger arranged to reciprocate longitudinally in the casing and provided with a longitudinal passage, one end of which passage is provided with a seat to engage the check valve to close the passage and to move the check valve out of engagement with the first mentioned seat, and the wall of said passage being provided with an opening arranged to register with the vent when the plunger is out of engagement with the check valve, and the perimetral wall of the plunger being provided with labyrinth grooves adjacent its valve-actuating end to prevent the escape of fluid between the wall of the casing and the plunger.

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