Sept. 7, 1954 W. L. HUNTINGTON 2,688,336

VALVE

Filed June 26, 1950

FIG. 1

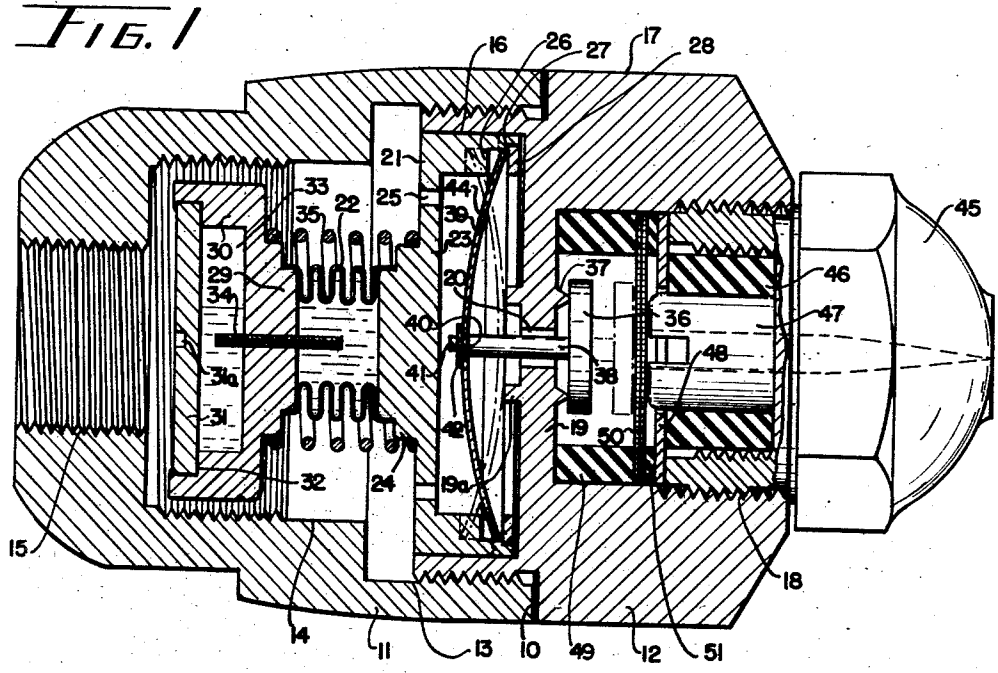


FIG. 2

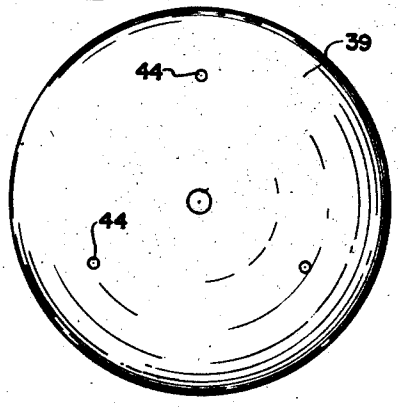
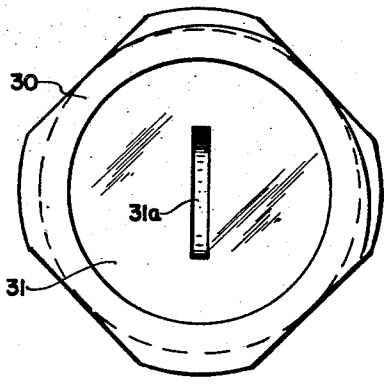


FIG. 3



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VALVE

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8 Claims. (Cl. 137—494)

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This invention relates to fluid control valves and, more specifically, to valves adapted to deliver oil only at atomizing pressure to an oil burner nozzle and to quickly cut off the supply of oil to said nozzle to prevent dribbling of oil from said nozzle after opening and/or closing of the valve.

One of the most troublesome problems of the prior art oil burner installations has been the one of unburned oil accumulating in the bottom of the oil-burning furnace. This accumulation usually is due to the failure of the oil to atomize immediately upon delivery of oil to the burner nozzle and the continued delivery of oil after the oil supply has been interrupted, causing the dribbling of a few drops of oil in each instance. This undesirable oil flow in prior art installations is due to the slow build-up of oil pressure to the atomizing pressure of the nozzle and the slow reduction in oil pressure from the atomizing pressure upon termination of the oil delivery, respectively.

One of the objects of this invention is to provide a simple, inexpensive and reliable control valve for use with an oil burning nozzle to prevent a delivery of unburned oil to the furnace in which the nozzle is installed.

Another object of the invention is to provide an oil control valve having a snap acting mechanism that is pressure-operated to provide clean "cut in" and "cut off" of the oil supply to a nozzle.

A further object of the invention is to provide a simple and small valve which provides means to give delayed delivery of oil to a burner nozzle following the supply of oil to the valve and the substantially simultaneous starting of a fan for delivering combustion air to the combustion chamber of the furnace.

Still another object of the invention is to provide a delayed acting oil valve of very small size that is pressure operated and suitable for installation on existing oil burner installations.

Another object of the invention is to provide an oil valve that may be inserted between an existing nozzle on an oil burner installation and its supply line so as to provide delayed but snap acting opening and closing of the oil supplies at or above atomizing pressure, following the starting of the delivery of fuel to said valve and air to the combustion chamber of said installation.

Still another object of the invention is to provide a hydraulic time delaying means for a snap acting oil valve to cause a delay in the delivery of oil with respect to the delivery of air to a furnace by conventional means.

Other objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawing wherein:

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Figure 1 is a longitudinal cross-sectional view of the valve with a partially broken away conventional nozzle attached thereto;

Figure 2 is an elevational view of a snap-disc, one of the elements of the valve; and

Figure 3 is an elevational view of the left-hand end of the valve actuating unit, as viewed in Figure 1.

The body of the valve is formed of two sections 11 and 12. The section 11 has an internally-threaded recess 13 that extends substantially a third of the length of said section, from the right-hand end thereof as shown in Figure 1. A second recess 14, of smaller diameter than the first-mentioned recess, extends from the bottom of the recess 13 a greater distance into said section than said first-mentioned recess 13. A threaded bore 15 extends from the left-hand end of section 11 to the bottom of recess 14 to provide an inlet port for the valve.

Section 12 has a recess 16 therein of smaller diameter than the recess 13 in section 11. The outer diameter of the wall of the recess 16 is of the same diameter as the recess 13 and is screw-threaded so as to permit the two sections 11 and 12 to be threaded together with a washer 18 therebetween to provide a sealed chamber. An enlarged-diameter body portion 17 extends from the bottom of the recess 16 to the right-hand end of the section 12, as viewed in Figure 1. An internally-threaded bore 18 extends from the right-hand end of the body portion 17 inwardly toward the recess 16, but terminates a spaced distance from said recess 16 to form a partition wall 19 between the recesses 16 and 18. An axial bore 20 extends through the wall 19 to complete the oil flow passage from the inlet 15 of section 11 through the valve body formed of sections 11 and 12 and through the outlet recess 18.

Slidably mounted in the recess 16, is a generally cup-shaped end member 21 of a bellows 22. The member 21 has a recess 23 in the right side thereof, as viewed in Figure 1, and a stepped boss 24 on the left-hand side thereof. Spaced holes 25 through the bottom of the recess 23 provide for the flow of oil between recess 13 and the bore 20. Two annular shoulders 26 and 27, formed in the outer edge of the recess 23, form with a washer 28 resting on the shoulder 27, an annular groove for a purpose to be presently described. The washer 28 is held in place by staking a portion or portions of the member 21 over the outer surface of the washer.

The other end of the bellows 22 is secured to a stepped boss 29 on a stationary generally cup-shaped, end member 30 by a welding or soldering process. A disc 31 rests on a shoulder 32 of a stepped recess in the left side of the end member 30 to provide a fluid reservoir 33 within said end

member. A capillary tube 34 extends from the center of the bellows 22 to the center of the chamber 33. The bellows 22 is completely filled with a suitable liquid such as oil while the chamber 33 is only a little over half filled with the same liquid. This construction enables the bellows to move slowly in a direction which causes liquid to move from said bellows and into the reservoir 33, compressing the air above the oil therein, and also enables the bellows to move more rapidly in the opposite direction, wherein oil will flow from the reservoir 33 into the bellows 22. The more rapid movement in said opposite direction is due to the fact that a vacuum may be created in the bellows without having to wait for the oil to flow thereinto from the reservoir 33. Extending between the end members 21 and 30 and resting on one of the steps of the stepped bosses thereon, is a compression spring 35 that normally tends to hold the end member 21 its furthest distance from the end member 30. To provide for the varying of the compression strength of spring 35, the disc 31 has a slot in the outer surface thereof which may be engaged by a screwdriver extending through the bore 15 to provide for the rotation of the end member 30. The peripheral edge of the member 30 is flattened on four sides to provide for the flow of oil past said end member and is screw-threaded for engagement with the screw-threads in the recess 14. Thus, when the member 30 is rotated by a screwdriver, the position of the member 30 axially of the section 11 may be varied to vary the compression of spring 35.

A disc valve 36 rests on a V-shaped annular rib 37, formed on the partition wall 19, providing a line-contact, ring valve seat. A stem 38, secured to the disc valve 36 in a conventional manner, extends through the bore 20 and through an opening in a snap disc 39. The snap disc rests on a shoulder 40 of the valve stem formed by a reduced-diameter extension 41 of said stem. A clip washer 42 fits in an annular groove (not shown) in said extension 41 to hold the disc on the stem 38. The snap disc has a plurality of openings 44 therein to provide for the passage of fluid from the inlet 15 to the outlet 18. The peripheral edge of the snap disc rests in the annular groove formed by the shoulder 26 and the washer 28. When the end member 21 moves toward the left, as viewed in Figure 1, the central portion of the snap disc 39 will remain motionless due to the fact that it is held by the valve stem 38 and the disc valve 36 is resting on the valve seat. The peripheral edge of the snap disc, however, will move with the end member 21 sufficiently far as to cause the snap disc to buckle and eventually snap over to the position shown in broken lines in the drawing, that is, with the central portion of the disc resting on an annular rib 19a, formed on the wall 19. This rib limits the movement of the valve disc 36 toward the right. For the sake of clarity, the curvature of the snap disc and the movement of the valve are both exaggerated in the drawing as compared to the actual construction of the valve. Movement of the end member 21 in the other direction, will cause the reverse action of the snap disc to quickly seat the valve 36 on the valve seat 37.

A burner nozzle 45, the details of which form no part of this invention, is shown screw-threaded into the outlet 18 of the section 12. A rubber sleeve 46 substantially fills the space between the side wall of the nozzle 45 and an orifice member 47 screw-threaded into the nozzle, to prevent the entrapment of air therein. A metallic washer 48 bears against the inner ends of the nozzle 45 and the sleeve 46. A second rubber sleeve 49 fits within the bottom of the recess 18, with the inner end thereof bearing against the wall 19, and serves to space a filter screen 50 from the valve 36, in either of its operating positions, as well as to help fill up the recess 18 to prevent the entrapment of air therein. A washer 51 likewise helps to fill up the recess 18 and spaces the screen 50 from the inner end of the orifice member 47 of the nozzle 45.

Operation

With the valve installed in an oil burner having a fuel pump or other means for controlling the delivery of oil to the inlet 15 of the valve and a fan for delivering combustion air to the burner, it is deemed apparent that upon the supply of oil to the inlet 15, said oil will flow past the flattened surfaces of the end member 30 and entirely surround the bellows 22, and will pass through openings 25 to the outer surface of the end 21 of the bellows and through the openings 44 in the snap disc to the opening 20 and the inner surface of the disc valve 36. As the pressure in the valve builds up rapidly, due to the operation of the fuel pump or other oil control means, the spring 35 will be only slowly compressed as the oil in the bellows 22 will only pass slowly through the small opening in the capillary tube 34 and into the chamber 33, compressing the air therein. As a greater length of time would be required for the end 21 of the bellows to move to its ultimate bellows-compressed position, than it would if the oil were not present in the bellows, it is obvious that the delayed action of the bellows will cause the disc to snap the valve 36 open as indicated above, only after a sufficient time has passed to assure that the fan for delivering air to the combustion chamber has come up to speed and is delivering the required amount of air to support proper combustion. It will be observed that since the valve 36 remains seated until the snap disc has moved past its dead center position, there will be no delivery of oil to the nozzle until the valve 36 opens with a snap action.

When there is a discontinuance of the supply of oil to the valve, as when a room thermostat of the heating system has become satisfied, which causes a cutting off of the oil supply to the valve, the reduction in oil pressure around the bellows will become quite rapid as, at that time, oil is still flowing through the nozzle. Then when the pressure has dropped to a predetermined value, spring 35 will move the end 21 of the bellows toward the right at a much more rapid rate than the end 21 moved toward the left, due to the fact that a vacuum will be created within bellows 22 to permit it to so move. The oil may then take its time flowing from the chamber 33 through the capillary tube 34 and into the bellows to refill said bellows. It will be observed, however, that the valve 36 will remain in its full open position until the snap disc has buckled past dead center in the other direction and caused a quick or snap closing of the disc valve 36 into engagement with the seat 37. This provides a clean shut-off of the oil and does prevent the dribbling of oil from the end of the nozzle in a non-burnable condition.

While the preferred embodiment of the invention has been described above, it will be apparent to those skilled in the art that other

modifications may be made thereof without departing from the spirit of the invention. Therefore, it is to be understood that the scope of the invention is to be determined solely from the appended claims.

I claim as my invention:

1. In a snap-acting valve, the combination comprising a valve body formed of two generally cylindrical inter-engaging sections, the first of said sections having a valve seat intermediate its ends, a valve head on the opposite side of said valve seat from the second of said sections and cooperable with said valve seat, a stem on said valve head and extending through said valve seat, an apertured snap disc secured at its center to said stem, a liquid filled bellows having one of its ends loosely secured to the periphery of said disc, and a stationary cylinder partially filled with liquid secured to the other end of said bellows, a passage of small internal diameter extending through a wall of said cylinder with the ends thereof in contact with the liquid in said cylinder and bellows respectively.

2. In a snap-acting valve, the combination comprising a valve body formed of two generally cylindrical interengaging sections, the first of said sections having a valve seat intermediate its ends, a valve cooperable with said valve seat, a stem on said valve, a snap disc secured at its center to said stem, a liquid filled bellows having one of its ends loosely secured to the periphery of said disc, and a stationary cylinder partially filled with liquid secured to the other end of said bellows, a capillary tube extending through a wall of said cylinder with the cylinder end thereof within the liquid in said cylinder.

3. In a snap-acting valve, the combination comprising a valve body formed of two generally cylindrical interengaging sections, the first of said sections having a valve seat intermediate its ends, a valve head on the opposite side of said valve seat from the second of said sections and cooperable with said valve seat, a stem on said valve head and extending through said valve seat, a snap disc secured at its center to said stem, a liquid filled bellows having one of its ends loosely secured to the periphery of said disc, and a stationary cylinder partially filled with liquid secured to the other end of said bellows, a capillary tube extending through a wall of said cylinder with one end thereof within the liquid in said cylinder and the other end thereof within said bellows.

4. The combination as defined in claim 3 wherein all of the elements of the combination are substantially coaxial.

5. A fuel control valve comprising an inlet and an outlet in coaxial alignment, a valve seat between and coaxial with said inlet and outlet, a valve head normally in engagement with said seat, a snap disc secured to said valve head for actuation thereof and coaxial with said inlet and outlet, and pressure responsive means operably engaging said snap disc and coaxial therewith, a bodily adjustable fluid reservoir between the inlet and said seat, said pressure responsive means having a restricted fluid connection with said reservoir to cause it to move slowly in response to pressure increase to provide delayed snap-action of said valve in response to said pressure increase, said fluid reservoir having parts thereof spaced from the side walls of said

valve to permit fuel to flow around it from said inlet to said seat.

6. A delayed action oil valve comprising an inlet and an outlet, a valve seat between said inlet and outlet, a valve normally in engagement with said seat, snap-acting means secured to said valve for actuation thereof, and pressure responsive means operably engaging said snap-acting means, a bodily adjustable reservoir between said inlet and seat, said pressure responsive means having a restricted fluid connection with said reservoir which causes said means to move slowly in response to pressure increase to provide delayed snap-action of said valve in response to said pressure increase, said inlet, outlet, valve, snap-acting means and pressure responsive means all being substantially coaxially aligned.

7. An oil burner valve comprising an inlet and an outlet, a valve seat between said inlet and outlet, a valve head coaxial with said inlet and outlet and normally in engagement with said seat, snap-acting means secured to said valve head for actuation thereof, and pressure responsive means within said valve operably engaging and coaxial with said snap-acting means, said pressure responsive means having a partially filled and fixed liquid chamber and an expandable and filled liquid chamber interconnected by a small passage therein which causes the expandable chamber to move slowly in response to pressure increase to provide delayed opening action of said valve head in response to said pressure increase, said liquid chambers having at least portions thereof spaced from the side walls of said valve to permit oil to flow around them from said inlet to said valve seat.

8. A valve for use in oil burners comprising an inlet and an outlet, a valve seat between said inlet and outlet, a valve head normally in engagement with said seat, snap-acting means substantially coaxial with said inlet and outlet and secured to said valve head for actuation thereof, and pressure responsive means within said valve operably engaging said snap-acting means, said pressure responsive means having an expandable chamber which causes the snap-acting means to move in response to pressure increase to provide delayed action of said valve head in response to said pressure increase, said last mentioned means comprising a fixed storage chamber partially filled with liquid and connected to said pressure responsive means by a capillary tube and said expandable chamber being filled with a liquid, said chambers being supported in spaced relationship with respect to the inner walls of said valve so that oil may flow substantially completely around said chambers when flowing through said valve.

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