Aug. 30, 1932. H. NIGHTINGALE ET AL 1,874,793

DELAY ACTION VALVE

Filed Dec. 11, 1930

Fig. 1

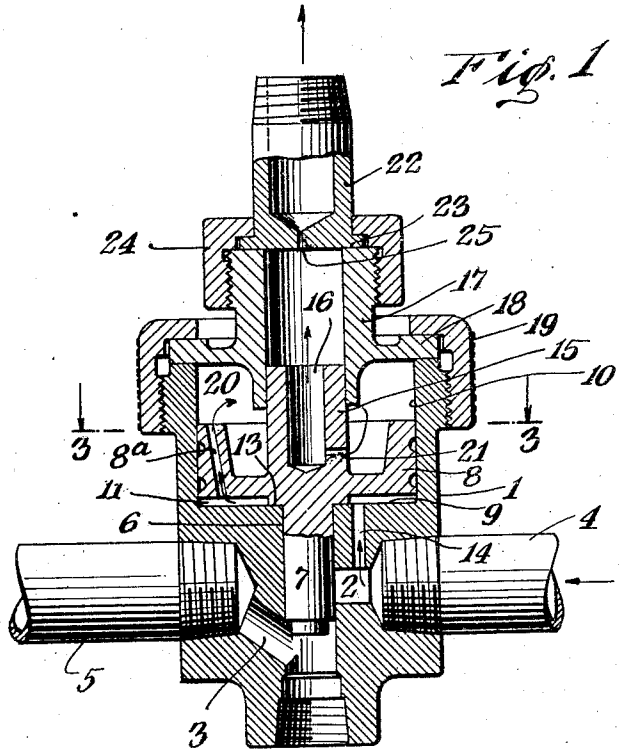


Fig. 2

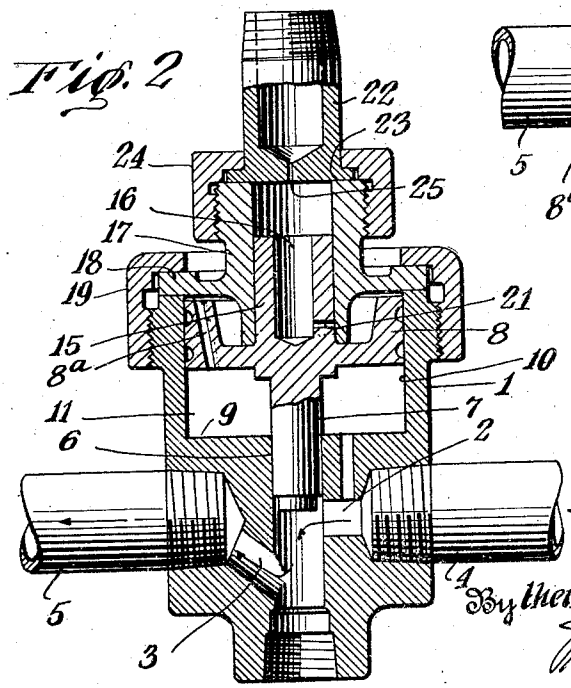
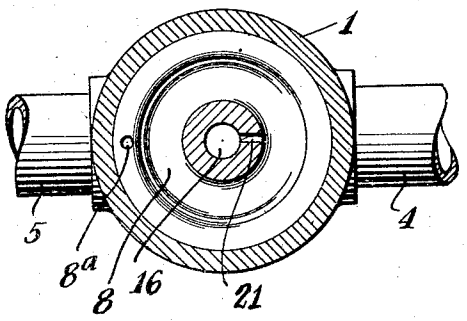


Fig. 3



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UNITED STATES PATENT OFFICE

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DELAY ACTION VALVE

Application filed December 11, 1930. Serial No. 501,498.

This invention relates to liquid control valves and our improvement is particularly directed to a delay action valve which is adapted to open automatically within a predetermined time lapse from the moment of first applying a pressure of liquid thereto.

Among other uses for our improved valve is that of controlling the flow of liquid fuel to furnaces in order to delay the flow to the burner until the speed of atomizer rotation and the pressure of air are adequate for efficiently atomizing the fuel.

It must be appreciated that one purpose in employing the delay action valve is in connection with the Todd type of liquid fuel burner with which is used a motor driven atomizer and a blower whose speed of rotation is high; also that the pump delivering the liquid fuel to the burner is operated by power means included in the same electrical circuit that operates the atomizer and the blower.

Therefore when the controlling switch is actuated to close the circuit, thereby applying the electrical current, the liquid fuel valve is caused to open and also the atomizer and blower are rotated. But since the motor shaft, which carries both the atomizer and the blower vanes requires a space of time in which to speed up to the R. P. M. at which the fuel will be efficiently atomized, it is necessary to delay the flow of liquid fuel to the atomizer.

Heretofore delay valves for controlling the supply of liquid fuel to furnaces have been caused to open under electrical actuating means, but without entirely satisfactory results.

Therefore our present invention consists in the provision of a pressure actuated, mechanical valve, set to open for the passage of fuel within a predetermined lapse of time following the closing of the circuit that energizes the source of power for the atomizer, blower and pump.

This valve comprises a casing having a fluid passage-way therethrough and a stem to close said passage-way, said stem carrying a plunger which is adapted to be raised by the liquid pressure that is applied thereto through a by-pass, to thereby lift the stem and open the liquid fuel passage-way.

The size of the by-pass is suitably gauged, and other by-passes are provided in the valve organism to apply back pressure thereon, whereby the elapsed time occupied in opening the liquid fuel passage-way is sufficient to enable the motor shaft to attain its maximum or efficient speed.

Other features and advantages of our invention will hereinafter appear.

In the drawing:

Figure 1 is a sectional elevation of our improved delay action valve, shown in its closed position.

Fig. 2 is a similar view, showing the valve open, and

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

In the views let 1 indicate a valve casing having the inlet port 2 and the outlet port 3. A supply pipe 4 is shown in communication with inlet port 2 and a delivery pipe 5 extends from outlet port 3.

The valve casing is shown as having a vertically disposed, axial bore 6 in its lower portion, and a stem 7 of a plunger 8 is adapted to have reciprocal movement in said bore, to open and close the passageway through the valve, between the ports 2 and 3. It will be noted that the port 2 is covered by the stem 7 in the valve closed position, so that liquid cannot pass to port 3, although the latter port, being positioned below the stem, remains uncovered. But when the stem is lifted, as shown in Fig. 2, then there is a free passage through the valve. Above the bore 6 the interior area of the valve casing is enlarged and presents a horizontal surface 9 and a cylindrical wall surface 10 within which the plunger 8 is adapted to reciprocate.

The base of plunger 8, opposed to surface 9, is spaced therefrom in the valve closed position over a clearance 11, which clearance of course increases in height as the plunger rises. In order to establish clearance 11 the stem 7 is increased in diameter above surface 9, to thereby provide a shoulder 13 whereby the plunger becomes seated upon surface 9 and supported thereby in the valve closed position.

Liquid admitted to port 2, but restrained from passage through the valve by the presence of stem 7, is caused to enter clearance 11 through a by-pass orifice 14 and being under pressure causes the plunger and stem to rise and thereby open the passage-way through the valve.

The upper portion or extension 15 of stem 7 is of increased diameter and is provided with an axial recess 16, said extension being slidable within a cylinder 17 which has a radial flange 18 that lies upon the peripheral edge of the casing wall, serving as closure means for the casing. An interiorly threaded cap 19 engages a screw thread formed upon the casing to secure the closure means thereto.

There is a by-pass orifice 8*a* through the plunger 8, leading from clearance 11 to the space 20 within the casing, between the plunger 8 and flange 18, and another by-pass orifice 21 through the wall of extension 15 leading into the space comprised by the recess 16 and the interior of cylinder 17. Also the top of cylinder 17 is provided with a cap in the form of a tubular section 22 having a base portion 23 which rests upon the top of cylinder 17, and is secured thereto as by a screw cap 24. Said base portion has a discharge orifice 25 through which liquid may flow, and the section 22 is intended to connect with a return pipe (not shown) to re-convey liquid to the source of supply.

The orifices 8*a*, 21 and 25 are all of smaller cross-section than orifice 14, and are intended to retard the rise of plunger 8 for the purpose of suitably delaying the action of stem 7 in opening the passage-way through the valve.

In practice we have found that orifice 8*a* may with advantage be smaller than orifice 14; orifice 21 smaller than 8*a*, and orifice 25 smaller than 21. As a practical example of orifice sizes, and without limiting our invention thereby, we refer to an example now operating successfully wherein liquid fuel is supplied to the valve at a pressure of ten pounds to the square inch and the motor shaft is intended to drive the atomizer and blower at 3,500 R. P. M. In this instance, using a quarter inch supply pipe, the diameter of orifice 14 is .070; orifice 8*a* is .06350; orifice 21 is .0505, and orifice 25 is .035. Under the influence of direct pressure applied through orifice 14 to the plunger at clearance 11, and the retardation afforded through the other orifices, we find the opening of the passage-way through the valve lifting action to be delayed for a period of about 15 seconds, and within that period of time the motor has become enabled to attain its maximum speed of 3,500 R. P. M.

It will of course be understood that if the liquid fuel were to pass to the furnace before the atomizer and blower were rotating at efficient speed, the result would be that the fuel would not become atomized but would merely flow into the furnace in a liquid state with the liability of creating a back fire.

Variations within the spirit and scope of our invention are equally comprehended by the foregoing disclosure.

We claim:

1. The combination with a valve casing having a passageway therethrough and an associated chamber, of a plunger in said chamber, a stem extended from said plunger to normally close said passageway, means for conveying fluid, under pressure, from a source of supply, to said passageway, by-pass means between said passageway and chamber adapted to convey fluid to the latter whereby fluid pressure may operate said plunger and stem to open said passageway, means for retarding the operation of said plunger, and means for returning all the by-passed fluid back to the source of supply, through the chamber.

2. The combination with a valve casing having inlet and outlet ports, forming a passageway through the casing, of means for conveying fluid, under pressure, from a source of supply, to said inlet port, a plunger having a stem to normally close said inlet port, a cylindrical chamber containing said plunger, said casing having a by-pass communicating from said inlet port to said chamber for the passage of fluid to said chamber, thereby permitting pressure of fluid to lift said plunger and stem for the delayed opening of the passageway, and means for returning all the by-passed fluid back to the source of supply, through the chamber.

3. The combination with a valve casing having inlet and outlet ports, forming a passageway through the casing, of means for conveying fluid, under pressure, from a source of supply, to said inlet port, a plunger having a stem to normally close said inlet port, a cylindrical chamber containing said plunger, said casing having a by-pass communicating from said inlet port to said chamber for the passage of fluid to said chamber, thereby permitting pressure of fluid to lift said plunger and stem for the delayed opening of the passageway, means for retarding the lift of said plunger, and means for returning all the by-passed fluid back to the source of supply, through the chamber.

4. In a delay action valve, the combination with a cylinder and a plunger therein, of a valve casing having a passageway therethrough, means for conveying fluid, under pressure, from a source of supply, to said passageway, a valve carried by said plunger to normally close said passageway, said casing having a by-pass orifice of capacity to admit to said cylinder within a predetermined period a quantity of the fluid under pressure from said fluid conveying means to lift said plunger and valve, thereby opening

said passageway, and said plunger having a relief orifice extending therethrough of less capacity than that in the casing, to retard the lift of the plunger, and means for returning all the by-passed fluid back to the source of supply, through the chamber.

5. In a delay action valve, the combination with a cylinder and a plunger therein, of a valve casing having a passageway therethrough, means for conveying fluid, under pressure, from a source of supply, to said passageway, a valve carried by said plunger to normally close said passageway, said casing having a by-pass orifice of capacity to admit to said cylinder within a predetermined period a quantity of the fluid, under pressure from said fluid conveying means to lift said plunger and valve, thereby opening said passageway, said plunger having a relief orifice passing therethrough of less capacity than that in the casing, to retard the lift of the plunger, and said plunger having a tubular extension whose wall is provided with a restricted orifice for the retarded issue of the fluid, and means for returning all the by-passed fluid back to the source of supply, through the chamber.

6. In a delay action valve, the combination with a cylinder and a plunger therein, of a valve casing having a passageway therethrough, means for conveying fluid, under pressure, from a source of supply, to said passageway, a valve carried by said plunger to normally close said passageway, said casing having a by-pass orifice of capacity to admit to said cylinder within a predetermined period a quantity of the fluid, under pressure, from said fluid conveying means, to lift said plunger and valve, thereby opening said passageway, said plunger having a relief orifice passing therethrough of less capacity than that in the casing, to retard the lift of the plunger, and said plunger having a tubular extension whose wall is provided with a restricted orifice for the issue of the fluid, a cylinder in which said extension rides to receive said fluid, and closure means for said cylinder having a more restricted orifice leading from said cylinder for further retardation, and means for returning all the by-passed fluid back to the source of supply, through the chamber.

New York, N. Y., December 2, 1930.

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