

Sept. 25, 1951

E. E. MEIER

2,568,924

PRESSURE DELAY VALVE

Filed Aug. 2, 1948

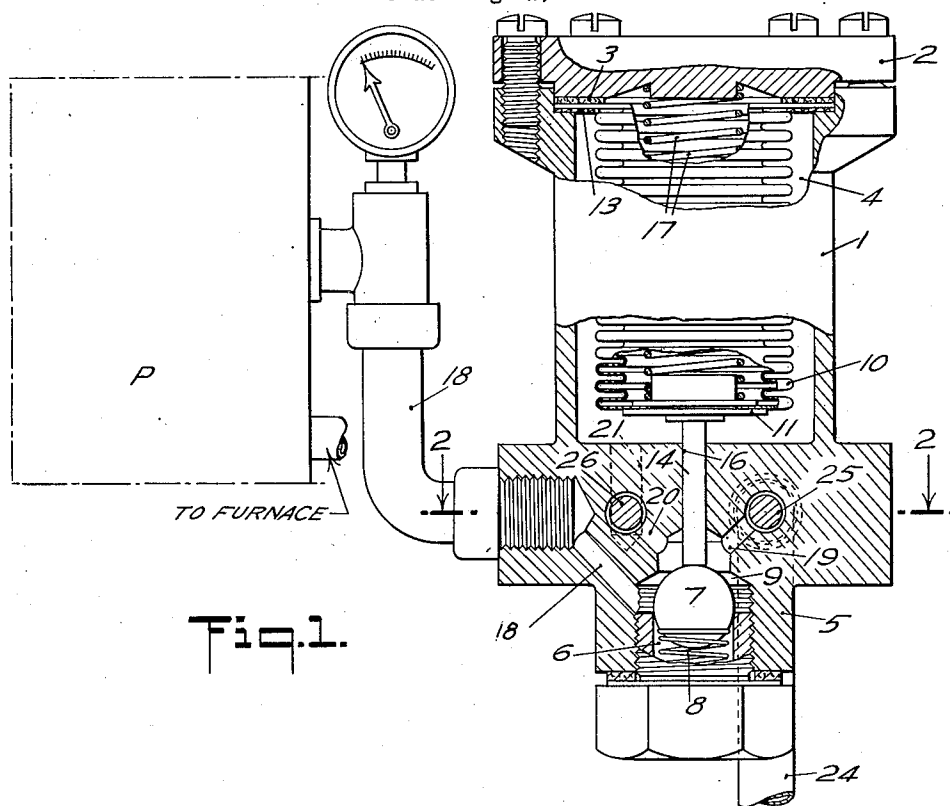


Fig. 1.

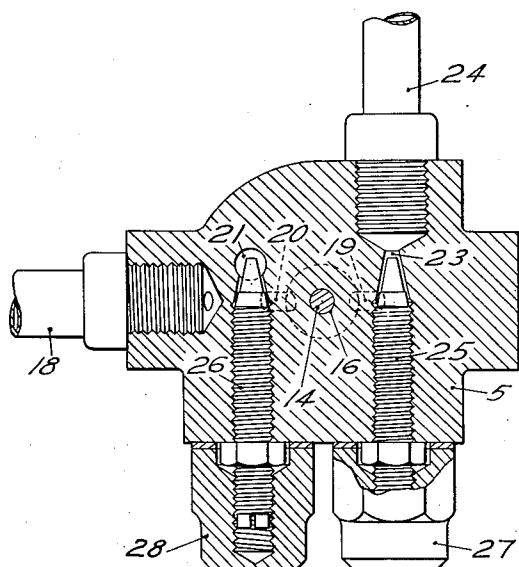


Fig. 2.

INVENTOR
EDWARD E. MEIER
BY
E. J. Mc Dougall
ATTORNEY

UNITED STATES PATENT OFFICE

2,568,924

PRESSURE DELAY VALVE

Edward E. Meier, Portland, Oreg., assignor to
Central Brass & Iron Foundry, Portland, Oreg.,
a partnership

Application August 2, 1948, Serial No. 41,946

10 Claims. (Cl. 103—42)

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This invention relates to a pressure delay valve that is especially useful as an adjunct for the oil pump of an intermittent type of oil heating apparatus, especially in domestic oil heating.

The intermittent operation of such apparatuses, especially in cool weather and in well insulated buildings, gives abundant time for the chimney to cool off, when there will be little if any natural draft available to carry away unconsumed vaporized fuel, at a succeeding start.

Such oil burners have a fan to furnish the air for combustion, that is fixedly set for the most economical operation. The oil pump delivers the oil supply through a calibrated fine nozzle that fixes the amount of oil supplied at a given pressure. The oil pump is arranged to pump a surplus of oil, over the capacity of the nozzle and an overflow pipe carries the surplus back to the supply reservoir after it has passed through a pressure relief valve which fixes the delivery pressure.

This pump setup, described supra, is almost universal if not quite so with intermittent oil burning apparatus and the pump and nozzle will be delivering the full normal supply of oil, within one or two seconds after the usual thermostat has started the oil burner; after a rest period and with a cool combustion chamber and a cooler chimney with small natural draft, the normal supply is too much oil and the unburned fog tends to accumulate in the furnace with danger of back-fire and always with a waste of fuel.

It is the object of the invention to improve the situation just described.

The specific purpose of the invention is to bypass the entire pump capacity at a pressure below the minimum fixed by underwriter requirements, for a limited time, so that the fan can run alone and start circulation of air through furnace and chimney prior to admission of oil spray.

This is done by by-passing the pump delivery to the supply reservoir through a by-pass that maintains a reduced pressure, lower than required to put the burner into operation until starting conditions are improved by initiating draft when the pressure delay valve cuts off the by-pass and the burner starts. After the pump is stopped for an intermission, the delay apparatus resets itself for the next start.

Other objects more specifically related to the instrument and its best form, will be apparent from the specification and are pointed out in the claims.

A drawing accompanies and forms a part hereof, in which the best but not exclusive form of

the invention is shown, for purposes of illustration.

In the drawing:

Fig. 1 is an elevation of the drawing, showing parts broken away, for clarity, and showing the schematic relationship of the delay valve to an oil pump.

Fig. 2 is a section of Fig. 1, taken on the plane 2—2 of that figure.

Describing the drawing in greater detail; a cylindrical hollow body 1 is fitted with a detachable flanged cap 2 made pressure tight therewith by a gasket 3 when compressed thereagainst by bolts. The body and cap, when assembled, constitute a pressure chamber, 4, as will be explained.

An extension 5, of the body 1, is likewise hollow and the space within it is defined as a valve chamber 6, within which is a valve 7, supported by a reaction spring 8, that tends to push it against its valve seat 9, where it can rest, only after the delay function has been accomplished.

Within the pressure chamber 4 is a flanged bellows of the well known type in the form of an elongated corrugated cylinder, flanged at one end and closed fluid tight by the closure 11 at the other end.

The flange of the bellows 12, rests in a recess of the flanged top of the body 1, and with a cooperating gasket 13, is made pressure tight with respect to the interior of the pressure chamber 4, when the flanged cap 2, is cap-screwed firmly to the flange of the body 1.

At the other or closed end of the bellows 10, is an axially extending plunger rod 14, that extends through a round hole 16, that provides a passageway for the plunger rod 14. The plunger rod 14, will be a close sliding fit in the hole 16, and while the movement of the plunger rod 14, therethrough will be smooth and relatively free, it will be also substantially liquid tight. When no liquid pressure exists within the apparatus, and for a short time afterwards, the valve 7, cannot reach its seat because of the projection of the plunger rod through the hole 16, and it is too long to permit the valve 7, to reach the seat 9. Even though there is a light spring behind the valve 7, there is a considerably stronger spring 17, inside of the bellows 10, tending to keep it fully extended with its closed end near to the bottom of the pressure chamber 4.

The plunger rod 14, is withdrawn into the pressure chamber 4, from where, as shown, it blocks the valve 7, in the following manner, which also includes the principle of operation.

A fuel oil pump P, for an oil burner, will be

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presumed to deliver oil at high pressure to promote efficient atomization; but when starting a cold furnace, it is desired that the fan shall have an opportunity to start the draft up the chimney before the oil supply actually begins. The pipe 18, is connected to the high pressure side of the oil pump P, and has no direct connection to the oil atomizer in delivering pressure from the pump to its burner nozzle. It delivers it to the valve chamber 6, at a point that is always above the valve seat 9, whether the valve 7, is resting on the seat or not. On the other side of the valve seat 9, are two ports 19 and 20, one of which, 20, is the inlet end of the conduit 21, that ends in the pressure chamber 4, and the other, 19, is the inlet end of the conduit 23, which leads directly to the overflow pipe 24, and from thence to an oil supply not shown.

Port 19 is governed by the needle valve 25, and the regulation of this needle valve fixes the amount of initial oil pressure. The conduit 21 is governed by the needle valve 26 and its regulation fixes the duration of the low pressure interval and the time allotted to start the natural draft to working.

When the main oil pump P starts its delivery, pressure is limited by the adjustment of needle 25, as stated, but some of the oil is forced into the pressure chamber 4, and tends to collapse the bellows 10, thus gradually withdrawing the plunger rod 14, and ultimately allowing the valve 7, to reach its seat 9. When the cut off occurs, it cuts off the oil to the overflow pipe 24 and to the pressure chamber 4, and the full pressure of oil, instantly restored, bears against valve 7, holding it firmly to its seat, and the oil burner takes over its designed operation with high pressure oil supply. The interior of the pressure chamber 4 is left in communication with the overflow conduit and the bellows 10 no longer receives oil as its supply is likewise cut off at the same time.

At the next intermission or stopping time, the bellows 10 will again extend itself, discharge its oil, unseat the valve 7 and place the high pressure side of the main oil pump in direct communication with the overflow pipe 24, thus considerably shorting the time of drip period and the spoonful or more of oil usually lost as drip from the nozzle, with its nuisance, is lessened to a very few drops.

To promote this action, the strength of the spring 17, is so regulated that its tendency to unseat the valve 7 is less than the holding power of the normal high pressure oil against it, when the pump is running, but near enough to it so that within one or two seconds after the pump stops, the spring 17, has overcome the liquid pressure that remains and the by-pass opens and liquid pressure throughout the system falls to zero.

It is pointed out that the pressure chamber 4, and its bellows constitutes a form of expansible chamber device and that a diaphragm or reciprocable piston and other devices may be substituted therefor without modifying the operative principle. It is also pointed out that if the needle valve 25 is replaced by a pressure relief valve, an important function of the apparatus, the reduction of drip after the pump stops, will be impaired, but the device will still be otherwise operative.

Having fully disclosed my invention so that those familiar with hydromechanical devices and oil burners, can understand and take advantage

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of its merits, what I claim as new and desire to secure by Letters Patent, is:

1. In intermittent oil burner apparatus, a pressure pump connected to an oil supply, a pipe connecting the discharge side of said pump to the oil supply, a biased valve in said pipe that tends to close said pipe, a metering device in said pipe nearer to said supply than said biased valve, an expansible chamber device connected to said pipe between said pump and said biased valve, said expansible chamber device spring biased to contracted position, a valve opener movable by said expansible chamber device, upon full contraction thereof, to overcome the bias of said biased valve to hold it open, said valve opener movable upon expansion of said expansible chamber to free said biased valve.

2. A delay valve for an intermittent pump operated oil burner that requires a predetermined pressure to begin operation, comprising a normally open pipe from the pump to the oil storage, a metering device therein, a spring loaded valve in said pipe ahead of said metering device that tends to close said pipe when said spring is free to move the valve, an expansible pressure responsive chamber device in communication with said pipe ahead of said other devices, and means movable by said expansible chamber device, upon expansion thereof, to free said spring loaded valve for closing said normally open pipe.

3. A delay valve for an intermittent pump operated oil burner that requires a fixed amount of pressure to begin furnishing oil, comprising an oil return pipe in open communication with said oil pressure supply means, a metering means interposed in said pipe, a valve in said pipe biased to completely close said pipe when free to do so, a pressure responsive expansible chamber device in communication with said pipe ahead of said last named valve and means operable by said expansible chamber that normally hold said pipe closing valve open and are withdrawn to free the valve upon expansion of said chamber.

4. The combination as claimed in claim 3 including a spring that stores energy from fluid pressure within said expansible chamber and reacts upon dropping of pressure within said chamber to open said oil return pipe by reopening said biased valve against its bias, by reversing the means operable by said expansible chamber.

5. Delay apparatus for an intermittent pump supplied oil pressure for a heating burner comprising a normally open waste pipe from the discharge of the pump supply to an oil reservoir, a valve in said pipe that is biased to close the same, means for normally overcoming the bias to maintain the normally open condition of said pipe, means for gradually causing less than operation pressure to accumulate in said waste pipe, a normally spring contracted expansible chamber device responsive to such gradually accumulating pressure to expand the same and a valve releasing device operable by said expansible chamber device upon full expansion thereof to release said biased valve to close said waste pipe.

6. The combination as claimed in claim 5 and including spring means for completely contracting said expansible chamber and reopening said biased valve when pressure ceases to be supplied from the intermittent pump, resetting the same for a succeeding operation.

7. Oil supply means for an intermittent fixed starting pressure oil burner, comprising a pump apparatus, an auxiliary by-pass pipe connected

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between said pump and a supply tank, a metering valve in said pipe having a capacity adjustably less than said pump, a shut-off valve in said pipe ahead of said metering valve biased to close when not held open, a delay valve, a pressure chamber therein, an expansible bellows therein, a spring tensioned to expand the bellows, a valve unseating rod operable by said bellows upon expansion thereof to unseat said shut-off valve, said bellows compressible by pressure accumulation in said by-pass pipe to withdraw said unseating rod to close said by-pass completely.

8. In an oil supply apparatus for intermittent oil burners, a delay valve, comprising an independent oil return pipe from an oil pump to an oil storage, a metering valve therein adjustably set to pass slightly less than normal pump capacity, a positive shut-off valve in said pipe normally held open, an oil storage device connected to said pipe behind said metering valve, a spring in said storage device tending to empty the same, said storage device including a movable element sensitive to compression and expansion of said spring, said movable element so connected to said shut-off valve that upon predetermined compression said shut-off valve becomes free to close.

9. In an oil supply apparatus for intermittent oil burners including a pressure pump with fixed pressure burner supply means, an independent overflow pipe between said pump and a suitable reservoir, a metering device therein of adjusted capacity less than said pumping means, a normally open shut-off valve ahead of said metering

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device, a variable capacity bellows device connected to said pipe inside of said shut-off valve, said last named device spring biased to oppose entrance of oil thereinto, and means movable by said bellows device effective to place the said shut-off valve into service to close said overflow pipe.

10. In an oil supply apparatus for intermittent oil burners including a pump with fixed pressure burner supply means, an independent overflow pipe connected to the delivery of the pump, a pressure raising metering device therein, a normally held open shut-off valve ahead of said metering device, closure biasing means therefor, a variable capacity oil storage device connected to said pipe ahead of said shut-off valve, said storage device spring biased to discharge its contents and a valve controlling device effective upon predetermined entrance of oil into said storage device by overcoming the spring bias to withdraw the holding means from said shut-off valve.

EDWARD E. MEIER.

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