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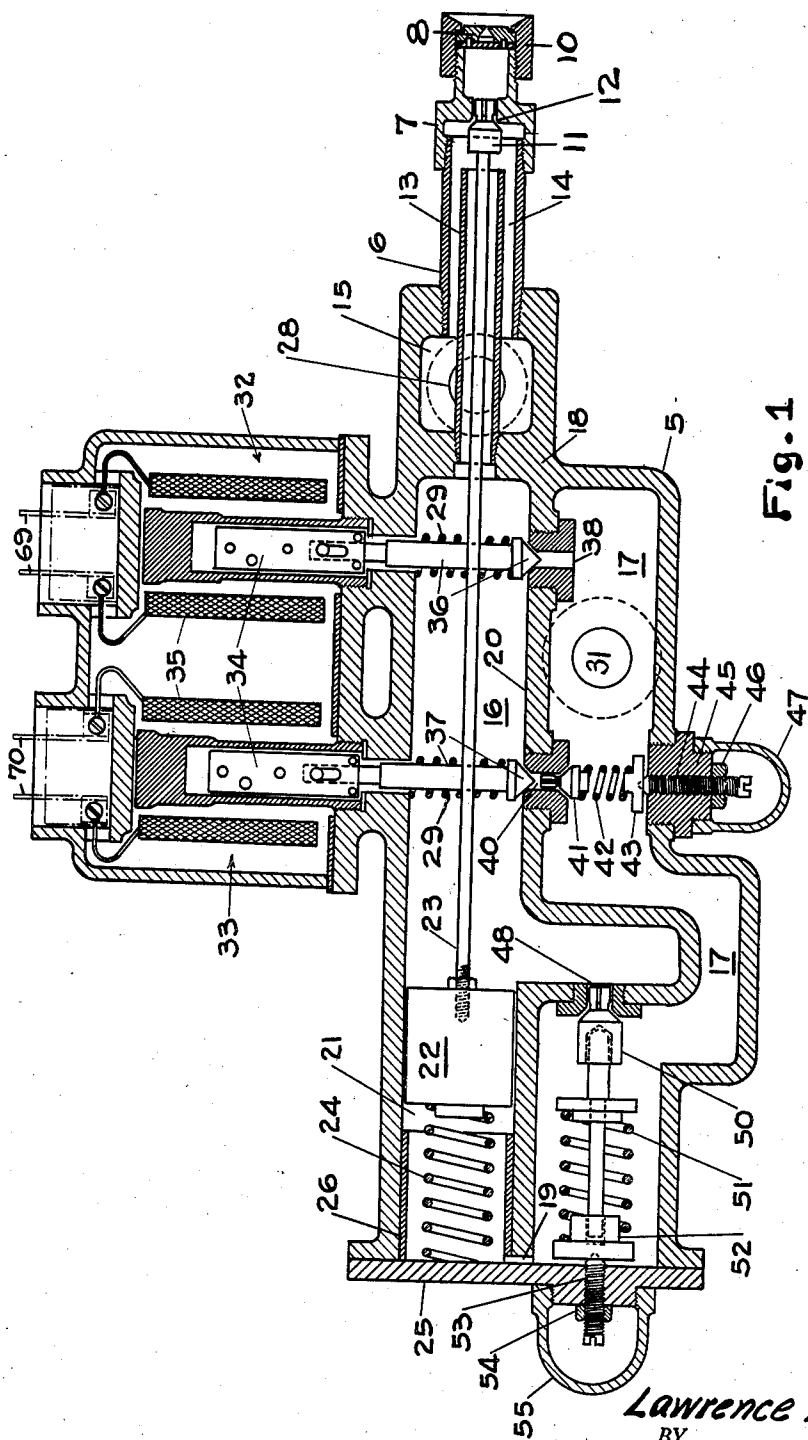
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2,179,846

FLUID FUEL CONTROL MEANS FOR OIL BURNERS

Filed Feb. 23, 1937

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

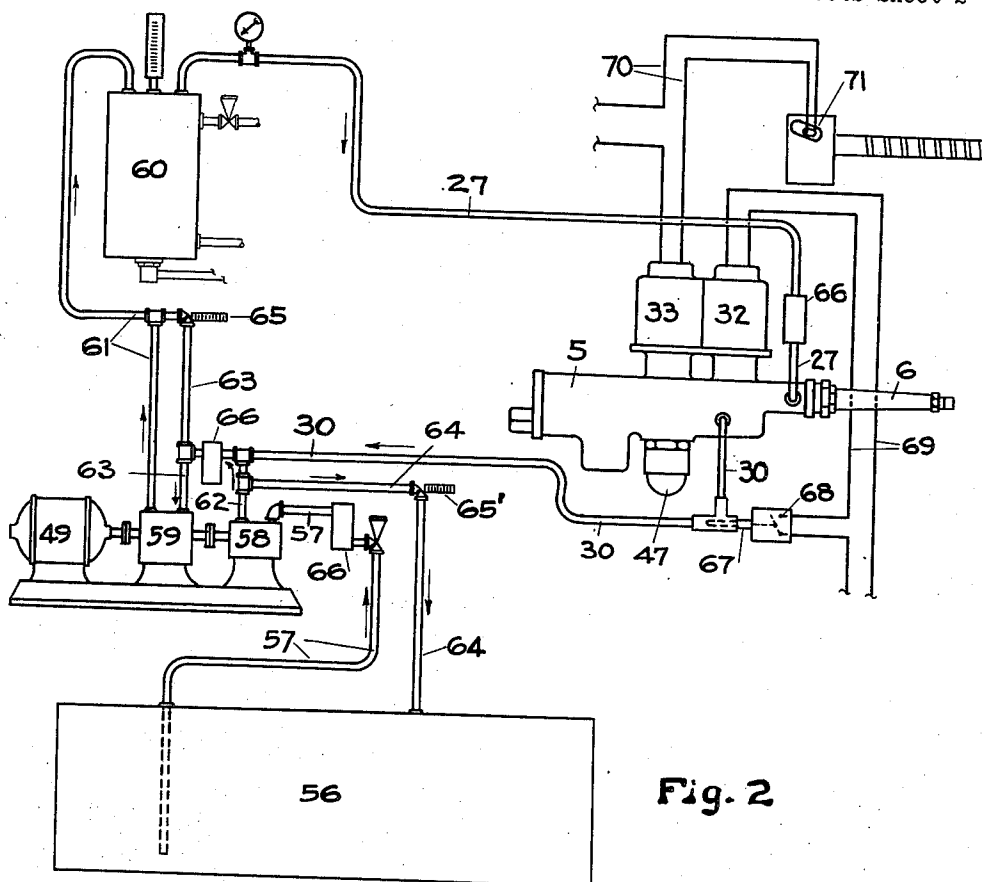


Fig. 2

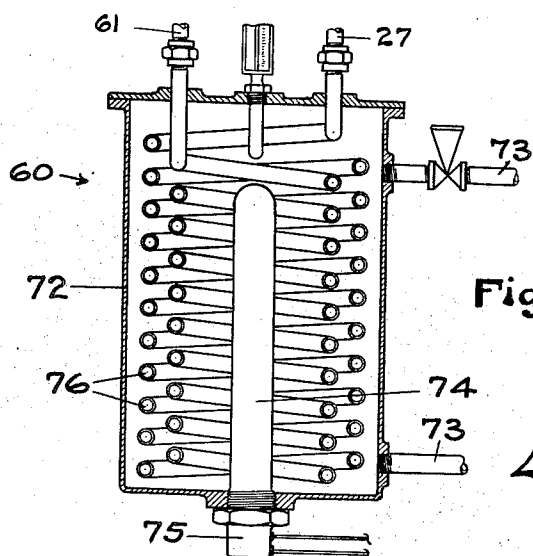


Fig. 4

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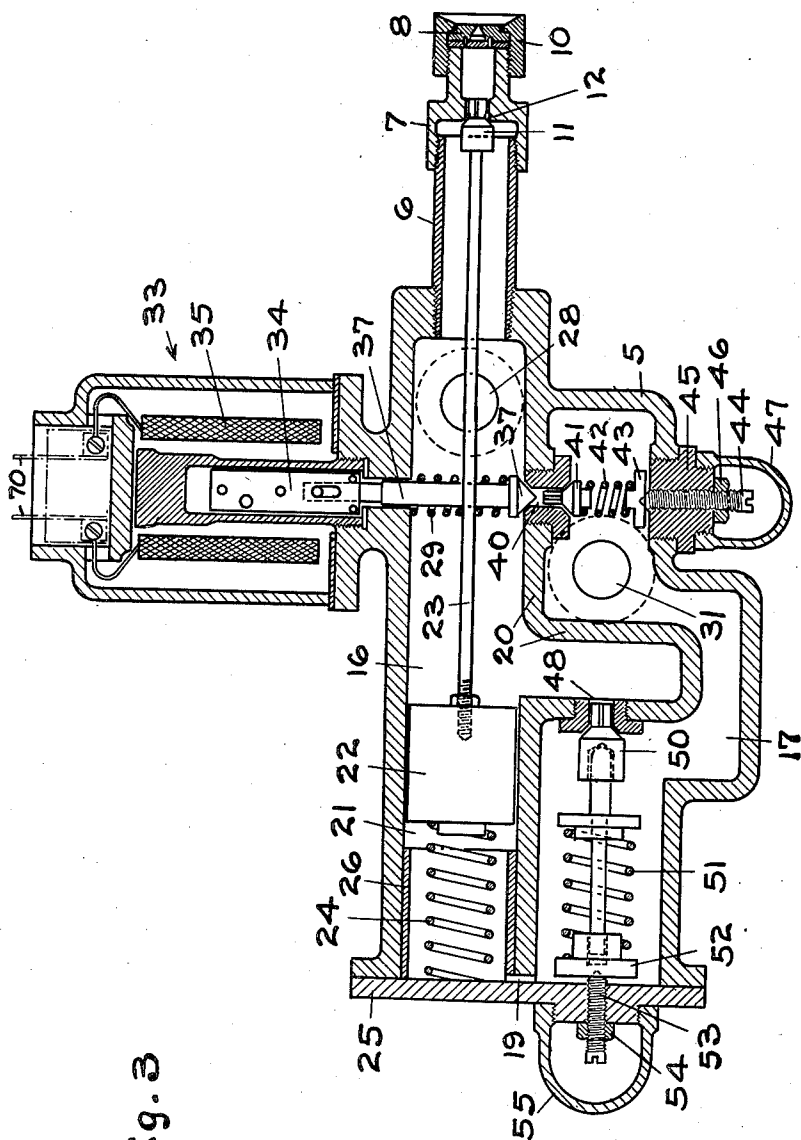


Fig. 3

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UNITED STATES PATENT OFFICE

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FLUID FUEL CONTROL MEANS FOR OIL
BURNERS

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Application February 23, 1937, Serial No. 126,989

6 Claims. (Cl. 158—36)

This invention relates to means for controlling the discharge of oil from an oil burner and is in the nature of an improvement on the Viscosity regulated fluid fuel control means disclosed in my co-pending application Serial Number 664,306, filed April 4, 1933.

The primary object of this invention is to provide a two stage oil discharge control means controlling the discharge of oil from an oil burner nozzle in such a manner that the burner will first be put into operation at low capacity and then automatically stepped up to full operating capacity as soon as proper heat and draft conditions obtain in the combustion chamber and smoke stack with which the burner is connected.

A further object is to provide a two stage oil burner control means of this nature in combination with means for preventing the burner from being put into operation at all until after the oil which is being supplied to the burner is reduced to a low enough viscosity so that it will be properly atomized when it is discharged from the atomizer nozzle of the burner.

In large oil burning installations if an oil burner is put into operation at substantially full capacity in a relatively cold combustion chamber or boiler which is connected with a relatively cold smoke stack it has been found that the temperature and draft are not sufficient to properly support and maintain combustion at the maximum at which it can be maintained after the heating plant is heated up and that vibration or hammering due to uneven combustion is liable to occur. To overcome this undesirable condition, I find that it is necessary to first put the burner into operation at a relatively low capacity and then change to full operating capacity after combustion at the lower capacity has been maintained for a sufficient period of time to have raised the temperature of the combustion chamber or boiler and connected smoke stack sufficiently to provide good draft action and insure proper combustion. I accomplish this by the devices hereinafter described and shown in the drawings.

Other objects of this invention are to provide fluid fuel control means of this nature which is simple in construction, reliable in operation and not expensive to manufacture.

Other objects are to provide oil circulation means for continuously circulating and by-passing heated oil and at the same time drawing cold oil from an oil supply tank without by-passing the heated oil back to the supply tank and to further provide novel and efficient oil heating means

which is economical to operate and always maintained in condition ready for operation even when the oil burner is shut down.

Other and more specific objects of the invention will be apparent from the following description taken in connection with the accompanying drawings.

In the drawings,

Fig. 1, is a longitudinal sectional view of a fluid fuel control device and oil atomizing nozzle constructed in accordance with this invention.

Fig. 2, is a diagrammatic view illustrating electrical and mechanical connections of the same with other parts of an oil burner installation.

Fig. 3, is a longitudinal sectional view of a device similar to the device shown in Fig. 1, except that certain viscosity controlled oil circulating parts shown in Fig. 1, are omitted in Fig. 3.

Fig. 4, is a detached sectional view of an oil heater embodied in the invention.

Like reference numerals designate like parts throughout the several views.

Referring to the drawings the numeral 5 designates a housing having a burner pipe 6 connected therewith and extending outwardly from said housing. A fitting 7 is provided on the end of the pipe 6 and an atomizer nozzle 8 is supported at the end of the burner pipe by a cap 10. An atomizer valve 11 is positioned adjacent the atomizer nozzle 8 and is arranged to seat on a valve seat 12 in the fitting 7 to cut off the supply of oil to the atomizer nozzle 8. A return tube 13, of smaller diameter than the burner pipe 6, is disposed substantially coaxially within said burner pipe 6 in such a manner as to leave an annular passageway 14 between the outer wall of the return tube 13 and the inner wall of the pipe 6. The outer end of the return tube 13 is spaced a short distance from the atomizer valve 11 and the inner end of said return tube communicates with an oil pressure chamber herein-after described.

The housing 5 is provided with an oil inlet chamber 15, a pressure chamber 16 and an oil outlet or discharge chamber 17. A wall 18 separates the oil inlet chamber 15 from the pressure chamber 16. Another wall 20 separates the pressure chamber 16 from the discharge chamber 17.

A cylinder 21 is provided at one end of the pressure chamber 16 and in communication with said pressure chamber 16. The cylinder 21 is preferably axially aligned with the return tube 13. A piston 22 is operatively disposed in the cylinder 21. A valve operating rod 23 connects

the piston 22 with the atomizer valve 11. This rod 23 extends through the inlet chamber 15 and return tube 13. A helical compression spring 24 is provided between the outer end of the piston 22 and the end 25 of the housing 5. A sleeve 26 serves as a stop means for limiting the outward movement of the piston 22 and as a seat means against which the piston 22 may seat and seal when said piston is pressed against the end of said sleeve. A relief port 19 is provided near the outer end of cylinder 21 communicating with the discharge chamber 17 to prevent the building up of a back pressure in the cylinder 21 and relieve the necessity for close fitting of the piston 22. An oil supply pipe 27, Fig. 2, is connected by an opening 28 with the oil inlet chamber 15 and an oil return pipe 30 is connected by an opening 31 with the oil discharge chamber 17.

Positioned on the housing 5 are two solenoids designated generally by 32 and 33. Each solenoid comprises a movable plunger or core 34 disposed within a coil 35. The plungers 34 of solenoids 32 and 33 have by-pass valve members 36 and 37 respectively connected therewith. The respective by-pass valve members 36 and 37 are movable into open and closed positions relative to the seats of valve openings or by-pass ports 38 and 40 respectively in the wall 20 which separates the pressure chamber 16 from the discharge chamber 17 and said by-pass valve members 36 and 37 are urged closed by gravity and by the force of springs 29 when the solenoids 32 and 33 are not energized. The by-pass port 40 with which the valve member 37 cooperates is further provided with a pressure operated relief valve 41, positioned in opposed relation to the by-pass valve 37 and urged toward a closed position by a spring 42. The spring 42 presses against plate means 43 which is adjustably supported by a screw 44. The screw 44 is threaded through a screw plug 45 and lock nut 46. A cap 47 protects the outer portion of the screw 44.

Another by-pass valve port 48 is provided in the wall 20 between the pressure chamber 16 and the discharge chamber 17. This by-pass port 48 is closed by a pressure operated relief valve 50 which is adapted to be opened by pressure within the pressure chamber 16. A spring 51 urges the relief valve 50 into closed position. The outer end of the spring 51 presses against a member 52 supported by a screw 53 which is threaded through the end 25 of the housing 5. A lock nut 54 and cap 55 preferably are provided for the screw 53. The relief valve 41 is adapted to be opened at a predetermined pressure for low capacity operation of the burner, while the relief valve 50 is adapted to be opened at a predetermined higher pressure for high capacity operation of the burner.

One preferred installation of this fluid fuel control means is somewhat diagrammatically shown in Fig. 2. It will be understood, however, that the installation therein shown is illustrative and may be varied.

In Fig. 2, 56 designates an oil storage tank, 57 a draw-off pipe, 58 a booster pump, 59 a service pump, 49 an electric motor adapted to drive both of said pumps, 60 an oil heater connected by the hereinbefore mentioned pipe 27 with the inlet chamber 15, and 61 a pipe connecting the oil heater 60 with the service pump 59. The oil return pipe 30 is connected with pipes 62 and 63 through which oil is passed from the booster pump 58 to the service pump 59. A by-pass return pipe 54 connects the pipe

62 with the oil supply tank 56. Relief valves 65 and 65' are provided in the pipes 63 and 64 respectively. The relief valve 65 in the service pump discharge is an emergency relief valve and will only operate in case the circulation of oil is completely stopped at some point as by an obstruction in a conduit or omission to open a valve, in which case this valve will by-pass oil back to the suction side of the service pump 59 before said pressure becomes great enough to damage any parts of the apparatus. During normal operation the by-passing of oil is controlled by relief valve 50.

Oil drawn from the storage tank 56 by the booster pump 58 is fed into the suction line 63 of the service pump 59. The relief valve 65' on the by-pass pipe from the booster pump 58 back to the storage tank 56 maintains any desired pressure on the inlet of the service pump 59 and at the same time by-passes all excess oil which is pumped by the booster pump 58 back to the storage tank 56. The oil which is being circulated by the service pump 59 does not return to the booster pump and does not by-pass back to the storage tank 56. The oil which is being drawn from the storage tank 56 by the booster pump 58 is fed into the oil circulating system as it is needed and any excess is by-passed back to the storage tank 56. Therefore, it is only necessary to heat the oil which is circulating and the oil in the storage tank is not heated at all. This conserves heat, resulting in a saving in expense, and makes it possible to heat up the circulating oil very quickly in starting the burner.

An oil hydrostat 67 is operatively connected with the oil return pipe 30 in such a manner as to render it responsive to the temperature of the oil flowing in said return pipe 30. The oil hydrostat 67 embodies a switch 68 connected with electric circuit wires 69 by which electric current is supplied to the coil 35 of solenoid 32. When the switch 68 is closed and current is being supplied to circuit wires 69 the solenoid 32 will be energized and the valve member 36 will be moved to open position. The oil hydrostat is arranged to maintain the switch 68 closed when cold oil is circulating in pipe 30 and to maintain the switch 68 open when the oil in circulation is of a predetermined temperature to insure a proper viscosity for efficient atomization and combustion. The viscosity of the oil varies with the temperature, within the range employed in oil burner operation, the oil becoming thinner as its temperature increases and thicker as its temperature decreases. The coil 35 of the solenoid 33 is connected with circuit wires 70 which extend to a source of supply of electric current. A stack switch 71, which is responsive to the temperature in the smoke stack or combustion chamber with which the oil burner is associated, is connected in the circuit wires 70 and the energizing and de-energizing of the solenoid 33 is controlled by the closing and opening of said stack switch. When the smoke stack is cold, the stack switch 71 will ordinarily be closed, and if current is supplied to the circuit wires 70 at this time, the solenoid 33 will be energized and the by-pass valves 37 will be held open. When the smoke stack becomes heated the stack switch 71 will be opened, the solenoid 33 will be de-energized and the valve 37 will drop by gravity into a closed position.

In Fig. 4, I have shown the oil heater 60 on 75

a larger scale. This oil heater is in the nature of a hot water storage tank 72 having connection, as by pipes 73 with a source of supply of hot water, as with a boiler, not shown, which is heated by this oil burner. When the burner is in operation and the boiler heated the water in the tank 72 will be maintained in a heated condition at a minimum cost and the water in the tank 72 will retain heat long enough to re-heat the circulating oil after short and intermittent periods of non-operation of the burner. To initially heat the water in the tank 72 and to insure keeping this water up to a predetermined temperature when the oil burner is operating intermittently, I provide an electric water heater 74 controlled by a thermostat 75 which will break the circuit to the heater when the water reaches or rises above the predetermined temperature. The oil to be heated circulates through oil circulating pipe means 76 in the tank 72. The function of this heater is to store enough heat to heat sufficient oil to raise the temperature of the water in the connected boiler sufficient to heat the oil to a desired temperature without the addition of heat from an outside source. On large installations the amount of oil required to bring the boiler water to the necessary temperature for heating the oil is a very material quantity and unless the requisite amount of heat is stored in the heater some outside means of large capacity for heating the oil will be required. A convenient source of outside heat is the electric heater 74. With the arrangement described since there is a sufficient amount of heat stored in the water the capacity of the electric heater installed need not be great. This is a desirable feature as the electric heater is then only required to maintain the water in the heater at the desired temperature during extended shut-down periods, or to raise the temperature of the water in the heater to the desired degree when initially starting an installation and even though the electric element is of small capacity, this can be accomplished by energizing the electric element a sufficient time in advance of starting the burner to enable the element to develop the required amount of heat.

In Fig. 3, I have shown fluid fuel control means which is substantially the same as the fuel control means shown in Fig. 1, except that the oil inlet chamber 15, solenoid 32 with connected parts, and means for continuously circulating the oil through nozzle pipes are omitted. Also in Fig. 3, the fuel inlet means 28 and oil burner nozzle pipe 6 are both directly connected with the pressure chamber 16. As the parts which are shown in Fig. 3 are substantially identical with the corresponding parts shown in Fig. 1 they are similarly numbered. The operation of the device shown in Fig. 3 is similar to the operation of the device shown in Fig. 1 except that oil will be discharged from the nozzle as soon as the burner is started and without preliminary circulation and heating up.

In describing the operation of the device shown in Fig. 1 it is assumed that the burner has been shut down and that the water in the oil heater is heated but that all other parts including the oil, the furnace or boiler and the stack are cold. When this condition obtains the switches 68 and 71 will both be closed but the circuits formed in part by the circuit wires 69 and 70 may both be de-energized. To put the burner into operation the necessary steps are taken

either manually or automatically, to start the pumps 58 and 59, provide ignition for the oil at the location of the atomizer nozzle 8 and supply current to the circuits including circuit wires 69 and 70, thus opening both valves 36 and 37. As soon as the pumps 58 and 59 are started cold oil will begin to circulate as follows:--from tank 56 through pumps 58 and 59, through pipes 62, 63, 61, through oil heater 60, pipe 27, into oil inlet chamber 15, outwardly through passageway 14 in burner pipe 6, past atomizing nozzle 8, back through return tube 13, into pressure chamber 16, which will be substantially devoid of pressure at this time, down through by-pass port 38, which will be open due to retraction of by-pass valve 36, out through pipe 30, past oil hydrostat 67, which is positioned so that it is subjected to the temperature of this circulating oil, and on through pipe 30 to the service pump 59 by which it will be again and repeatedly circulated through this same cycle. As soon as this circulating oil is heated up enough to reduce the viscosity of the same to the proper degree for efficient combustion, this heated oil will operate the oil hydrostat 67, open the switch 68, de-energize the solenoid 32 and permit the by-pass valve 36 to close. As soon as the by-pass valve 36 closes a pressure will build up in pressure chamber 16, moving piston 22 and piston rod 23 toward the end 25 of the housing 5, opening atomiser valve 11 and permitting atomized oil to be discharged from the nozzle 8 to start combustion in the cold furnace or boiler which is connected with the cold smoke stack. At substantially the same time this discharge of oil for starting purposes is commenced excess oil, supplied to the pressure chamber 16, will begin to escape past the low pressure relief valve 41. At this time the by-pass valve 37 will still be open due to the fact that the stack switch 71, has not yet had time to become heated and remains closed thus maintaining the circuit to the solenoid 33 closed. The oil will be reduced to the proper viscosity before it is permitted to discharge from the atomizing nozzle at all. The pressure under which the oil for starting and warming up purposes will discharge will be substantially below the normal operating pressure. This starting pressure will be determined by the strength of the spring 42 and size of the relief valve 41 and said spring 42 is adjustable by the screw 44. Under this lower pressure the burner will start easily and operate smoothly while the plant including the smoke stack is warming up.

As soon as the plant, including the smoke stack, has been warmed up to a predetermined temperature suitable for normal operation the stack switch 71 will be opened. This will break the circuit to the solenoid 33 and permit the by-pass valve 37 to close, whereupon pressure will immediately build up in the pressure chamber 16 to the maximum required for normal, full capacity, operation, after which excess oil will by-pass past the valve 50 into the oil discharge chamber 17.

Oil burners of the type employing this invention will ordinarily be thermostatically controlled and fully automatic. Whenever the burner shuts down for a long enough period to cause the plant to cool off it will go through the hereinbefore described cycle in starting and will go into operation smoothly and without vibration.

From the foregoing description it will be seen that the fuel control device shown in Fig. 1, upon being put into operation, will circulate the oil un-

til such oil becomes heated sufficiently to attain the required viscosity, after which the burner will go into operation at a pressure substantially below the normal operating pressure until the plant including the smoke stack becomes sufficiently heated to establish normal draft and combustion conditions, whereupon the burner will begin normal, full capacity operation at normal pressure.

The operation of the control device shown in Fig. 3 is substantially the same as the hereinbefore described operation of the control device shown in Fig. 1 is after the by-pass valve 36 closes. In the device of Fig. 3 as soon as the pumps are started oil pressure will build up in the pressure chamber 16 and open the atomizer valve and combustion, at the lower predetermined pressure limit, will begin immediately and before the oil is heated up. During this lower pressure operation, oil will by-pass past the relief valve 41. As soon as the stack switch is heated up enough to insure normal combustion and draft conditions the stack switch will operate, causing solenoid 33 to release by-pass valve 37. As soon as this by-pass valve 37 closes, pressure in chamber 16 will build up to the predetermined higher limit and the burner will commence operation at normal high capacity with the oil by-passing past relief valve 50.

The foregoing description and accompanying drawings clearly disclose a preferred embodiment of my invention but it will be understood that this disclosure is merely illustrative and that changes may be made within the scope of the following claims.

I claim:

1. In fluid fuel control means for an oil burner of the oil circulating type, a housing having an oil pressure chamber therein; oil pressure supply means communicating with said oil pressure chamber; oil burner nozzle means connected with said oil pressure chamber; an oil by-pass port providing an outlet from said oil pressure chamber; a resiliently supported pressure operated relief valve closing said oil by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber; a by-pass control valve positioned to open and close said oil by-pass port; another oil by-pass port providing another outlet from said oil pressure chamber; a resiliently supported pressure operated relief valve positioned to close said last mentioned by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber, said last mentioned relief valve being opened by a higher pressure than said first mentioned relief valve after said by-pass control valve has been closed; and pressure actuated means actuated by a lower pressure than said relief valves controlling the discharge of oil from said oil pressure chamber through said oil burner nozzle, whereby discharge of oil from said nozzle may be prevented while a circulation of oil through said chamber is being maintained.

2. In fluid fuel control means for an oil burner of the oil circulating type, a housing having an oil pressure chamber therein; oil pressure supply means communicating with said oil pressure chamber; oil burner nozzle means communicating with said oil pressure chamber; an oil by-pass port providing an outlet from said oil pressure chamber; a resiliently supported pressure operated relief valve closing said oil by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber; a by-pass control valve positioned to open and close said oil

by-pass port; pressure actuated means operated by a lower pressure than said relief valve controlling the discharge of oil from said oil pressure chamber through said oil burner nozzle means, whereby discharge of oil from said nozzle may be prevented while a circulation of oil through said chamber is being maintained; another oil by-pass port providing another outlet from said oil pressure chamber; a resiliently supported pressure operated relief valve positioned to close said last mentioned by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber, said last mentioned relief valve being opened by an increase of pressure in said oil pressure chamber in response to the closing of said by-pass valve, whereby oil will be discharged at a predetermined pressure from said oil burner discharge means when said by-pass valve is open and at a predetermined higher pressure when said by-pass valve is closed.

3. In fluid fuel control means for an oil burner of the oil circulating type, a housing having an oil pressure chamber therein; oil pressure supply means communicating with said oil pressure chamber; oil burner nozzle means communicating with said oil pressure chamber; an oil by-pass port providing an outlet from said oil pressure chamber; a resiliently supported relief valve closing said oil by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber; a by-pass valve positioned to open and close said oil by-pass port; temperature actuated means adapted to close said by-pass valve in response to an increase in temperature in the combustion chamber and smoke stack means with which the oil burner is connected; pressure actuated means operated by a lower pressure than said by-pass relief valve controlling the discharge of oil from said oil pressure chamber through said oil burner nozzle means, whereby discharge of oil from said nozzle may be prevented while a circulation of oil through said chamber is being maintained; another oil by-pass port providing another outlet from said oil pressure chamber; a resiliently supported relief valve positioned to close said last mentioned by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber, said last mentioned relief valve being opened by an increase of pressure in said oil pressure chamber in response to the closing of said by-pass valve, whereby oil will be discharged at a predetermined pressure from said oil burner nozzle means when said by-pass valve is open and at a predetermined higher pressure when said by-pass valve is closed.

4. In fluid fuel control means for an oil burner of the oil circulating type, a housing having an oil pressure chamber therein; oil pressure supply means communicating with said oil pressure chamber; oil burner nozzle means communicating with said oil pressure chamber; an oil by-pass port providing an outlet from said oil pressure chamber; a resiliently supported relief valve closing said oil by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber; a by-pass valve positioned to open and close said oil by-pass port; electrically actuated opening and closing means connected with said by-pass valve; energized circuit means connected with said opening and closing means; a stack switch operatively connected with the smoke stack with which the oil burner is associated and actuated by an increase of tempera-

ture in said stack to bring about the closing of said by-pass valve; pressure actuated means operated by a lower pressure than said by-pass relief valve controlling the discharge of oil from said oil pressure chamber through said oil burner nozzle means, whereby discharge of oil from said nozzle may be prevented while a circulation of oil through said chamber is being maintained; another oil by-pass port providing another outlet from said oil pressure chamber; a resiliently supported relief valve positioned to close said last mentioned by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber, said last mentioned relief valve being opened by an increase of pressure in said oil pressure chamber in response to the closing of said by-pass valve, whereby oil will be discharged at a predetermined pressure from said oil burner nozzle means when said by-pass valve is open and at a predetermined higher pressure when said by-pass valve is closed.

5. In fluid fuel control means for an oil burner, a housing having an oil pressure chamber therein; oil pressure supply means communicating with said oil pressure chamber; oil burner nozzle means communicating with said oil pressure chamber; an oil by-pass port providing an outlet from said oil pressure chamber; a by-pass valve positioned to open and close said oil by-pass port; means governed by the temperature of the oil being supplied to said oil pressure chamber adapted to open said by-pass valve when the temperature of said oil is below a predetermined degree and close said by-pass valve when the temperature of said oil is above said predetermined degree; a second oil by-pass port providing a second outlet from said oil pressure chamber; a resiliently supported relief valve closing said second oil by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber upon the closing of said by-pass valve; a second by-pass valve positioned to open and close said second oil by-pass port; a third oil by-pass port providing a third outlet from said oil pressure chamber; and a resiliently supported relief valve positioned to close said third by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber, said first mentioned relief valve being opened by an increase of pressure in said oil pressure chamber when said first mentioned by-pass valve is closed and said last mentioned relief valve being opened by a further increase of pressure in said oil pressure chamber when said second by-pass valve is closed, whereby no oil will be discharged from said nozzle means when said first mentioned by-pass valve is open and oil will be discharged from said nozzle at a predetermined pressure when said first mentioned by-pass valve is closed and said second by-pass

valve is open and oil will be discharged from said nozzle at a predetermined higher pressure when both of said by-pass valves are closed.

6. In fluid fuel control means for an oil burner, a housing having an oil inlet chamber and an oil pressure chamber and an oil discharge chamber; oil burner circulating conduit means connected with said oil inlet chamber; an atomizing nozzle on said oil burner circulating conduit means; an oil return tube positioned in said oil burner circulating conduit means and having an opening in its outer end portion and having its inner end portion connected with said oil pressure chamber; an atomizer valve controlling the discharge of oil through said atomizer nozzle; yielding means urging said atomizer valve closed; pressure responsive means connected with said atomizer valve and operated by pressure within said oil pressure chamber to open said atomizer valve; an oil by-pass port providing an outlet from said oil pressure chamber; a by-pass valve positioned to open and close said oil by-pass port; means governed by the temperature of the oil being supplied to said oil pressure chamber adapted to open said by-pass valve when the temperature of said oil is below a predetermined degree and close said by-pass valve when the temperature of the oil is above said predetermined degree; a second oil by-pass port providing a second outlet from said oil pressure chamber; a yieldingly supported relief valve closing said second oil by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber upon the closing of said by-pass valve; a pressure operated relief valve positioned to open and close said second oil by-pass port; a third oil by-pass port providing a third outlet from said oil pressure chamber; and a resiliently supported relief valve positioned to close said third by-pass port and adapted to be opened by a predetermined pressure in said oil pressure chamber, said first mentioned relief valve being opened by an increase of pressure in said oil pressure chamber when said first mentioned by-pass valve is moved to closed position and said last mentioned relief valve being opened by a further increase of pressure in said oil pressure chamber when said second by-pass valve is moved to closed position, whereby no oil will be discharged from said atomizing nozzle when said first mentioned by-pass valve is open and oil at a predetermined pressure will be discharged from said atomizing nozzle when said first mentioned by-pass valve is closed and said second by-pass valve is open and oil at a predetermined higher pressure will be discharged from said atomizing nozzle when both of said by-pass valves are closed.

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