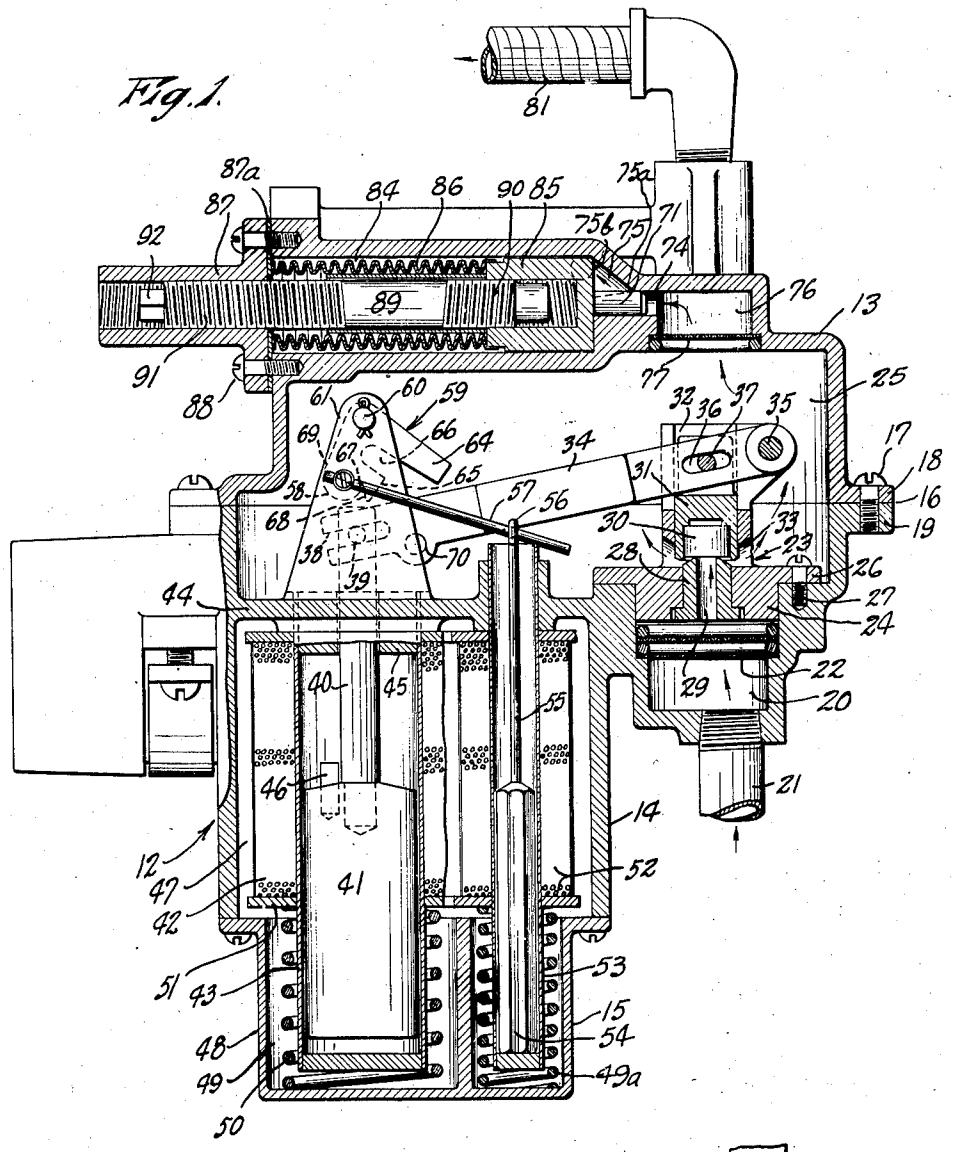
Nov. 12, 1935. C. L. WARNER 2,020,710

FLUID CONTROL

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Fig. 1.



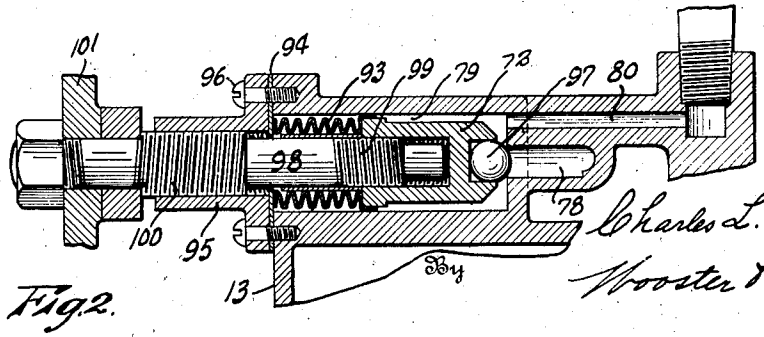


Fig. 2.

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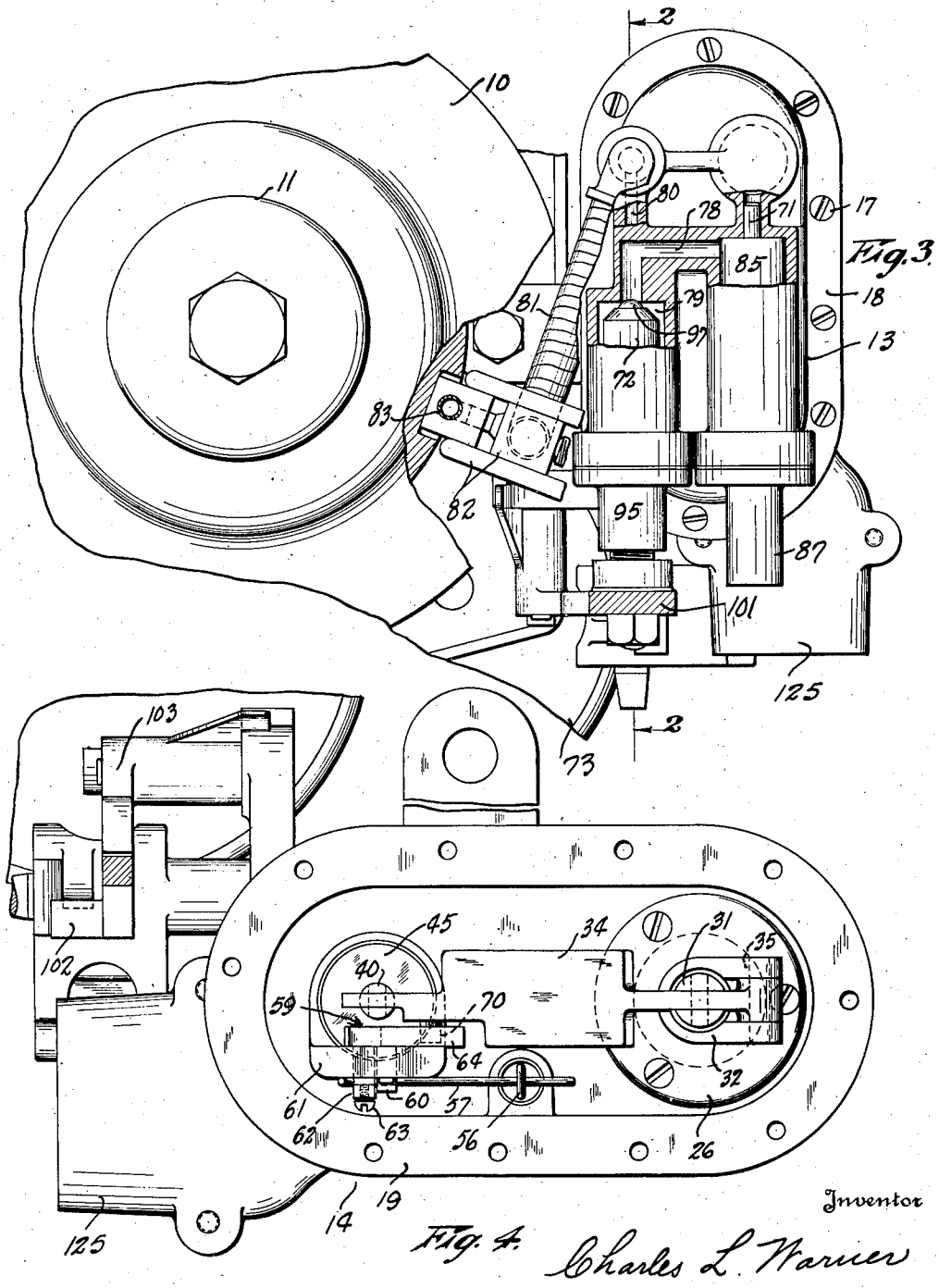


Fig. 3.

Fig. 4.

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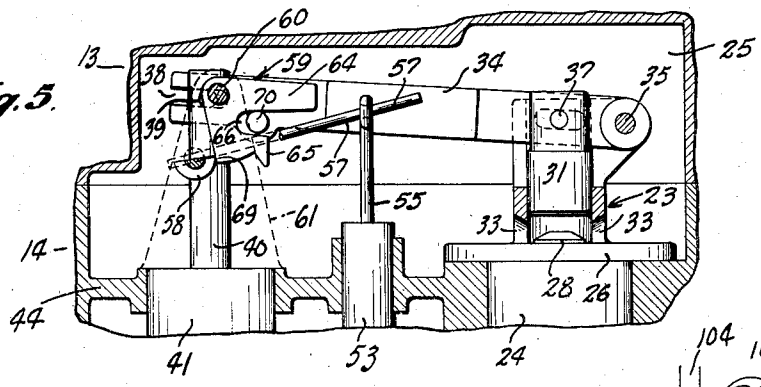
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FLUID CONTROL

Filed July 9, 1931 3 Sheets-Sheet 3

Fig. 5.



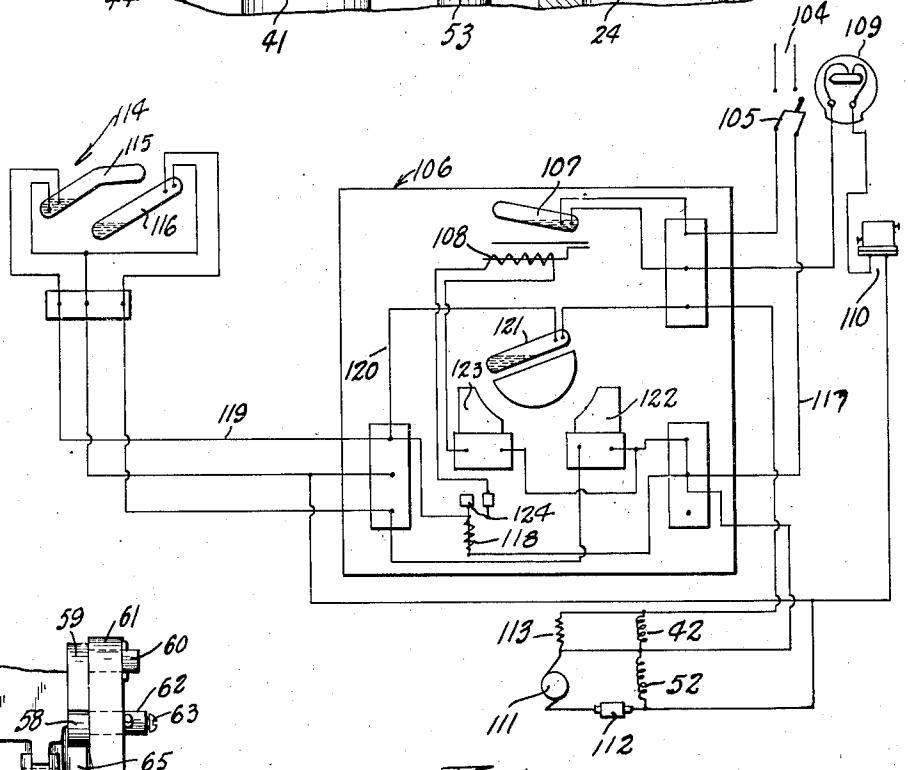


Fig. 7.

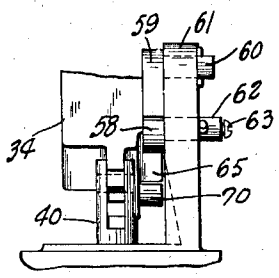


Fig. 6.

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UNITED STATES PATENT OFFICE

2,020,710

FLUID CONTROL

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Application July 9, 1931, Serial No. 549,670

6 Claims. (Cl. 137—139)

This invention relates to an automatic control device for a fluid, such for example as is used for oil or gas burners in heating plants, but is adapted for controlling any fluid and has for an object to provide an improved control device for the fluid, which is simple in construction and not easily gotten out of order.

It is also an object of the invention to provide a control in which there is an electrically operated locking means for the main fluid valve which will hold this valve in open position after it is operated to this position by electrically operated means, which locking means requires less current than the operating means for the valve, and therefore there is a great saving in current consumption over what would be required if the main valve operating means were relied on to hold the valve in open position during operation of the burner or other device using the fluid.

Another object of the invention is to provide an improved construction and arrangement of the control valves and operating means therefor whereby the enclosing casing may be die-cast, thus greatly reducing the machining operations required and also making all parts easily accessible for assembling, renewal, inspection or repair.

A further object is to provide an improved construction and arrangement of the control device in which the liquid fuel flows always in an upward direction from the point of entrance through the control device to its point of exit to the burner so as to eliminate possibility of the formation of a gas pocket which would cut off the flow of fuel and render the device inoperative.

Further objects will become apparent from a detailed description of the invention taken in connection with the accompanying drawings forming a part of this specification.

In these drawings:

Fig. 1 is a vertical section through the device;

Fig. 2 is a vertical detailed section of the safety cut-off valve taken substantially on line 2—2 of Fig. 3;

Fig. 3 is a partial top plan view and a partial horizontal section;

Fig. 4 is a top plan view with the upper section of the casing removed;

Fig. 5 is a detailed vertical section showing the control valve in open position;

Fig. 6 is a side elevation of the valve locking means; and

Fig. 7 is a wiring diagram showing the relation of the control to the various thermostatic elements.

The improved control is located at one side of the burner indicated at 10 which may be any suitable type of burner, but is indicated as of the type where an upright electric motor rotates an oil distributing head 11 to throw the oil laterally in a continuous circular film so that it burns as an annular flame within the usual firebox such for example as that shown in my prior application for Oil burner, Serial Number 505,093, filed December 27, 1930. The various valves and operating means for these valves of this control device are enclosed in a body or casing indicated as a whole at 12 and comprising an upper section 13, a lower section 14 and a cover section 15, all of which due to my improved arrangement of the valves and associated elements can be made of die-castings so that the machining operations required in the manufacture of this control unit are reduced to a minimum. The two sections 13 and 14 of the body or casing are separated at the point 16, and they are detachably connected together by any suitable means such as the screws 17 passing through the flange 18 on the section 13 and threaded into the flange 19 on the section 14.

The lower section 14 of the body is provided with a small chamber 20 to which the inlet or fuel supply pipe 21 leads from any suitable storage tank (not shown) for the liquid fuel. In this chamber 20 are mounted any desired number of screens 22 to catch particles of dirt which may pass in with the oil. Above these screens is the main control valve 23. This valve includes a valve lever support 24 seated in the top of the chamber 20 and supported on the bottom wall of the chamber 25 by a flange 26 through which extend securing screws 27. This member 24 has an opening therethrough for the valve plug 28 having a longitudinal passage 29 for the flow of oil, and this plug has a seat at its upper end on which may close the valve element 30 of any suitable material, preferably of a vulcanized somewhat resilient rubber. This element 30 is mounted in a movable plunger 31 guided for vertical movement by the upright guiding means 32 carried by the member 24, and lateral openings 33 permit flow of oil from the passage 29 into the chamber 25 when the valve 30 is raised from its seat.

This valve is operated by a valve lever 34 pivoted at 35 to the uprights 32, and it has a slot 36 to receive an operating pin 37 carried by the valve plunger 31. At its opposite end the lever 34 is forked at 38 to receive a pin 39 on a rod 40 connected to solenoid armature and weight 41, this armature being mounted in the main solenoid coil 42 and capable

of sliding vertically in enclosing tube 43 passing through the wall 44 of the body to seal the oil out of the solenoid and forming a guide for the armature weight. The upper end of the tube 43 may be closed by plug 45 through which the rod 40 extends and is guided. The armature weight 41 may carry a stop plug 46 which may engage the plug 45 to limit upward movement of the armature under the action of the solenoid coil 42. The limit of the upper movement of the armature weight 41 may be adjusted by using stop plugs 46 of different lengths. The solenoid coil 42 is in the chamber 47 under the wall 44 which chamber opens at its lower end through the lower wall of section 14 and is closed by the cover section 48 detachably secured to the section 14 of the body. This cover section has a chamber 49 to enclose the lower end of the tube 43 and also carries spring 50 engaging at its upper end under a plate 51 for supporting the solenoid coil.

Also mounted in the chamber 47 is a smaller or lock operating solenoid coil 52 supported similarly to the solenoid coil 42 and embracing the guide tube 53 for lock operating armature weight 54. The tube 53 extends through the wall 44 of the body to seal the chamber 47 from the chamber 25, but is open at its upper end for the passage of the operating rod 55 which has an eye 56 through which extends a rod 57 forming a lever arm connected to a catch 58 that cooperates with a locking lever 59 pivoted at 60 on the upright arm 61 preferably formed as an integral part of the wall 44. The catch 58 is substantially semicircular and is carried by a stud 62 pivoted in the arm 61, the arm 57 passing through this stud and adjustably secured therein by a set screw 63. The lever 59 is also pivotally mounted in this arm 61 by the stud 60. This lever has an arm 64 and a shorter arm 65 below it between which is a notch or recess 66. The arm 65 has on its lower edge a curved surface 67 struck from the center of the stud 60 leaving a shoulder 68 to engage one edge of the latch 58 to limit downward movement of the lever 59 and providing a shoulder 69 at its other end to engage the latch 58 and hold the lever 59 in its elevated position as shown in Fig. 5 for a purpose which will later be described. The valve operating lever 34 has a laterally extending stud 70 adapted to seat in the recess 66 as shown in Fig. 5 so as to hold the lever 34 elevated and the valve 30 open.

After these various elements are assembled as shown the upper section 13 of the body may be placed thereon as indicated in Fig. 1 completing the chamber 25 enclosing the operating elements just described. This upper section 13 carries a needle control valve 71 for controlling the rate of feed of fuel to the burner, and also a safety shut off valve 72 for completely cutting off the fuel should the burner go out or not light and the fuel should flow out the burner into a drip pan 73. The needle control valve 71 controls a passage 74 and lateral V-shaped passage 75 leading from a small chamber 76 communicating with the upper part of the chamber 25, and if desired a screen 77 may be provided at the lower part of this chamber. The passage 75 is V-shaped so that it tapers from the inlet end 75a to outlet end 75b so as to give a fine adjustment to the fluid control and also so that if dirt were carried in with the fluid it would not lodge in the passage but would be carried through. The fuel flows from the passage 75 to the lateral passage 78 leading to the safety shut off valve 72, and the chamber 79 from which another passage 80 leads to the flexible conduit 81 connected by a detachable coupling 82 to the conduit 83 leading to the burner 11.

The valve 71 and its adjusting means is mounted in the longitudinal chamber 84 in the top of the body section 13, and comprises a head 85 soldered to one end of the flexible bellows tube 86, the other end of which is soldered to a packing ring 87a clamped over the outer end of the chamber 84 by a cap 87 which is secured by any suitable means such as screws 88. The head 85 is threaded to an adjusting screw 89 by a left hand thread 90, and this screw 89 is also threaded by a right hand thread 91 to the head 87. The flexible bellows 86 forms a seal to prevent leakage of oil, and by turning screw 89 by any suitable means such as a socket wrench receiving the square head 92, the head 85 and valve 71 may be adjusted to control the rate of feed of fuel to the passage 75. It will be noted the outer open end of the chamber 84 is as large as the inner portion of the chamber and therefore the plunger for forming this chamber in the die-casting operation can be readily withdrawn from the casting.

The same is true of the chamber 79 as indicated in Fig. 2, and the valve head 72 is soldered to a flexible bellows tube 93 which is soldered to the packing plate 94 clamped between the cap 95 and the face of the body by any suitable means such as the screws 96. The bellows 93 therefore seals this valve also and permits movement of the valve 72 to and from the seat surrounding the passage 78. It is preferred to mount a ball 97 in the end of the head 72 to engage this seat. The valve stem 98 is threaded by a right hand thread 99 to the head 72 and by a left hand thread 100 to cap 95. Therefore, by rotating the stem 98 the valve 97 will be moved toward and from the seat. A lever 101 carrying an operating weight (not shown) is secured to the valve stem 98 and operates to turn the stem 98 to close the valve 97 and shut off flow of fuel to the burner should the burner go out or for any other reason oil should flow from the burner into the safety drip pan 73. Oil getting into this pan weights it and causes it to drop down and release the catch device 102, 103 all as clearly disclosed in my prior application, Serial Number 504,734, filed December 26, 1930.

It will be noted all the chambers 25, 76, 79 and 84 are of substantially the same size throughout or slightly tapered so the plungers or other parts of the mold or dies forming them and body section 13 can be readily withdrawn. In the lower body section 14 the same is true of the lower part of chamber 25 and chambers 20 and 47, so this section 14 can be readily die-cast. Section or cover 48 can also be readily die-cast as chambers 49 and 49a are straight and of substantially uniform size throughout or slightly tapered so the die parts will draw properly. By so constructing and arranging the parts that the body can be die-cast the required machining operations are reduced to a minimum greatly reducing cost of production.

Referring to the diagram of Fig. 7, this diagram indicates diagrammatically the various thermostats and electric switches for controlling this fuel control device. At 104 is indicated the supply connection to the house wiring system controlled by a main switch 105. The arrangement of elements enclosed in the square 106 is called a control unit and includes a lock out switch 107, such as a mercury switch as shown

controlled by a thermal unit 108. In series with the switch 107 is the room thermostatic switch 109 in series with a limit switch 110 controlled by means responsive to temperature or pressure conditions in the boiler or other heating device. The coil at the lower part of this figure indicated at 42 represents the large or main solenoid coil 42 of Fig. 1, while the coil 52 represents the small or auxiliary lock operating solenoid coil 52 of Fig. 1. The operating motor for the burner is indicated at 111 with a resistance 112 in series with it, and the ignition device for the burner 11 is indicated at 113. This may be either a gas or an electrical ignition device, but is electrically controlled. At 114 is shown a switch operated by means which becomes effective if or when the fuel is ignited at the burner, such for example as a thermostatic element in the stack or smoke flue leading from the furnace, but it is to be distinctly understood that this is mentioned merely as an example and any other means which becomes effective if the fuel becomes ignited can be used such as locating the element in the fuel door or fire box, or a light sensitive element etc. and the term stack switch in the specification and claims is used in the generic sense to cover any such device, and includes two mercury switch elements 115 and 116 which are operated together, but are so arranged that while the switch 115 is closed as shown the switch 116 is open and vice versa. Connected to the switch element 115 and supply lead 117 is a thermostatically operated oil delay switch 118 which it will be noted connects through the lead 119 to the switch 115 and connected to lead 119 is a lead 120 extending to the switch 121. The lead 117 also connects to an electromagnetic holding coil 122 and the electromagnetic operating coil 123. The thermal element 118 when heated operates to close the switch contacts 124, but as it requires a given time for element 118 to heat up after the circuit through it is closed it will be evident closing of switch 124 is delayed accordingly.

The operation is as follows: The elements are shown in their normal position in Figs. 1 and 7 when the burner is not operating, but with of course, the main electrical switch 105 normally closed. If now the temperature of the room goes below a certain point the room thermostat will call for heat by closing the switch 109. Closing this switch 109 energizes the coil 52 (of course assuming that the temperature of the boiler is such that the switch 110 is closed) for the locking device, and also energizes the burner motor 111. Closing switch 109 also causes current to pass through the thermostat coil 118 of the oil delay switch as the switch 115 is closed. Energizing of the coil 52 will tend to lift the armature 54, but due to the fact that the latch 58 is under the curved wall 67 it cannot move upwardly at this time. The thermal switch 118 is heated by the current and after a predetermined time closes the contacts 124 and closes the circuit through the thermal element 108 of the switch 107. The switch 107, is not however affected until the thermal element 108 is heated to a given temperature which requires a predetermined time depending on the adjustment. Closing of the switch 124 also energizes the electromagnetic coil 123 which kicks over the switch 121 to closed position thus closing the circuit through the large or main solenoid coil 42 and the ignition mechanism 113. Energizing of the coil 42 raises the armature weight 41 which lifts the valve lever 34 and opens the valve 30 to permit oil to flow from the inlet supply 21 to the chamber 25 and through the needle valve 71 and the cut off valve 72 to the burner. This delay in the closing of switch 121 has permitted the burner motor to come to full operating speed before the oil is turned on and therefore this oil is thrown out in a fine spray and is ignited by the igniting device 113. In other words it provides a delayed oil feed so motor gets up to speed before any oil is supplied to the rotating atomizing cup. Also the ignition comes on with the oil.

The burner is now lighted, and of course, the furnace begins to heat up, the valve lever 34 being held in its upper position by the solenoid coil 42 operating on the core or armature 41. As the lever 34 moved upwardly the lug 70 carried by this lever engaged under the arm 64 of the latch lever 59 swinging this lever counterclockwise as viewed in Fig. 1, and causing the lug 70 to enter the recess 66 as shown in Fig. 5. This movement of the lever 59 carries the curved surface 67 to the right of the catch 58 and permits the armature 54 in the smaller solenoid coil 52 to move upwardly to the position of Fig. 5 as this coil 52 was energized when the room thermostat switch was closed. This upward movement of the weight 54 turns the catch 58 to the position in Fig. 5 with its right hand edge engaging behind the shoulder 69 on the lever 59. As the burner is now operating the furnace begins to heat up and the heat going up the stack operates the stack switch 114 to open the switch 115 and close the switch 116. This breaks the circuit to the large solenoid coil 42 and also to the ignition 113, but does not affect the circuit through the burner motor 111 and the locking solenoid 52 which remains closed so that the burner continues to operate. It also breaks the circuit through the oil delay switch coil 118 causing it to cool down and open the switch 124 and the circuit through the heating element 108. Still further as operation of the stack switch closes switch 116 it energizes electromagnet 122 which holds switch 121 over until stack cools and switch 114 swings back. Then switch 121 swings back to its original position as shown on the drawings. This holding over of switch 121 until the stack cools is desirable because of other features not shown which would throw current onto certain elements if switch 121 came back before the stack cooled. These features are not shown as they would tend to complicate the description and drawings and a showing thereof is not necessary as they form no part of my invention. It will be evident that as the large solenoid coil is now not energized its core 41 would drop and close the valve 30 unless it were held in the upper position. This is what the latch mechanism 59 does. As the solenoid coil 52 is still energized its armature 54 is held in the upper position of Fig. 5 which holds the catch 58 behind the shoulder 69 of the lever 59. This lever is therefore locked in the elevated position of Fig. 5, and will hold the valve lever 34 and the solenoid weight 41 elevated because the stud 70 carried by lever 34 rests on the lower wall of the notch 66. Thus the main valve 30 is held open so long as the small solenoid 52 is energized and the burner will continue to function. It will be evident that this effects a great saving in the consumption of electric current while the burner continues to operate, because while solenoid coil 42 may require

85 or 90 watts to operate it, the smaller coil 52 requires only about 5 watts.

The burner continues to function until the room thermostat controlling the switch 109, or the boiler limit switch 110 is satisfied, at which time one of these switches is opened. It will be evident that opening of either one of these switches completely shuts off current from the control unit, the locking solenoid 52 and the burner motor 111. The burner motor of course then stops and the solenoid coil 52 being deenergized permits the weight 54 to drop swinging the catch 58 downwardly away from the shoulder 69 on the locking lever 59 and permitting this lever to drop, which in turn permits the lever 34 and the weight 41 to drop and close the valve 30, thus shutting off further flow of fuel to the burner. As soon as the stack cools down switch 114 swings back and the elements of the control unit 106 automatically return to the starting position.

After the circuit is closed by the room thermostat switch 109 and the oil delay switch 118 has closed the contacts 124, if for any reason the burner should not light, then of course, the stack switch 114 would not be operated, but would remain in the normal position of Fig. 7. In this event after a given length of time the thermal element 108 would become sufficiently heated to open the lock out switch 107 which would open the electrical supply circuit to the control device, and therefore the flow of fuel would be shut off and motor stopped. If, however, the burner lights as it should then the stack thermostatic switch 114 would operate before the thermal element 108 had had time to heat sufficiently to open the lock out switch 107 and the burner would continue to operate as above described.

Leads from the various control switches may be led to the solenoids by a cable, not shown, carrying the conductors and attached to a removable connector plug adapted to be inserted in a socket 125 having the desired contacts (not shown) connected with the solenoids and adapted to engage the plug contacts in the usual manner to provide an easily connected and detachable connection, but of course, regular permanent lead connections may be used if preferred.

Although the device has been described as for controlling fuel oil to an oil burner it will be evident the device could also be used to control the flow of gas to a gas burner, or a valve for controlling any fluid in any location desired.

The layout of Fig. 7 is shown merely as an example to indicate a control system which may be used with my improved fluid control, but I wish it to be distinctly understood that my device is not limited to use with this arrangement but may be used with any system where there is means for energizing the main solenoid and auxiliary solenoid and then cutting off current from the main solenoid so the valve is held open by the auxiliary solenoid during use of the fluid. It is also to be understood that altho the system of Fig. 7 uses a delayed operation or opening of the main control valve this is not necessary and the device can be used equally well without the delayed operation.

Having thus set forth the nature of my invention, what I claim is:

1. In a fluid control, a control valve, a lever connected to said valve and provided with a projection, a vertically movable armature connected to said lever, a solenoid capable when energized of lifting said armature and lever to open the valve, a locking lever having an arm in the path of movement of said projection to be engaged by said projection to lift the locking lever to holding position when the first lever is lifted and also having a notch in which said projection may rest to hold the valve lever in raised position, a latch for holding the locking lever in raised position, and an auxiliary electrically operated means for shifting the latch.

2. In a fluid control, a body comprising a plurality of sections including a main section open at the top and an upper section closing the open top of the main section, said main section including a transverse wall carrying a support, a control valve carried by said main section, a lever connected to said valve, a latch means mounted on the support for holding the valve in open position, said main section being provided with a chamber within its walls in the lower part of the section, solenoids in said chamber for operating the valve and the latch, and said chamber opening through the bottom of the section and at least as large at its outer end as inwardly therefrom so that the section can be die cast.

3. In a fluid control, a body including a main section and an upper section having cooperating walls forming a chamber, a valve in the main section controlling flow of fluid to said chamber, means mounted in the main section for controlling said valve including electrical means for opening the valve, and electrically operated latch means for holding the valve open, said section having chambers for said electrical means opening through walls thereof, all said chambers being arranged so that the section may be die cast, said upper section also having chambers opening through the walls thereof arranged so the section can be die cast, a needle control valve located in one of said chambers, and a safety cut off valve located in the other chamber.

4. In a fluid control, a control valve, an operating lever connected to said valve and provided with a projection, a vertically movable armature connected to said lever, a solenoid capable when energized of lifting said armature and lever to open the valve, a locking lever having an arm projecting laterally over the path of movement of said projection whereby it will be engaged by said projection on its upward movement to lift said arm, a shorter arm on the locking lever spaced below the first arm and mounted to move to a position under the projection when the locking lever is raised and capable of holding the operating lever in elevated position, a latch adapted to be shifted to engage the locking lever to hold it in its elevated position, and a solenoid for operating said latch.

5. In a fluid control, a control valve, an operating lever connected to said valve and provided with a projection, a vertically movable armature connected to said lever, a solenoid capable when energized of lifting said armature and lever to open the valve, a locking lever having an arm projecting laterally over the path of movement of said projection whereby it will be engaged by said projection on its upward movement to lift said arm, a shorter arm on the locking lever spaced below the first arm and mounted to move to a position under the projection when the locking lever is raised and capable of holding the operating lever in elevated position, said locking lever being provided with a shoulder, a pivoted latch having a stop wall movable into and from

the path of movement of said shoulder and capable when moved into the path of said shoulder to hold the locking lever elevated, an arm connected to said latch to rotate it, an armature connected to the arm and normally holding the latch out of holding position, and a solenoid for shifting the armature to turn the latch to holding position.

6. In a fluid control, a body having a chamber, a fluid inlet to said chamber, a valve controlling said inlet, a lever connected to said valve for operating it, a latch means associated with said lever for holding the valve in open position, an armature connected to said lever for operating it, an armature connected to the latch for operating it, said body being provided with a chamber opening through its outer wall, tubular elements connected at an open end to the wall of the chamber and closed at their other ends and embracing said armatures, solenoids in said chamber embracing the tubular elements to operate the solenoids, a closure for the open side of said chamber, and springs held against the solenoids by said closure and mounting the solenoids in position.

CHARLES L. WARNER.