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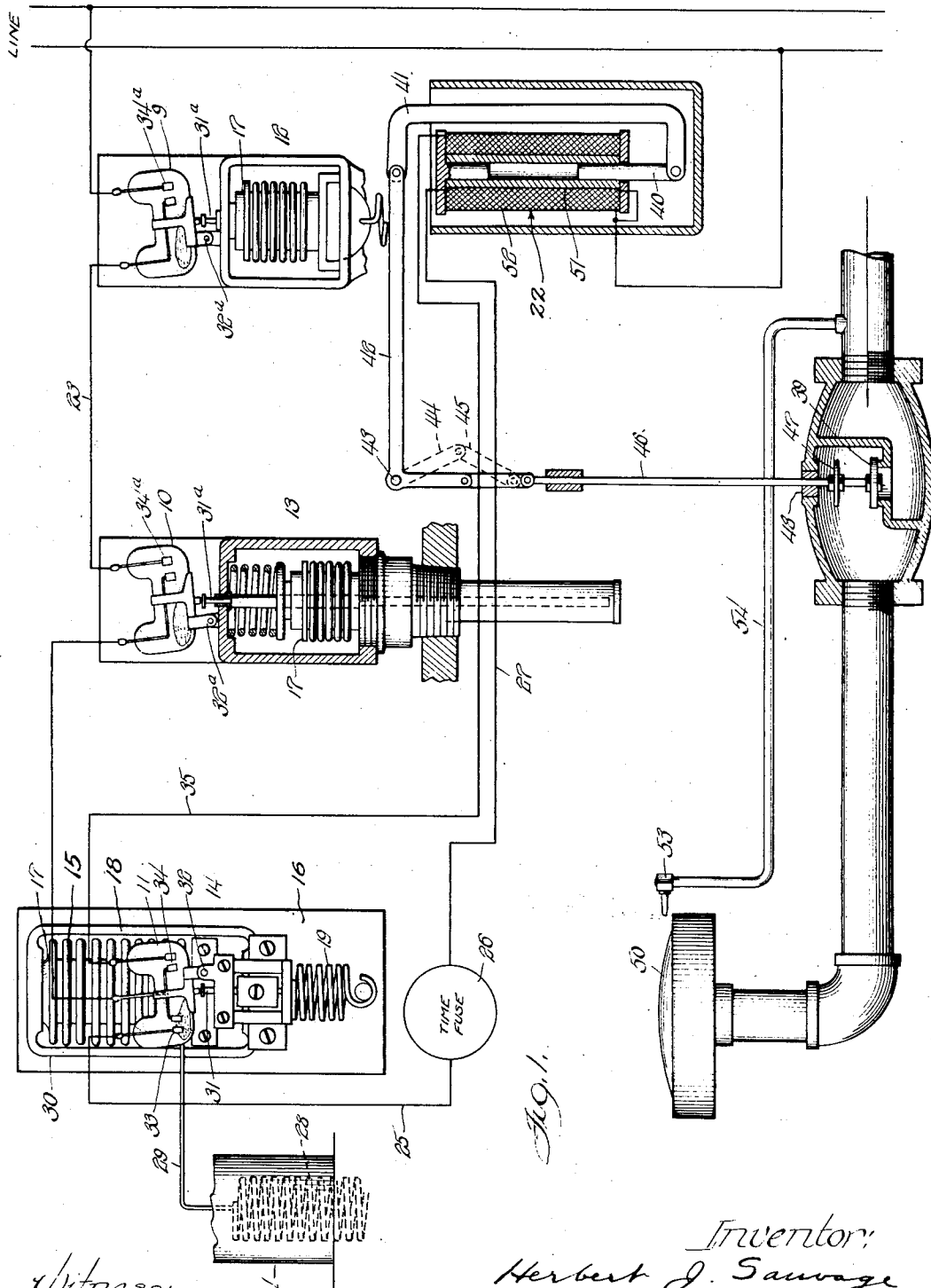
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CONTROL MEANS FOR FLUID FUEL BURNERS

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2 Sheets-Sheet 1



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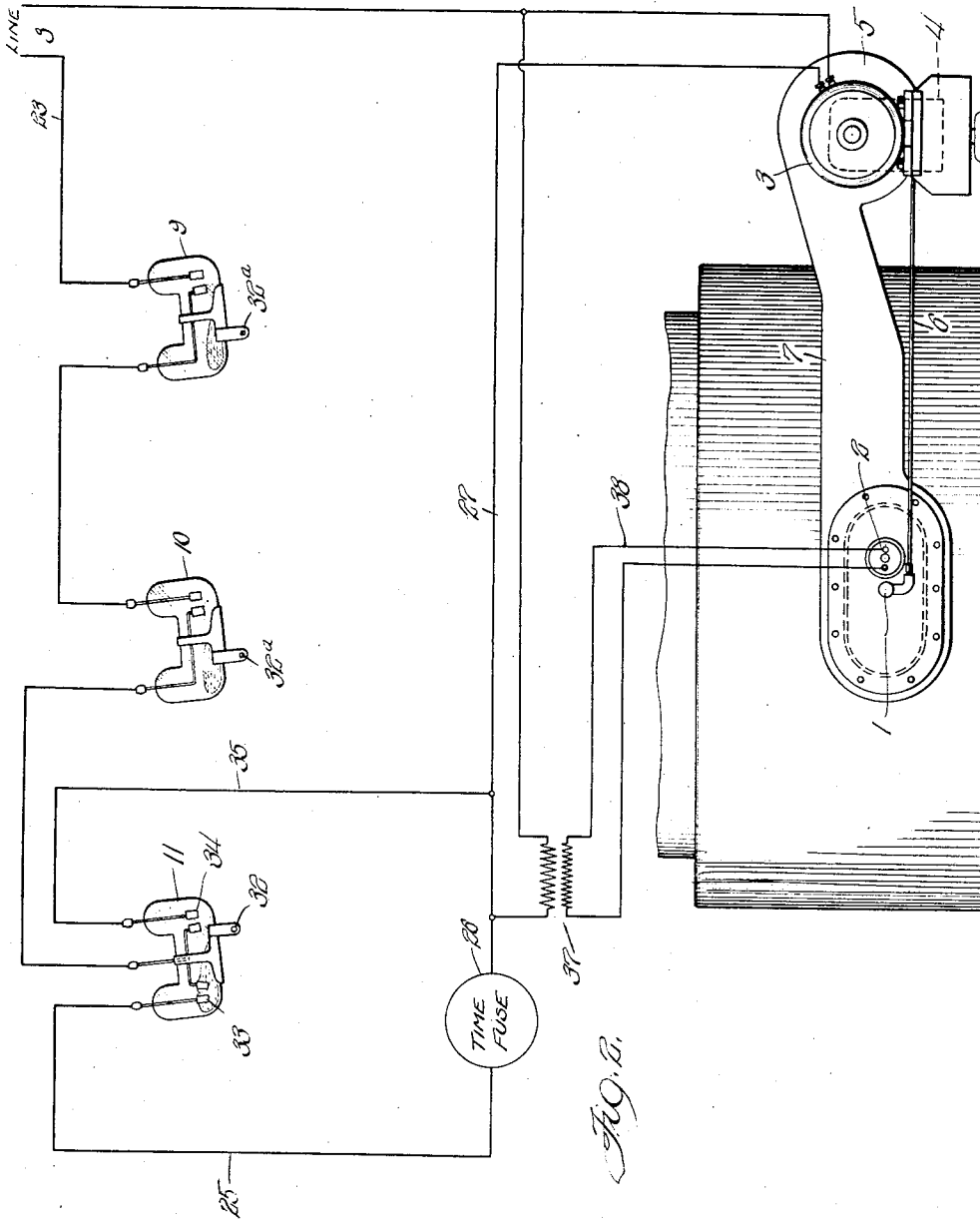
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UNITED STATES PATENT OFFICE.

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CONTROL MEANS FOR FLUID-FUEL BURNERS.

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This invention relates to electrical means for controlling the operation of oil burners, gas burners, etc., and the objects of the invention are to avoid some of the complications ordinarily occurring in control systems of this nature wherein it is necessary to provide electrical means for controlling the supply of fuel and for insuring that the fuel supply be cut off in case the ignition means fails to operate upon starting an operation of the burner.

Figure 1 shows the improved arrangement in diagram, as applied to gas burners.

Fig. 2 shows a similar system in connection with an oil burner provided with electrical ignition means.

The plan of the arrangement herein disclosed includes the use of suitable thermostatic or pressure operated devices in connection with electromagnetic means for controlling the fuel supply of an oil burner or operating the gas valve of a gas burner, and circuits for said electromagnetic means which are controlled by the thermostatic or pressure operated devices in order to initially include a time fuse in the circuit of the electromagnetic means, and then in case combustion takes place within a predetermined time interval after starting the operation, to shunt out said time fuse and connect the electromagnetic means directly with the source of power.

Referring to the drawings, in the diagram of Fig. 2, an oil burner nozzle is diagrammatically indicated at 1, adjacent to an ignition device, which may be in the form of a spark plug 2. A motor is shown at 3 for driving an oil pump indicated by the dotted lines 4, and an air blower 5. The numeral 6 indicates a fuel conduit for connecting the pump 4 with nozzle 1, and 7 is an air conduit leading from the blower 5 to the oil burner. The circuit of the motor 3 is from the feed wires 8 through a plurality of switches 9, 10, and 11. These switches may be respectively controlled by a room thermostat indicated at 12, Figure 1, a boiler thermostat 13, and a stack thermostat 14.

Each of these thermostats may consist of a bellows 15, containing a fluid expansively

sensitive to temperature rises. The base plate 16 of each bellows is mounted in fixed position while the upper closing plate 17 is movable and controls the operation of one of the switches.

The plate 17 of the stack thermostat 14 bears against a yoke 18, the bottom of which is connected with a normally expanded spring 19 drawing downwardly upon the yoke. The yoke also has provision at its lower end for shifting a plunger 31 upwardly upon expansion of the bellows in order to permit corresponding switch 11 to rock upwardly from its normal position. Normally the switch 11 is in the position indicated in the drawings, with the circuit closed through the contacts 33. Thus, the current from the line over conductor 23 if permitted to pass through the switches 9 and 10 will from switch 11 pass along the conductor 25, time fuse 26, and conductor 27 to the gas valve operating electromagnet 22, Figure 1, or the oil burner motor 3, Figure 2. If, under these circumstances, ignition takes place as intended and the stack thermostat coil 28 is heated up promptly, switch 11 will be rocked into position for closing contacts 34 and the current will pass from the conductor 23, leading into the switch, to the conductor 35 and the electromagnet 22 or motor 3. The time fuse 26 will be cut out as the circuit is opened at the contacts 33. If the coil 28 is not heated as required for effecting this operation of switch 11 within a predetermined time, the time fuse will blow out and the supply of fuel to the burner will be stopped, due to the return of the armature of electromagnet 22 to normal position, or the stoppage of the oil burner motor 3.

The operation above described is preferably dependent upon automatically operated switches, such as the switches 9 and 10 respectively under the control of a room thermostat 12 and a boiler thermostat 13. The switches 9 and 10 differ from the switch 11 being only one-way switches and normally closed in the position opposite to the position indicated in the drawings, with the bellows 17 thereof contracted. When the bellows is expanded upon a rise in temper-

ature sufficiently to force the plungers 31^a of these devices upwardly, the switches rock around their pivotal supports 32_a to cause the mercury therein to roll into position for opening the circuit at the contacts 34^a. Therefore, when there is a drop in room temperature and boiler temperature, to a certain point, the circuit of the motor 3 of Figure 2, or the electromagnet 22, Figure 1, is closed through the switches 9 and 10, and also through the switch 11 and, as before mentioned, first through the pair of contacts 33 and then through contacts 34 provided coil 28 is heated.

If ignition promptly takes place, as intended, then the stack 24 of the furnace becomes heated, causing expansion of a fluid within the coiled tube 28 located in the stack. This tube communicates with the bellows of the thermostatic device 14 by a conduit 29. The expansion of this bellows, through the yoke 30, shifts the plunger 31 upwardly, rocking switch 11 around its pivotal support 32, and thereby opening the circuit at the switch contacts 33 and allowing the mercury within the switch to roll over into position for closing the contacts 34. This action cuts out the conductor 25, including the time fuse 26, and closes the circuit of either the electromagnet 22, Figure 1, or the motor 3, Figure 2, through the conductor 35. Had the stack failed to heat up as intended, the switch 11 would remain in its normal position and the time fuse would burn out, resulting in the electromagnet or motor circuit being opened and remaining open until the time fuse is replaced. The blowing of the fuse would again be repeated unless the necessary correction were made in the meantime to cause the ignition device to properly function.

In Figure 2 the conductor 27 is shown as having a branch leading to the primary of a small transformer 37. The secondary coil of the transformer is in the circuit 38 of the ignition device 2.

When the switch 11 operates to throw out the time fuse and to cause the current to flow through conductor 35, the motor is directly, except through the switches 9 and 10, connected to the line and continues to operate until the thermostats controlling the switches 9 and 10 are so affected by a rise in temperature as to permit these switches to move to open position. After stoppage of the motor and the oil burner operated thereby, the stack thermostat gradually cools and permits the switch 11 to return to normal position, as indicated in the drawings.

The electromagnetic device 22, shown in Figure 1, is arranged for controlling the position of a gas valve 39 for a gas burner 50. When the magnet 22 is energized, its armature 40 draws upwardly upon a link 41,

rocking a bell crank lever 42 upwardly around its pivot 43. The small arm 44 of the bell crank lever 42 forms a toggle, with a link 45 connecting the bell crank lever with a valve rod 46. Thus, when the magnet is energized, valve 39 is raised from its seat, while the disk 47 on the valve rod effectually closes the valve housing at the packing 48.

The electromagnet 22 of Figure 1 is shown provided with two coils, one the coil 51 being the operating coil for drawing up the armature of the magnet and through it operating the gas valve 39. The coil 51 is energized only when the current passes through the contacts 33 and time fuse 26, becoming de-energized when the switch 11 is rocked into position for closing the contacts 34. At the same instant, the coil 52 is energized since this coil is connected with the conductor 35. The function of coil 52 is to hold the armature 40 in its upper position and therefore does not require as much energy as would the lifting coil 51 were it continuously energized during operation of the burner. The pilot light for this burner is indicated at 53 at the end of the gas conduit 54 which by-passes the gas valve.

In the operation of the gas valve controlling means shown in Figure 1, the valve is normally closed due to magnet 22 being de-energized and permitting the armature 40 to remain in its lower position under the action of gravity. The circuit for the electromagnet comprising conductor 23, switches 9, 10 and 11, and either conductor 25 or 35, is normally open at switches 9 and 10 respectively under the control of a room thermostat 12 and a boiler thermostat 13. These switches are open when the temperature of the place to be heated or the temperature of the boiler is up to the maximum desired degree. When the temperature falls to a predetermined point, the contraction of the bellows 17 in each of these thermostatic devices permits the switches 9 and 10 to rock downwardly around their pivotal supports 32^a into closed positions. Current then passes from the line through the contacts 33 of switch 11, since these contacts would be in closed position at such time, due to the heat from the burner not being applied to the coil 28. From switch 11, the current passes along conductor 25, through the time fuse 26 and coil 51 of electromagnet 22 back to the line. The armature 40 is drawn upwardly into the magnetic circuit of the coil and in this movement operates the bell crank lever 42 which through link 45 draws upwardly on the valve rod 46 unseating the valve. Assuming that the pilot light is burning, ignition would immediately take place at burner 50, and before the time fuse 26 has time to burn out, the coil 28 is heated sufficiently to cause

the expansion of the bellows 17. This operation through the yoke 30 draws the plunger 31 upwardly and rocks the switch 11 to the right where its contacts 34 are closed. The time fuse is thus short circuited and the current flows to the coil 52 of magnet 22. So long as the gas burner is in operation, this coil will hold the armature 40 in its upper position. When the circuit is opened, due to predetermined expansion of the bellows 17 of either the room thermostat 12 or boiler thermostat 13, the armature drops by gravity and, through the toggle formed by arm 44 and the link 45, tightly jams the valve 39 to its seat.

In the operation of the circuit, as shown in Figure 2, the motor 3 is normally at rest, due to the circuit being open at the switches 9 and 10. The motor 3 and the burner controlled thereby are set in operation by the closing of switches 9 and 10, due to the expansion of both thermostats for these switches. As soon as switches 9 and 10 are closed, the current may flow from the line 8 through all three switches, since the contacts 33 of switch 11 are normally immersed in the mercury, and the current may pass along conductor 25 through the time fuse 26 and through the conductor 27 to the motor, and from there back to the line 8. Since the ignition device 2 is subject to transformer 37, the primary of which is included in conductor 27, the ignition device will be in operation when the motor 3 is running. When the stack thermostat 14 is expanded, due to the required rise in temperature in the stack, the switch 11 is rocked to the right around its pivot 32, causing the mercury to roll away from contacts 3 and connect the contacts 34. The current then passes through the conductor 35 to the conductor 27, leaving the time fuse out of the circuit of the motor. However, if ignition fails to take place within the time intended, as regulated by the capacity of the time fuse, this fuse will burn out and the circuit will be permanently opened, since, under those conditions the stack thermostat 14 would fail to operate and change the position of switch 11.

The specific arrangements disclosed herein may, in some respects, be altered without departing from the invention as defined by the claims.

I claim:

1. An electrical controlling means for fluid fuel burners comprising a burner and electromagnetic means for supplying fuel thereto, a circuit for said electromagnetic means including a two-way switch, temperature responsive means for positioning said switch, a branch conductor leading from said switch to the electromagnetic means and another branch conductor leading from said switch through a time fuse to said electro-

magnetic means, said temperature responsive element being arranged to position said switch at a certain temperature so that the current may pass through the time fuse, but upon a predetermined rise in temperature to change the position of said switch in order to cut out the time fuse and connect the source of current directly with said electromagnetic means.

2. An electrical controlling means for fluid fuel burners comprising a burner and electromagnetic means for supplying fuel thereto, a circuit for said electromagnetic means including a two-way switch, temperature responsive means for positioning said switch, a branch conductor leading from said switch to the electromagnetic means and another branch conductor leading from said switch through a time fuse to said electromagnetic means, said temperature responsive element being arranged to position said switch at a certain temperature so that the current may pass through the time fuse, but upon a predetermined rise in temperature to change the position of said switch in order to cut out the time fuse and connect the source of current directly with said electromagnetic means, said electromagnetic means being provided with two operating coils, one of which is connected through the branch circuit including the time fuse, and the other of which is connected directly with said two-way switch.

3. In combination in an electrical controlling means for fluid fuel burners, electromagnetic means for supplying fuel thereto, said electromagnetic means including a high resistance coil and a low resistance coil, a circuit for each of said coils, temperature responsive means for controlling said circuits, said temperature responsive means being arranged so that at one temperature the current may pass through the low resistance coil and at a higher temperature the current may pass through the high resistance coil.

4. An electrical controlling means for fluid fuel burners, comprising a burner and electromagnetic means for supplying fuel thereto, said electromagnetic means including a high resistance coil and a low resistance coil, a circuit for each of said coils, a two-way switch controlling said coils, temperature responsive means arranged to position the switch at a certain temperature so that the current may pass through the low resistance coil, but upon a predetermined rise in temperature to change the position of said switch so that the current may pass through the high resistance coil.

5. In combination in an electrical controlling means for fluid fuel burners, electromagnetic means for supplying fuel to the burner, said means including a low resistance coil and a high resistance coil, a time

fuse in circuit with the low resistance coil and a thermostat adapted to shunt current from one coil to the other.

6. In combination in an electromagnetic burner control, a burner having an oil inlet valve, a solenoid for opening and holding said valve and means responsive to temperature changes adapted to control the solenoid

so that the solenoid has a low resistance to obtain a heavy current for lifting the valve 10 and a higher resistance for reducing the amount of current for holding the valve.

Signed at Chicago this 11th day of June, 1925.

HERBERT J. SAUVAGE.