Sept. 27, 1927. 1,643,859

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CONTROLS FOR FLUID FUEL FURNACES

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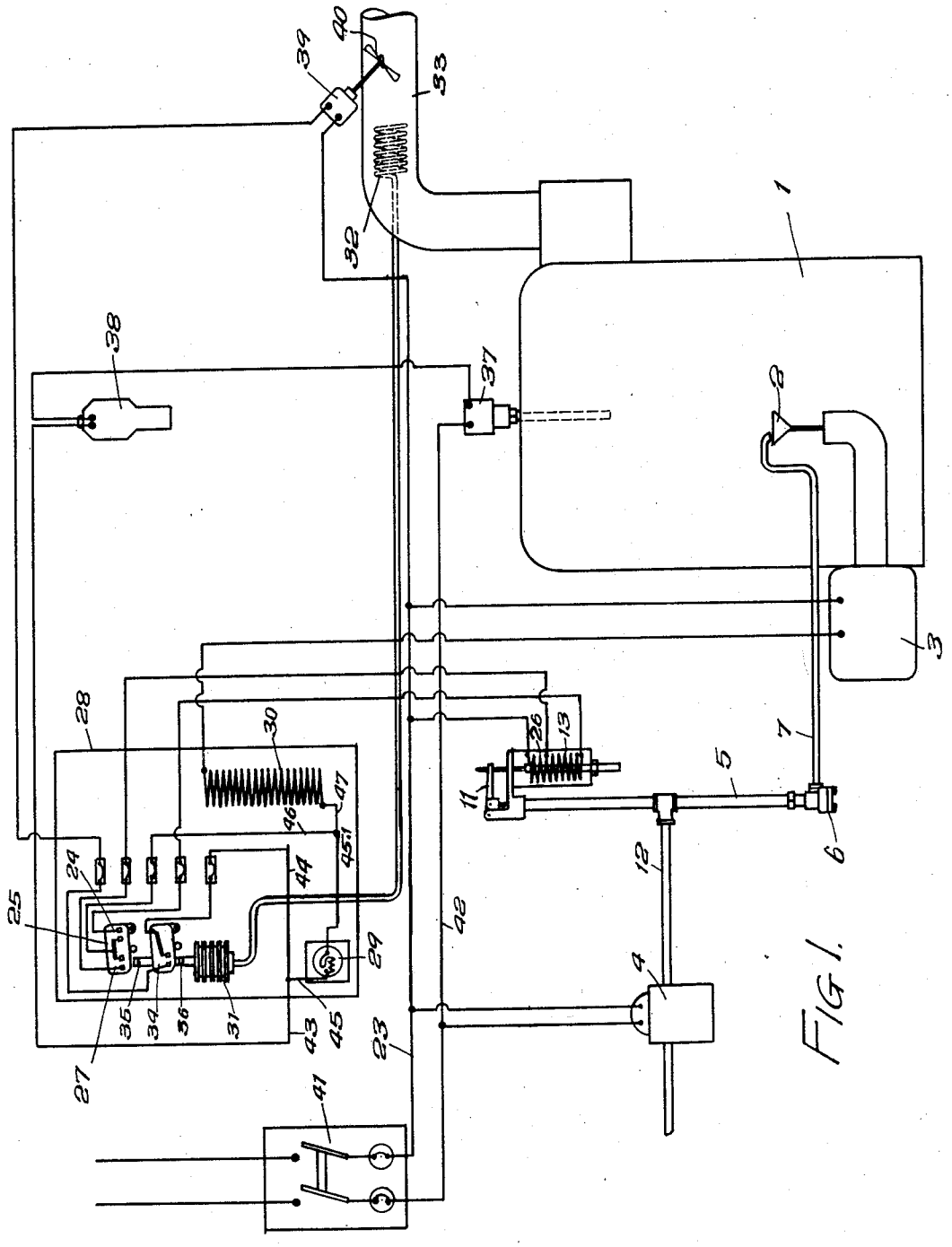


FIG. 1.

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FIG. 2

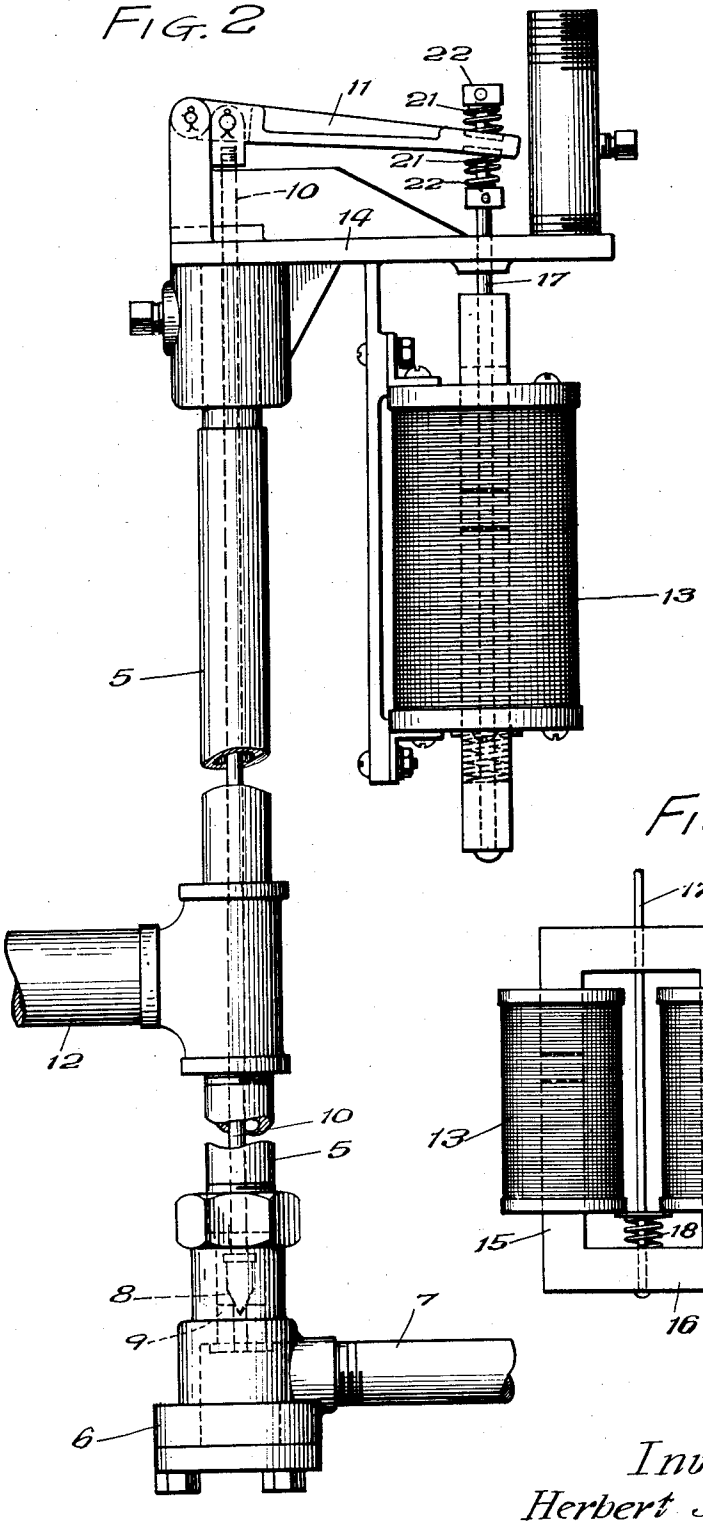


FIG. 4

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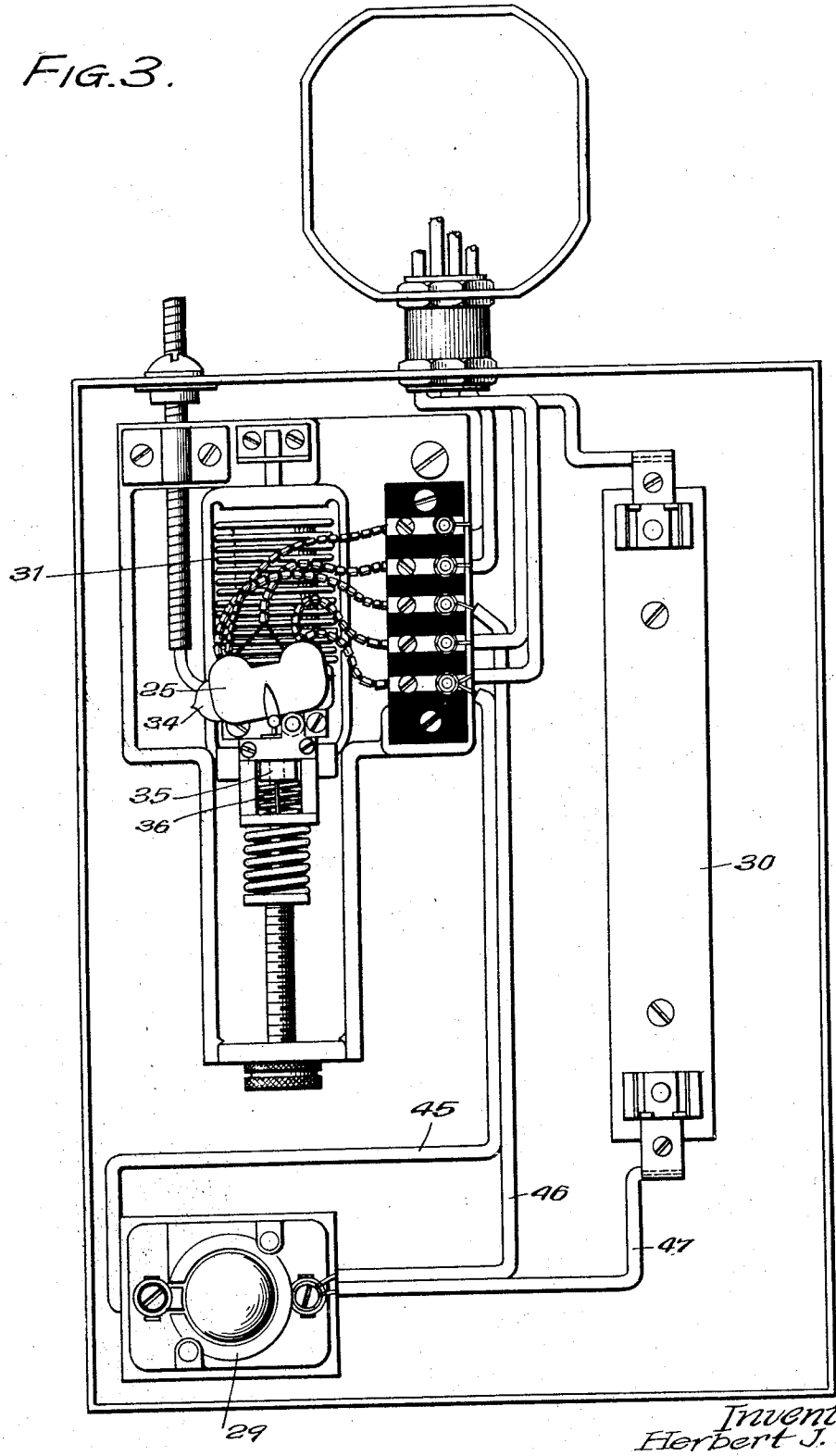
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FIG. 3.



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UNITED STATES PATENT OFFICE.

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CONTROL FOR FLUID-FUEL FURNACES.

Application filed November 9, 1925. Serial No. 67,856.

This invention relates to improvements in fluid fuel furnaces and more particularly to improvements in the control mechanism thereof.

It is chiefly characterized by certain simplified arrangements and having means for opening the electrical operating circuits in case the burner fails to ignite or when combustion stops; such means being controlled by the temperature in the exhaust flue so that the apparatus is only maintained in operating condition for a definite period in case the burner is not lighted.

The main objects are to provide a simplified control apparatus, to provide safeguarding means in case parts of the furnace are out of order to render the furnace inoperative, and to minimize the amount of electricity consumed for maintaining electrically operated parts in operating position.

An illustrative embodiment of the invention is shown in the accompanying drawings in which:

Figure 1 is a diagram of the furnace control system.

Fig. 2 shows the electrically operated oil valve.

Fig. 3 is a view of the control switch box with the cover removed.

Fig. 4 is a front elevation of the solenoid shown in Fig. 2.

The furnace is controlled by a room thermostat system. In the inoperative condition, the solenoid which lifts the oil inlet valve from the valve seat has only a few turns in the control circuit on the circuit which is closed by the thermostat, so that a heavy current is used in starting. A time fuse in said circuit is adapted to open when the heavy starting currents persist a predetermined length of time which is normally sufficient for the furnace combustion to be started.

If the combustion starts in the proper manner a switch is then operated by a stack thermostat which decreases the current in the operating circuit by cutting in the full number of turns in the solenoid winding, increasing the electrical impedance and reducing the current to an amount which the time fuse will carry or, in other terms, the time fuse is rendered inoperative.

Also an auxiliary stack fan may be included to prevent carbon deposits and also to prevent back pressure in the cold furnace.

In the drawings, the furnace 1 is provided with an electrically operated burner 2 having a motor 3. The burner is automatically ignited in any well-known manner as soon as the burner starts in operation. The oil supply line, for illustrative purposes, is shown as leading through a device 4 for maintaining a constant level, into the stand pipe 5, through the supply valve 6 in the lower end of the stand pipe and through the pipe 7 to the burner 2.

The valve member 8 closes the valve orifice 9 in lower position and is secured to the valve rod 10 which is pivotally connected to the lever 11, pivoted on the upper end of the open stand pipe 5. The oil level is held at approximately the level of the oil connection 12 leading into the stand pipe 5, and packed or movable joints are eliminated in the construction just described.

The two solenoid coils 13—13 are mounted on the bracket 14 secured on the upper end of the stand pipe 5 and the movable solenoid plungers 15 are connected by the yoke 16 to a rod 17 which extends through the outer end of the lever 11. The solenoid armature is limited in the upward movement by means of the spring 18, and when the solenoid is released the entire weight thereof is applied to holding the valve 8 closed. A degree of resilience is provided by the springs 21 between the end of the lever 11 and the collars 22 pinned on the rod 17 on either side of the lever.

The upper ends of the solenoid windings 13 are connected to the line 23 and the lower end to the switch 24 of the double switch element 25. A portion 26, including the upper turns of the solenoid 13, is tapped and connected to the alternate switch 27 of the double switch 25.

In the control box 28 is mounted the time fuse 29, the resistance 30 and a pneumatic thermostat element or bellows 31 of the stack thermostat, which has the operating element or coils 32, located in the stack or exhaust flue 33 of the furnace 1. The double solenoid switch 25 and the stack fan motor switch 34 are pivotally mounted and normally rest on suitable stops in position to close the switches 27 and 34. When the bellows 31 is expanded by pressure communicated from the stack coils 32, suitable members 35, 36, secured to the bellows 31, contact with the switches 25 and 34, and rotate the same

clockwise to open the fan motor switch 34 and the switch 27 and close the solenoid switch 24.

The boiler thermostat 37 and the room thermostat 38 are connected in series and the motor 39 operates a stack fan 40 located in the exhaust flue 33 of the combustion passages of the furnace. The resistance 30 is in series with the burner motor 3 to suitably reduce the amount of current thereto.

When the main switch 41 is closed the two lines 23 and 42 are connected to a suitable source of electrical current. The constant level pump 4 is connected across the lines 23 and 42, and maintains the oil level in the stand pipe 5. When the furnace is cold, which is the condition represented in Figure 1, the switch of the boiler thermostat 37 is closed and the line 42 is connected to the room thermostat 38.

When the room thermostat 38 closes, connection is made through the line 43 to a branch 44 leading to the fan switch 34, and to a branch 45 leading to the time fuse 29. From the time fuse 29 a connection 45.1 leads to a branch 46 to the connected points of the switches 27 and 24, and through a branch 47 through the fixed resistance 30 through the burner motor 3 back to opposite line 23.

The switch 34 connects through the fan motor 39 to the opposite line 23, and the switch 27 is connected through the tapped solenoid coils 26 to the line 23. Thus when the thermostats 37 and 38 are closed the fan motor is in circuit and operates to start the draft, and the burner motor 3 and the portion 26 of the solenoid 13 are connected in parallel from the line 23 to the time fuse 29. The burner motor operates and the solenoid is energized to raise the fuel supply valve 8. The electrical impedance of the coils 26 is such that a current is flowing through the time fuse 29 which is sufficiently great to cause the time fuse to operate to open and disconnect the burner motor and valve solenoid, after a definite length of time.

If combustion starts properly the stack thermostat element 32 is heated by the combustion gases and the bellows 31 expands to open the switch 27 and close the switch 24 to include all of the turns of the solenoid 13 in circuit, before the time fuse opens.

The switch 34 is simultaneously opened and the fan motor stopped. The normal heating condition then prevails; the burner motor is in circuit to operate the furnace combustion; and the full number of turns of the solenoid are energized to hold the valve 8 open. The electrical impedance of the solenoid is then high and a small amount of current is flowing through the fuse 29, which is an amount the fuse is adapted to carry without operating.

When the room thermostat 38 opens the connections from the time fuse 29 to the line 42 are broken and the two operating circuits, the valve solenoid circuit and the burner motor circuit, are electrically disconnected. Then as soon as the combustion chamber of the furnace 1 cools the bellows 31 contracts and the starting position of the switches is restored.

If the combustion should stop while the thermostats remain closed, the bellows 31 would contract and allow the switches to rotate counter-clockwise to the starting position. The tapped coils 26 would then be in circuit with the time fuse 29 and after the given time period the fuse would open and disconnect the operating circuits.

Although but one specific embodiment of this invention has been herein shown and described, it will be understood that numerous details of the construction shown may be altered or omitted without departing from the spirit of this invention as defined by the following claims.

I claim:

1. In combination in a fluid fuel furnace, a burner motor circuit including a time fuse, an electrical inlet-valve controlling circuit also including said fuse, a room thermostat controlling said circuits, and a stack thermostat adapted to control the electrical impedance in said controlling circuit.

2. In combination in a fluid fuel furnace, a burner motor circuit including a time fuse, an electrical inlet-valve controlling circuit also including said fuse, an auxiliary stack fan circuit, a room thermostat controlling said circuits, and a stack thermostat adapted to control the electrical impedance of said solenoid circuit and adapted to electrically connect and disconnect said fan circuit.

3. In combination in a fluid fuel furnace, means for initiating and maintaining combustion in the furnace, having an oil inlet valve, electrical means for opening and holding said valve, means for controlling the electrical impedance of said electrical means operable by the temperature in the furnace combustion passages, and a time fuse in circuit with the said electrical means.

4. In combination in a fluid fuel furnace, means initiating and maintaining combustion in the furnace having a motor and an oil inlet valve, a solenoid for opening and holding said valve, means for controlling the electrical impedance of said solenoid operable by the temperature in the furnace combustion passages, and a time fuse in circuit with the said solenoid and said motor.

5. In combination in a fluid fuel furnace having an exhaust gas flue, an electrically operated burner having an inlet valve, a solenoid for opening and holding said inlet valve open, means for changing the electrical impedance of the solenoid, a pneumatic thermostat having an element located in said

exhaust flue and adapted to control said means, and a time fuse in circuit with said solenoid.

6. In combination in a fluid fuel furnace having a burner motor, a time fuse, a variable electrical impedance element, said element and said motor being parallel connected to said fuse, and a thermostat operable by the temperature of combustion in the furnace for varying the impedance of said element.

7. In combination in an electrically operated furnace having an oil inlet valve, a solenoid for opening and holding said valve and means operable by the temperature of the gases in the combustion passages for changing the number of turns of the windings in said solenoid for obtaining a heavy current for lifting the valve and a lighter current for holding the valve.

Signed at Chicago this 27th day of October 1925.

HERBERT J. SAUVAGE.