

Aug. 17, 1926.

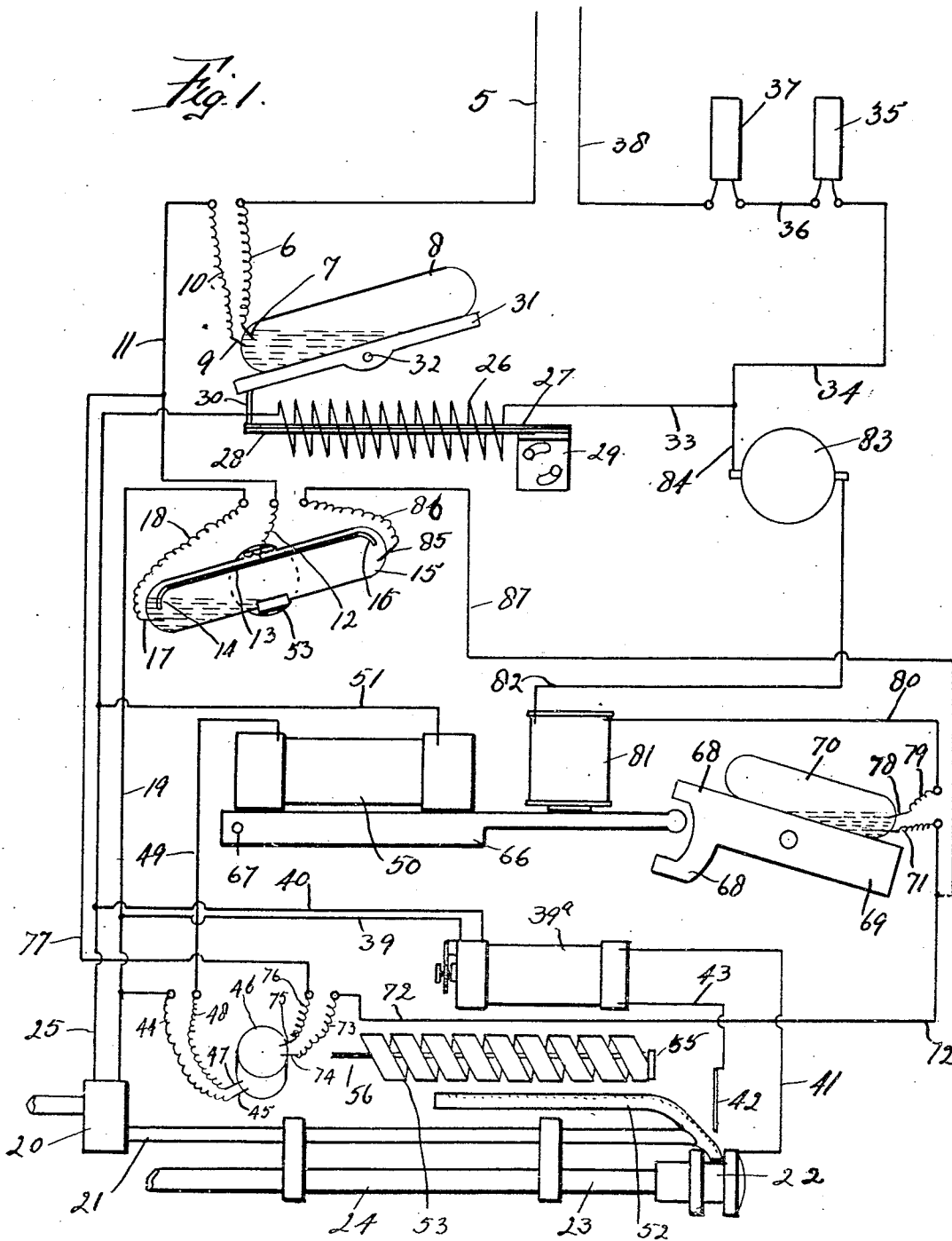
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OIL BURNER CONTROL

Filed April 13, 1926

2 Sheets-Sheet 1



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Fig. 2

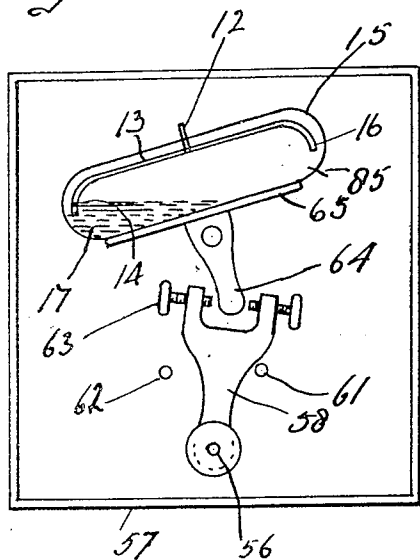


Fig. 3

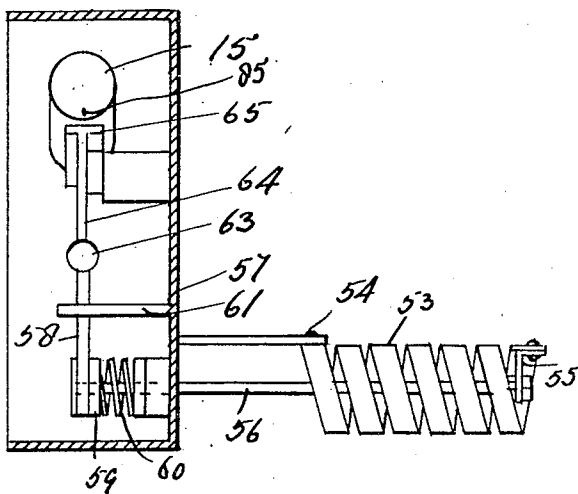
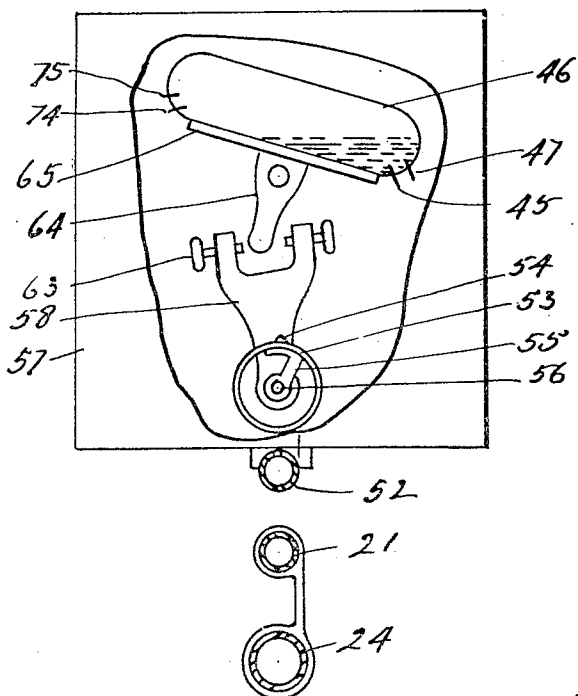


Fig. 4



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OIL-BURNER CONTROL.

Application filed April 13, 1926. Serial No. 101,655.

My invention relates to new and useful improvements in an oil burner control, and more particularly to safety controls for automatic liquid fuel or oil burners, and has for its primary object to provide a device of this character which will prevent the burner starting prior to ignition taking place.

A further object of the invention is to provide a safety control which:

1. Prevents the burner from starting in case the ignition should fail.
2. Prevents the burner from starting should the spark coil, magnet or other ignition device fail to function.
3. Prevents the burner from starting should the spark gap become short-circuited or the ignition cable become grounded or short-circuited.
4. Prevents the burner from starting even though it is shut off only for an instant by interruption of electric current or from other cause, until ignition has again taken place.
5. Prevents the burner from starting without the electric spark jumping at the spark gap as intended.
6. Prevents the burner from starting should the electric spark jump at any other place except at the point set for proper ignition.
7. Prevents the starting of the burner should any one of the devices used in the entire system fail to function.
8. Prevents the starting of the burner should any wire or connection in the entire system become disconnected or broken.

Other objects of the invention are to provide a safety control device which starts the burner from the effect attained from actual ignition being supplied at the proper point for igniting fuel in the combustion chamber or furnace; one that is not affected by the refractory heat in the furnace; which shuts off the burner should the fuel supply fail, in which case the safety control must be manually reset before the burner can be started; which operates on either straight electric or electric and gas ignition; and which absolutely eliminates the injection of fuel into the furnace if said fuel is not ignited.

With these ends in view, this invention consists in the details of construction and combination of elements hereinafter set

forth and then specifically designated by the claims.

In order that those skilled in the art to which this invention appertains, may understand how to make and use the same, I will describe its construction in detail, referring by numerals to the accompanying drawings forming a part of this application, in which:

Fig. 1, is a diagrammatic view of the several circuits and parts used to make up the control;

Fig. 2, is an end view of a thermostatic controlled mercury tube switch shown within a housing, the cover of which has been removed;

Fig. 3, is a sectional view thereof;

Fig. 4, is a view similar to Fig. 2; showing the relation of one of these thermostatic control switches relative to the burner.

All automatic liquid fuel or oil burning systems are equipped with room thermostats for controlling room temperature and with temperature or pressure controls for controlling temperature or pressure on boilers or furnaces, as the case may be. All of these controls or regulators are employed in connection with the system utilizing my safety control.

Many liquid fuel burners use what is known as a stack switch which must also be used with my invention, but will be considerably changed in construction and design in order to cooperate with the other elements and in fact become a part of the combination system.

In carrying out my invention as herein embodied, 5 represents a wire or other suitable conductor leading from a source of electrical energy to a conductor 6 connected with a contact 7 in a tiltable mercury tube switch 8, and the tube of this switch also has another contact point 9 from which leads a conductor 10 to another conductor 11 which in turn is connected with another conductor 12 attached to a contact 13, preferably of the two point type, so that one of its points 14 is at one end of the mercury tube switch 15, while the other point 16 is at the other end of said tube. The contact point 14 is associated with the contact 17 from which leads a conductor 18, the latter being connected with a conductor 19 running to the magnetic ignition valve 20 for controlling the flow of gas through the ig-

niton tube 21 terminating adjacent the nozzle 22 of the burner 23 including an oil feed pipe 24 leading to the nozzle.

In order to complete the circuit partially described above, the conductor 25 leads from the magnetic ignition valve 20 to a heating coil 26 of a bi-metallic thermostat 27 which includes the thermostatic element 28 mounted upon the adjustable bracket 29 and provided with a stem 30 in cooperative relation to the tiltable table 31 pivoted at 32 and on which the tube of the mercury switch is mounted. From the heating coil 26 leads a conductor 33 connected to a conductor 34 which, in turn, is connected with a thermostat, hydrostat, or pressurestat 35, and this instrument is connected by a conductor 36 in series with a thermostat or similar instrument 37, the latter being connected by a conductor 38 with the other pole of the source of electrical energy, opposite to the one connected by the conductor 5.

An associated or branch circuit includes a conductor 39 leading from the conductor 19 to one side of the spark coil or other ignition device 39^a, such as a motor driven magneto, transformer and the like, while the other side of the ignition device is connected by a conductor 40 with conductor 25, thus making up the primary circuit for the ignition device. The secondary of the ignition device is conventionally represented by a conductor 41 leading from the spark coil to a portion of the burner nozzle, as one of the electrodes and ground, with which is associated an electrode 42 connected by a conductor 43 with the spark coil.

Another circuit associated with the first one includes a conductor 44 leading from the conductor 19 to a contact 45 mounted in the tube of the mercury tube switch 46, with this contact is associated another contact 47 from which leads a conductor 48, the latter being connected to a conductor 49 which, in turn, is connected with one pole of the electro or lifting magnet 50, while the other pole thereof is connected by a conductor 51 with conductor 25.

From the foregoing description, it will be seen that the valve 20, the ignition device 39^a and the lifting magnet 50 are mounted in multiple or parallel with suitable automatic switches in their circuits.

The ignition tube 21 is designed to convey gas, alcohol or other combustible substance, and from this leads a secondary tube 52 which I will call, for want of a better term, a pilot tube, and this pilot tube is provided with a plurality of perforations for the emission of the combustible substance, whereby a flame will be produced if the proper electric spark is provided by the electrical ignition system. A helix or spiral thermostat 53 is mounted in prox-

imity to the pilot tube 52, preferably above the same, and as shown in Figs. 2, 3 and 4, the helix has one end permanently fixed, as at 54, while the other end is free and has a bracket 55 connected therewith, which in turn is secured to a rod 56 passing through the helix and journaled in the rear wall of the casing 57. On this rod is a fork 58, frictionally held in place by a washer 59 and spring 60, so that under certain conditions the rod may slip or rotate without actuating the fork, which may be limited in its movements by the stops 61 and 62. In the arms of the fork are mounted suitable set screws 63 for coaction with the depending leg 64 of the tiltable table 65 which holds the mercury tube switch 46.

From the above, it will be obvious that when the helix moves, due to a change in temperature, the rod 56 will be rotated, and the fork 58 will be oscillated in order to transmit motion to the depending leg 64 and tilt the table 65 in one direction or the other, thereby opening a circuit, closing a circuit, or opening one circuit and closing another, depending upon the number of circuits terminating in the mercury tube.

Associated with the lifting magnet 50 is an armature 66 pivoted, as at 67, and having its free end projecting into the space between the arms 68 of the fork at the end of the tiltable table 69 carrying a mercury tube switch 70. In the tube of this switch is a contact 71 connected by a conductor 72 with a conductor 73 leading to the contact 74 in the end of the mercury tube switch 46 opposite contacts 45 and 47, and associated with this contact 74 is another contact 75 connected by a conductor 76 with conductor 77 leading to conductor 11 so that connection is made with one side of the source of electrical energy.

In the tube of the mercury tube switch 70 is another contact 78 connected by a conductor 79 with the conductor 80 leading to the electro or holding magnet 81, and from this magnet leads a conductor 82 to one pole of the motor 83, while the other pole thereof is connected by a conductor 84 with the conductor 34 and therefore the other side of the source of electrical energy.

Another circuit is formed by the use of a contact 85 connected by a conductor 86 with the conductor 87 which, in turn is connected with the conductor 72 leading to the contact 71; the other side of this circuit being completed through the holding magnet 81 and motor 83 previously described.

When heat or pressure is required, the thermostat, hydrostat and pressurestat are closed, and therefore the current is flowing through the safety switch 18, and if this switch is in the position shown in Fig. 1 so that the mercury closes the circuit between the contacts 7 and 9, said current will flow

through the contacts 14 and 17 of the stack switch 15, providing the heater is cold or a few degrees below the temperature of said heater when the burner stopped, thence through the lifting magnet 50 and the ignition control switch 46 and through the magnetic ignition valve 20 and the ignition device 39^a, such as a spark coil, motor driven magneto, transformer or the like, and thence through the heating coil 26 and the aforementioned hydrostat or the like and thermostat, thereby completing a circuit and its branches. The current flowing through the lifting magnet 50 will raise the armature 66 so as to tilt the mercury switch 70 to the position shown in Fig. 1, thereby completing one part of the circuit through the holding magnet and motor.

The current flowing through the magnetic ignition valve 20 opens the latter and allows gas, in the case of gas and electric ignition, to flow through the valve to the ignition point at the nozzle of the burner. Simultaneously with the opening of the ignition valve the electric ignition is set into operation causing the spark to jump at the end of the gas pipe 21 which lies adjacent the burner nozzle, thereby igniting the gas or an equivalent substance, such as alcohol, which is flowing through the pipe 21. At the same time a certain amount of the gas will flow through the pipe 52 and out of its perforations where said gas will be ignited and produce a flame along the pipe 52, and the heat generated directly under the helix or spiral 53 causing the latter to expand and actuate the armature 58 so as to tilt the mercury switch 46, thereby closing a circuit which includes the contacts 74 and 75 which therefore completes the circuit through the holding magnet 81 and the motor 83, and it is to be understood that the holding magnet may be wound for connecting it with the motor, either in series or parallel without affecting the working of the system. The ignition being in working order, the motor will start and deliver the fuel just after the ignition has been placed in operative condition. It will be obvious that if ignition had not taken place, the helix or spiral would have remained in its normal condition, and the switch 46 would not have been operated, and therefore the motor could not have been started.

The ignition having taken place, should there be no fuel delivered by the motor, the current will continue to flow through the heating coil 26, and shortly cause the associated thermostat 28 to actuate the safety switch 8, so that it will be tilted to a position opposite that shown in Fig. 1, thereby opening the several circuits and causing the magnets to be deenergized, so as to release the armature 66 which will open the switch 70, and at the same time, the gas valve 20 will

be closed and the ignition shut off permitting the helix or spiral 53 to cool down until the switch 46 assumes its normal position. After the heating coil 26 has cooled down sufficiently, the switch 8 may be again manually closed placing the system in condition for further operation.

If, however, fuel is delivered to the nozzle of the burner, and it is ignited, the heat from the furnace passing up the smoke pipe or stack will cause the stack switch 15 to be actuated in the same manner as the switch 46 for said switch 15 is also provided with a helix or spiral rheostat or an equivalent actuating means. The switch 15 being tilted to the position opposite that shown in Fig. 1 by the heat in the stack, as above stated, the circuit is completed through conductors 5 and 6, safety switch 8, the stack switch 15 by means of its contacts 16 and 85, thence through the conductors 86, 87, 72 and the contact 71, the switch 70, contact 78, conductors 79 and 80, holding magnet 81, conductor 82, motor 83, conductors 84 and 34, the controlling element 35, conductor 36, controlling element 37 and conductor 38 to the other side of the source of electrical current.

As the last mentioned circuit is closed, the operation of the safety switch 15 opens the circuit or circuits, through the valve 20, the lifting magnet 50 and the ignition device 39^a, thereby cutting off those parts which are no further needed, until it becomes necessary to restart the burner.

Should the main supply of electric current be interrupted, even for an instant, the holding magnet 81 will be deenergized, thereby dropping the armature 66 which will open a switch 70, thereby cutting off the current to the motor 83, and this switch 70 will remain in this position until the temperature of the stack drops sufficiently to tilt the stack switch 15 to the position shown in Fig. 1, when the ignition cycle can be repeated and the burner again started.

From the foregoing description it will be noted that the switch 46 being operated from heat generated by the ignition spark and gas, or ignition spark and alcohol, as the case may be, eliminates any possibility of the burner starting until ignition actually takes place, and as the operations of the magnets depend upon this heat generated from the ignition, it follows that the motor cannot be started until ignition has taken place, and cannot continue to operate unless a steady flow or current is passing through the motor so as to operate the latter. Further, it will be noted that should the burner be extinguished, or what is commonly known as the flame leaving the burner, the temperature of the stack will decrease, and therefore the switch 15 will be moved from the running position to the starting position, as shown in Fig. 1, and the motor will

be stopped until ignition has again taken place.

After fully comprehending the scope of the invention from the foregoing description, it will be obvious that at no time can a large quantity of fuel be delivered to the furnace, without being ignited, thereby reducing to a minimum, if not entirely eliminating, the possibility of explosions and conflagrations.

Of course I do not wish to be limited to the exact details of construction as herein shown as these may be varied within the limits of the appended claims without departing from the spirit of my invention.

Having thus fully described my invention, what I claim as new and useful is:

1. A safety oil burner control including a switch in the main circuit of a motor operating an oil burner, a thermostat to operate said switch under certain conditions, a heating coil for actuating the thermostat, a burner and ignition device for said burner, an electrically actuated valve to supply the ignition device with a suitable burnable substance, a spark producing means, a double switch, means to open one side of said switch and close the other side thereof due to heat generated by the ignition device, a lifting magnet, a holding magnet, an armature associated with said magnets, a switch actuated by said armature to partially close a circuit through the holding magnet and the motor of the oil burner and a double

stack switch, operable from heat within a stack to open one side and close the other side, due to a rise in temperature within the stack, whereby the circuit through the holding magnet and motor is completed, and the circuit through the lifting magnet, the spark producing device and valve is opened, all co-operating to the end that the motor cannot be started until an effective ignition has been completed.

2. A burner control including an ignition means; thermo and pressure control means; a burner motor; and electrically actuated mechanisms to place the ignition means in operative condition through the medium of the thermo or pressure regulating means; and means responsive to the ignition means to start the motor due to heat generated by said ignition means.

3. The combination with a burner and a motor for supplying fuel to said burner, of an ignition means associated with said burner; means for placing the ignition means in operative condition; means responsive to the ignition means to start the motor; other means responsive to the last-mentioned means for cutting out the ignition means while retaining the motor in running condition; and another means responsive to heat generated by the burner for controlling said other means.

In testimony whereof, I have hereunto affixed my signature.

JOSEPH B. HOFF.