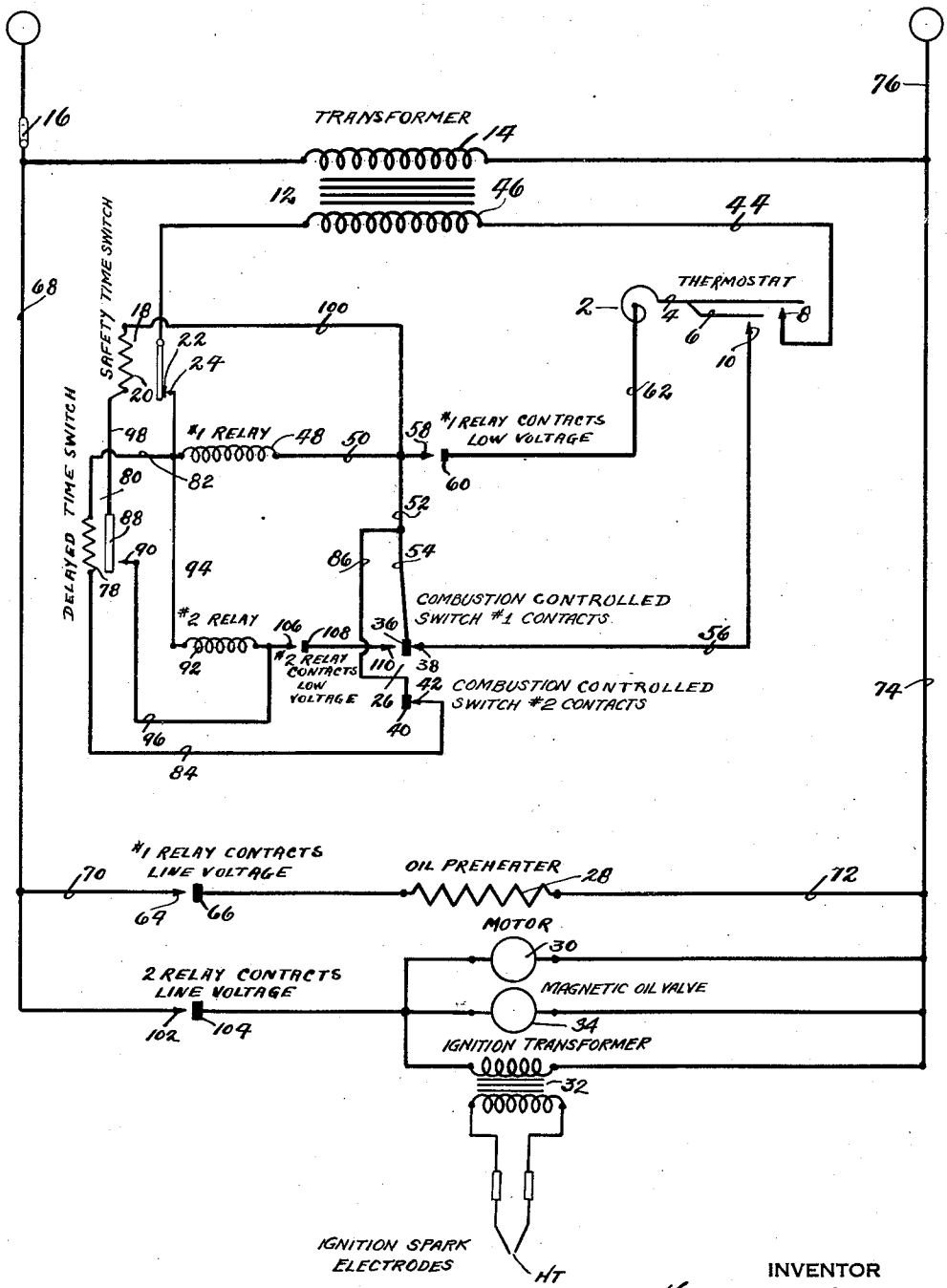
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CONTROL FOR OIL BURNERS

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CONTROL FOR OIL BURNERS

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This invention relates to an improvement in oil burner controls, and is particularly applicable to oil burners burning heavy or viscous fuel oils that require preheating to promote a satisfactory degree of atomization.

This type of oil burning apparatus usually consists of a motor for driving the mechanism, means for conducting the oil from a storage tank to the burner, means for atomizing the oil, an oil preheater, means for admitting and stopping the supply of fuel oil to the atomizing means, means for igniting the oil and establishing combustion, and controls for automatically starting and stopping or regulating the burner in response to demands for heat.

One of the objects of my invention is the provision of a control system wherein the oil preheater is energized for a period of time prior to operation of the burner motor and other parts that establish combustion, so as to provide a proper degree of temperature in the fuel oil before initiating combustion thereby assuring proper atomization or breaking up of the oil immediately upon starting the burner.

Another object of my invention is to provide means for preventing the energizing of the oil preheater, the motor and other parts that establish combustion until all other contacts or parts of the control system are in the starting position.

A further object of my invention is to provide for de-energizing the oil preheater, the motor and other parts that establish combustion, upon a failure of the burner to ignite or upon failure of the burner due to loss of flame from any condition whatsoever, said means keeping the said parts de-energized or disconnected from the circuit until the switch establishing contact with same is reset manually.

Another object of my invention is to provide in a control system means for assuring that the oil preheater will be energized a sufficient period of time prior to the energization of the motor and other parts that establish combustion each time the burner is called upon to operate even though the periods of operation may be quite frequent and the time between a shutdown of the burner and a subsequent starting up of the burner may be of short duration.

The accompanying drawing shows diagrammatically an embodiment of my invention.

Referring to the drawing in detail: 2 designates a room thermostat provided with a flexible blade 4 and relatively stiff blade 6, the more flexible blade 4 cooperating with fixed contact 8, and the relatively stiff blade 6 with fixed contact 10.

12 designates a transformer, the primary winding 14 of which is closed upon the closure of the main switch 16.

18 is a heat actuated safety switch, provided with heater coil 20, and normally closed contacts 22 and 24. This switch in practice is arranged with means for maintaining the contacts 22 and 24 in a locked out or disconnected position after they have become disconnected by the heater coil 20. Reestablishment of the contacts is made by a lever or button that must be reset manually.

26 designates a switch operated by the heat or light of combustion. 28 designates an oil preheater which in my system is on whenever the burner is operating. 30 designates the burner motor, 32 the ignition transformer and 34 the oil valve, while HT designates the high tension spark electrodes that ignite the atomized oil.

Inasmuch as an automatically controlled oil burner requires means for automatically starting and stopping the flow of oil from the pump or other oil transporting means to the atomizing means, I have shown a magnetic oil valve 34 in my control mechanism for performing this function. It is to be understood, however, that this magnetic oil valve may be replaced by a mechanical or oil or air pressure actuated means for accomplishing the same result.

The drawing represents circuit conditions with the burner not in operation. The main switch 16 is shown closed, of course.

It is to be noted too that the contacts 22 and 24 of the safety time switch 18 are closed, as above noted, and that the contacts 36 and 38 as well as the contacts 40 and 42 of the combustion controlled switch 26 are closed.

When the temperature in the room falls below the setting of the thermostat 2, the flexible blade 4 thereof first makes contact with the fixed contact 8, and within approximately a further temperature drop of one and one-half degrees the stiffer blade 6 will have contacted with fixed contact 10.

Upon the closure of the two thermostat blades upon their respective contacts, a circuit is established as follows: Contact 8, conductor 44, transformer secondary 46, normally closed contacts 22 and 24 of safety time switch 18, relay winding 48, conductors 50, 52 and 54, contacts 36 and 38 of the combustion controlled switch 26, these contacts being closed or in starting position because combustion has not been initiated and back by way of conductor 56 and contact 10 to the blades 6 and 4 of the thermostat.

Inasmuch as the relay winding 48 has now been

energized the relay will close its contacts 58 and 60 to establish a holding circuit which will not be affected by vibration of the blade 6 of the thermostat 2. This circuit may be traced as follows: Thermostat contact 8, conductor 44, transformer winding 46, safety time switch contacts 22, 24, winding 48, conductor 50, relay contacts 58, 60, conductor 62, back to the thermostat blade 4.

Immediately upon energization of the relay winding 48 the line voltage contacts 64 and 66 are closed and establish a circuit through the oil preheater 28, as follows: One side of the line, switch 16, conductors 68 and 70, contacts 64, 66, preheater 28, conductors 72, 74 and 76 to the other side of the line.

At the same time that the first mentioned circuit is established, another circuit is closed including the heating element 78 of delayed time switch 80. This circuit may be traced: Thermostat contact 8, conductor 44, transformer secondary 46, safety time switch contacts 22, 24, conductor 82, heating element 78, conductor 84, contacts 42 and 40 of the combustion controlled switch 26, conductors 86, 52, relay contacts 58 and 60, conductor 62 back to the thermostat blade 4.

Up to this time the only circuit closed across the main line, with the exception, of course, of the transformer primary 14, is the circuit for the oil preheater 28. Consequently the circuits of the burner motor 30, ignition transformer 32 and oil valve 34 are still open.

Upon the establishment of the circuit, last traced, to the heater coil of the delayed time switch 80, the bimetallic element 88 of the time switch heats up and warps closed upon its fixed contact 90 to establish a circuit to relay winding 92 as follows: Thermostat contact 8, conductor 44, transformer secondary 46, contacts 22, 24 of the safety time switch 18, conductor 94, relay winding 92, conductor 96, contact 90 and bimetal member 88 of the delayed time switch 80, conductor 98, heater coil 20 of the safety time switch 18, conductor 100, relay contacts 58 and 60, conductor 62 back to the thermostat blade 4.

Relay winding 92 now being energized, this relay will close its contacts 102 and 104 to close the circuit to burner motor 30, ignition transformer 32 and oil valve 34 across the line, the circuit of the oil preheater 28 remaining closed.

Energizing of the relay winding 92 also effected closure of contacts 106 and 108, which will establish a holding circuit for the winding 92 when combustion has been established. The switch 26 is combustion controlled so that after combustion has been established the heat generated will cause the contacts 36 and 40 of this switch to move away from "cold" contacts 38 and 42 and cause contact 36 to close on "hot" contact 110. When this contact has been made the circuit to the relay winding 92 may be traced as follows: Contact 8, conductor 44, transformer secondary 46, contacts 22, 24 of the safety time switch 18, conductor 94, relay coil 92, low voltage contacts 106 and 108 of this relay, contacts 110 and 36 of the combustion controlled switch 26, conductors 54, 52, contacts 58 and 60, conductor 62 to thermostat blade 4.

Upon the establishment of this last traced circuit the winding 20 of the safety time switch 18 is automatically shunted out of the system and the heating element 78 of the delayed time switch 80 is open circuited because of the breaking of the contacts 40 and 42.

The foregoing operations take place under normal conditions and it will be understood that when the thermostat 2 opens as the desired temperature is reached, all parts are returned to the positions illustrated in the drawing.

Let us assume, however, that there was a demand for heat on the part of the thermostat 2, but for some reason there was failure of ignition. Under these conditions the system is adequately protected against damage. Under the assumed demand for heat it will be understood that a circuit will be established to the relay windings 48 and 92. As already pointed out, the circuit of the relay winding 92, which in turn closes the circuits to the burner motor 30, ignition transformer 32 and oil valve 34, must pass through the heater coil 20 of the safety time switch 18 and the contacts 88 and 90 of the delayed time switch 80, until such time as the combustion controlled switch 26 closes its contact 36 on the contact 110. If this contact 36 does not close on 110 after a predetermined time, approximately one and one-quarter minutes in practice, the heater coil 20 of the safety time switch 18 will have had sufficient time to warp the contact 22 of this switch out of engagement with contact 24 to open the circuit of relay windings 48 and 92, so that the circuits of the preheater 28, as well as of the motor 30, ignition transformer 32 and oil valve 34 will be opened. The safety time switch 18, in practice, is of such construction, as I have previously pointed out, that once the contacts 22 and 24 are broken, the circuit is locked out and must be reset manually. As a consequence, on ignition failure, the burner is automatically locked out of circuit.

Means are provided also for ensuring that upon failure of the safety time switch mechanism, due to burning out or failure of the heater coil 20, for example, it would be impossible to energize the relay winding 92 and thereby to energize the motor, ignition transformer and oil valve. In order to energize the relay winding 92 initially the current for same must pass through the heater coil for the safety time switch, and if this is burned out or open for any reason it will be apparent that a circuit cannot be established through relay winding 92.

In order that the contacts 22 and 24 of the safety time switch will remain closed after combustion has been initiated normally, it is necessary that heating of the heater element 20 be discontinued immediately upon establishment of proper combustion conditions. To this end, therefore, when combustion has been initiated and the contact 36 of the combustion controlled switch 26 has closed on the fixed contact 110, a shunt circuit is established around the heater element 20 of the safety time switch 18 as well as around the contacts 88 and 90 of the delayed time switch.

Many oil burner installations require that the burner be started and stopped quite frequently. In such installations it is desirable to have a substantially definite period of time during which the oil preheater circuit is established before the burner motor, ignition transformer and oil valve are energized, each time the burner is called upon to operate, in order that the oil may be heated sufficiently to promote proper atomization immediately upon starting up the burner.

In order that the heat accumulated in the heating coil 78 of the delayed time switch 80 from any given starting cycle of the burner can be dissipated promptly so as to provide substantially the same heat effect on the thermal element 88

of the delayed time switch and in turn substantially the same delayed time period on the next starting cycle of the burner, which may be only a very short time after a stoppage of the burner, it is necessary that the heating coil **78** of the delayed time switch **80** be disconnected from the circuit as soon as proper combustion conditions have been established. Otherwise if the coil **78** were permitted to remain heated throughout the entire operating cycle of the burner, there would be so much residual heat left in the coil that the time required for it to cool down might exceed the time between burner operations. This heater coil **78** has therefore been placed in series with the contacts **40** and **42** of the combustion controlled switch **26**, and immediately combustion conditions are established and these contacts are separated the heater coil **78** will be open circuited.

It will be apparent from all of the foregoing that aside from the fact that my improved control will provide the necessary cycles of operation for the safe starting and stopping of an oil burner wherein an oil preheater is used, my construction has the following desirable characteristics: Nothing can be started or electrically energized, not even the oil preheater **28**, unless the contacts **36** and **40** of the combustion controlled switch are on the "cold" side, that is, closed on contacts **38** and **42**, respectively.

In the event of ignition failure the contacts **22** and **24** of the safety time switch **18** will open and remain open until manually closed, thereby keeping open the circuits of the oil preheater, the ignition transformer and the oil valve. If the circuit of the oil preheater were not opened upon ignition failure, it would remain closed until someone had discovered the burner had failed to ignite and would disconnect the burner from the line. Again, if the oil preheater were left on without oil flowing over the same the oil would be cracked to free carbon and other solids which would eventually clog the burner or cause damage to the preheater itself.

It will be appreciated also that, if for any reason the transformer secondary **46** or the relay coil **48** should burn out, the entire equipment would be open circuited causing the same to fail safe.

Likewise it will be appreciated that if the relay coil **92** should be burned out, the circuits of the burner motor **30**, ignition transformer **32** and oil valve **34** could not be closed.

It will be appreciated, furthermore, that if the contacts **36** and **40** of the combustion controlled switch should become broken or could not close on the cold side, the burner could not be restarted after a shutdown.

It is to be understood that changes may be made in the details of my improved control without departing from the spirit and scope of my invention.

What I claim is:

1. Controlling mechanism for oil burners comprising an oil burner motor, an ignition transformer and a magnetic oil valve; said controlling mechanism comprising in combination a room thermostat, a current transformer, an initially closed safety time-switch, a heating element therefor, a relay winding and a combustion controlled switch having two cold contacts and a hot contact; said thermostat, the secondary of said current transformer, said safety time-switch, said relay winding and a first of said cold contacts of said combustion controlled switch being connected in a series circuit adapted to be activated by the closing of said thermostat and prior to initiation of operation of said burner motor, ignition means and oil valve; said relay winding upon energization closing a holding circuit for itself in parallel with said first cold contact; an electrical oil preheater, said relay winding when energized closing a circuit to energize said oil preheater; a second relay winding; an initially open delayed time switch; a heating element therefor; said second relay winding, said delayed time switch and heating element of said safety time switch being connected in a series circuit and in parallel with said first relay winding and said heating element of said delayed time switch and being connected in parallel with said first relay winding through the second of said cold contacts of said combustion controlled switch; said second relay winding closing circuits over said oil burner motor, magnetic oil valve and ignition transformer, and also closing a holding circuit for itself through said hot contact of said combustion controlled switch to the holding circuit of said first relay winding.

2. Controlling mechanism for oil burners comprising an oil burner motor, an ignition transformer and a magnetic oil valve; said controlling mechanism comprising in combination, a room thermostat, an initially closed safety time switch, a heating element therefor, a relay winding, a current transformer and a combustion controlled switch having two cold contacts and a hot contact; said thermostat, the secondary of said current transformer, said safety time switch, said relay winding and a first of said cold contacts of said combustion controlled switch being connected in a series circuit adapted to be activated by the closing of said thermostat, and prior to initiation of operation of said burner motor, ignition means and oil valve; an electrical oil preheater, the circuit of which is closed by the energization of said relay winding; a delayed time switch in series with the heating element of said safety time switch; a heating element therefor in series with the second of said cold contacts of said combustion controlled switch the circuit of which is closed upon energization of said relay winding; a second relay winding the circuit of which is closed by the closing of the contacts of said delayed time switch, and contacts for said second relay winding closed by energization of said second relay winding for closing circuits through said oil burner motor, ignition transformer and oil valve, the heating element of said delayed time switch being open circuited upon the establishing of combustion conditions and consequent heating of said combustion controlled switch.

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