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ELECTRIC CONTROL SYSTEM

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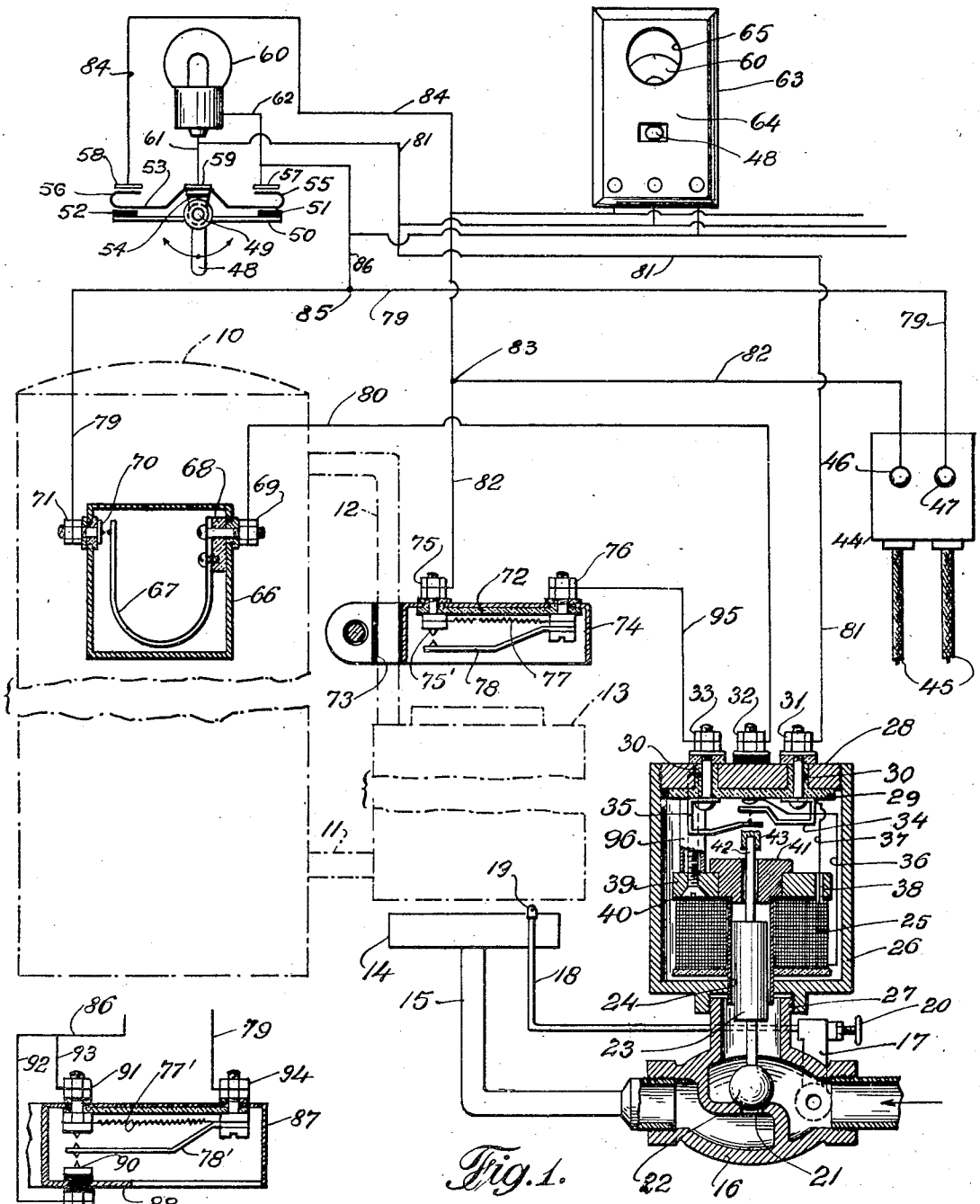


Fig. 1.

Fig. 2.

INVENTORS

Lucas Kraft and Leopold Mayr

BY

ATTORNEY

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LUCAS KRAFT AND LEOPOLD MAYR, OF ELIZABETH, NEW JERSEY

ELECTRIC CONTROL SYSTEM

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This invention relates to an electric control system for governing a supply of heating media of a heating system.

One of the objects of our invention is to provide an electro-magnetically operated closing and opening device for such media, electrically connected with a series of manual and thermostatic switches, adapted to govern the operation of said device.

Another object of our invention is to provide in such electric control system, one or more hand operable switches, normally open, combined with an annunciator, for manually starting or stopping the operation of the electro-magnetic valve device.

Another object of our invention is to provide in such electric control system, a thermostatic switch, bridged by an electric resistance, adapted to permit either a reduced or full flow of electricity to pass to the electro-magnetic valve device.

Another object of our invention is to provide in such electric system, a thermostatic switch controlling a direct supply of electric current leading to said electro-magnetic device.

A further object of our invention is to provide within such system an electro-magnetic device equipped with means for automatically closing or opening an electric circuit for energizing or deenergizing its own electro-magnetic coil.

The foregoing and further objects will become more fully apparent, as the following description progresses, and from the accompanying drawings illustrating in diagrammatical form, and for explanatory purposes only, an electric wiring system, including the various devices mentioned above in only one of the many possible forms they may be designed.

Referring to the drawings, Fig. 1 represents a diagram of the electric control system and,

Fig. 2 illustrates a modified form of a resistance-bridged thermostatic switch.

For the purpose of explaining the basic principle of our system, we have chosen to show a gas heater hot water generator, in which the gas supply is electrically controlled. Be it understood however, that the same or similar systems may be employed, with necessary modifications, in any heating system supplied by either gas, oil, or other heating media, in which the latter may be controlled by our method.

In the drawings, numeral 10 denotes a hot water tank, shown diagrammatically in broken lines, which is connected by means of pipes 11 and 12 to water heater indicated at 13. Below the water heater there will be seen a burner 14 supplied through gas pipe 15 which is connected with a valve casing 16. The latter is provided near its inlet with a hollow bracket 17 from which leads a small supply pipe 18 to the pilot 19. The pilot supply is preferably controlled by a small needle valve indicated at 20.

Valve casing 16 is provided with a valve seat 21 adapted to be closed by valve 22, which in this case is shown to be a ball, but may take any desired shape. Valve 22 connects with a core or armature 23 which is guided in a metal tubing 24 of the solenoid 25.

The latter is enclosed in a casing 26 connecting at 27 with valve casing 16. The upper end of the housing is closed by a threaded cover 28. At the bottom of the cover is provided an insulating disc 29 having three (3) tubular extensions 30 passing through the cover and forming air-tight passages for binding posts 31, 32, and 33.

Connected with binding post 31 is contact spring 34, while a similar contact spring 35 connects with binding post 33. These contact springs are normally apart from each other as shown in the drawing. To binding post 32 is connected a conductor 36 which leads to one end of solenoid 25. To binding post 31 is connected another conductor 37 which leads to the other end of the solenoid.

This conductor passes through an opening 38 provided in an iron disc 39. The iron disc 39 rests upon an insulating layer 40 which abuts with the upper end of solenoid 25. In the center of the disc is an iron bushing 41 forming a bearing for guide tube 24. Bushing 41 extends into the solenoid and becomes magnetized when the latter is energized,

thereby attracting core 23 and enhancing the drawing-up power of the solenoid.

At the upper end of core 23, extension 42 will be seen, which passes through an aperture provided in iron cap 41, in which the extension is guided. On the top of the latter is seen a dielectric abutting member 43 arranged just below the free end of contact spring 35.

When the solenoid is energized, core 23 is drawn upwards, thereby unseating valve 22, and at the same time causing contact spring 35 to connect with contact spring 34.

At the right-hand side of the drawing will be seen a transformer, indicated at 44, supplied by cables 45. From binding posts 46 and 47 of the transformer electric energy is directed to the system.

At the left-hand upper corner of the drawing is shown a diagrammatical illustration of our manual switch. The latter consists of a hand lever 48 adapted to swing in right and left-hand directions, as indicated by the arrow, and is pivoted at 49. Extending from the pivotal point is bar 50 provided at its ends with dielectric cushions 51 and 52. Bar 50 is balanced by means of contact spring 53, which is held stationary at 54, while its loops 55 and 56 tend to press against cushions 51 and 52. Opposite the loops of the spring are arranged contact points 57 and 58, while the center contact point 59 connects permanently with the center 54 of the spring.

Permanently connected with center contact 59 and side contact 57 is an annunciator, indicated at 60, which in this case constitutes an electric bulb. The respective connections between the contact points and the bulb are made, respectively by conductors 61 and 62.

While we have shown a bulb as an annunciator, be it understood that a signaling device of any other design may be substituted. To the right hand of the first switch is shown at 63 a similar manual switch covered by a wall plate 64, through which protrudes handle 48 of the switch lever, while through opening 65 bulb 60 may be seen. The wire connections shown leading to switch 63 form continuations of the conductor connected with the left-hand switch, previously described.

Suitable associated with water tank 10 is a housing 66 of a thermostat, composed of a thermostatic spring 67, insulated at 68 from the housing and having a binding post 69. An insulated contact point 70 is arranged opposite the free end of spring 67 and is equipped with another binding post 71.

Above the gas generator 13, and clamped to pipe 12, is a casing 74. The latter is insulated from pipe 12, both electrically and against heat, by means of an asbestos layer, indicated at 73. Within the casing there will be seen an insulating strip 72 through which pass binding posts 75 and 76.

Below the lower face of the insulating strip 72, and making connection between the binding posts, is an electric resistance 77. Attached to binding post 76 is a thermostatic spring 78 adapted to contact with the contact point 75′ of binding post 75.

Electric energy supplied from transformer 44 is led from binding post 47 by means of conductor 79 to binding post 71 of the first thermostatic switch. From the binding post 69 of the latter, conductor 80 leads to binding post 32 of the electro-magnetic valve, and through that binding post electric energy is supplied, passing over conductor 36, to the lower end of solenoid 25.

The upper end of the solenoid, connected through conductor 37 to binding post 31, is connected from that binding post by means of conductor 81 to conductor 61, which connects central contact point 59 of the switch with one pole of the annunciator 60.

From binding post 46 of the transformer conductor 82 leads to the resistance-bridged thermostat, where it connects with binding post 75. Binding post 76 of this second thermostat connects with binding post 33 of the electro-magnetic valve and through it to spring 35. At junction 83 conductor 82 is connected with the conductor 84 leading to the contact point 58 of the switch.

At junction 85 of conductor 79, starting from binding post 47 of the transformer, conductor 86 is connected, and leads to contact point 57 of the switch, by connecting with conductor 62, which leads from contact point 57 to the other pole of annunciator 60.

The purpose of the first thermostat, connected with water tank 10, is to interrupt the current when the water reaches a certain temperature. The purpose of the second thermostat, arranged above the gas heater, is to break direct current when no heat is generated in the heater, thereby automatically causing the current to pass through resistance 77.

Operation

Assuming valve 22 is in its closed position, as shown in the drawing, thereby preventing gas from entering through pipe 15 to burner 14, the temperature of the water in the tank is low, and thermostatic spring 67 makes contact with contact point 70 of the first thermostat, and it is now desired to heat water in tank 10.

By throwing handle 48 of the switch lever in left-hand direction, contact is made between spring end 56 and contact point 58. The moment this contact takes place, the current passes from binding post 46, over conductors 82 and 84 to contact 58. The current continues from contact point 58 over spring loop 56 to contact point 59, to conductor

81 to binding post 31, then through conductor 37 over the windings of the solenoid 25 to conductor 36, and finally to binding post 32. From here the current continues over conductor 80 to binding post 69 of the first thermostat, over the latter to binding post 71, to conductor 79, and finally to binding post 47 of the transformer. In this manner the circuit is closed, the solenoid is energized and the armature 23 is drawn upwards and the gas will then be permitted to flow through the valve casing to the burner. Pilot 19 being constantly lit, will ignite the gases escaping from burner 14 and start heating the water.

The upward movement of armature 23 causes abutment 43 of armature extension 42 to compress spring 35 against spring 34. It will be recollected that while no heat is emanating from the gas heater, thermostatic spring 78 is disconnected from the contact point 75′ of binding post 75. The moment contact is made between springs 35 and 34 current passes from the transformer over rheostat 77 to binding post 33 over spring 35 to spring 34, and through binding post 31 to annunciator 60.

In this manner sufficient current is permitted to pass through the solenoid to keep it energized, so as to hold core 23 in its upward position in spite of the fact that meanwhile the hand switch 48 reverted to its normal state and spring loop 56 is no longer in contact with contact point 58.

Before manual switch 48 has been operated, annunciator 60 cannot show any light. The moment however, spring loop 56 has touched and released contact point 58, the circuit is temporarily closed as follows: From binding post 46 of the transformer, current passes over conductors 82, 84, to contact point 58, and continues over spring loop 56 and spring 53 and conductor 61 to annunciator 60. Having passed through the latter, the current flows over conductor 62, 86 and 79 to binding post 47 of the transformer. At the same time, current passes from conductor 61 through conductor 81 to binding post 31, which connects with the upper end of the solenoid, and flows through the latter to binding post 32, through conductor 80, and through the first thermoswitch and conduit 79 to binding post 47 of the transformer.

The armature 23 is now drawn upwards and causes contact between springs 35 and 34. The resistance-bridged thermostat permits electric current to pass from transformer binding post 46 over conductor 82, over its resistance 77, to binding post 33 of the electro-magnetic valve, and over the springs 35 and 34, and binding post 31, to conductor 81, which connects with one pole of the annunciator. The other pole of the annunciator, as has been said before, is connected by means of conductors 62, 86 and 76, to binding post 47 of the transformer.

Once the second thermostat has been shunted into the circuit, the annunciator 60 will light up, first dimly, as long as the current passes through the resistance 77, and then bright when thermostatic spring 78 has contacted with binding post 75, due to the fact that the heat emanating from the gas heater has caused thermostatic spring 78 to contact with contact point 75′.

When the contact is made between spring 78 and contact point 75′, the resistance 77, shunted across binding posts 75 and 76 is eliminated from the circuit, and full current passes to both the solenoid and the annunciator.

When it is desired to deenergize the electromagnet, or rather cause springs 34 and 35 to disconnect, a temporary movement of handle lever 48 to the right will accomplish the desired result. The following operation takes place:

Spring loop 55 connects with contact point 57. The current from binding post 47 of the transformer, led by conductors 79 and 86 to conductor 62, connected with contact member 57, is caused to continue now through loop 55 of the spring to its contact point 59, and through conductors 61 and 81, to binding post 31 of the electro-magnet. From here, the current passes through spring 34, spring 35, through binding post 33, to the second thermostat, and over the latter, and conductor 82, and finally to binding post 46 of the transformer. Thus a temporary short circuit is caused in the line, which results however in deenergizing the solenoid. Consequently, core 23 drops and permits the disengagement of springs 34 and 35. When core 23 drops, it closes valve 22 and no gas is permitted to flow to the burner. At the same time, the current is interrupted and the light of the annunciator goes out.

The thermostat switch 66 attached to the tank 10, is provided for the purpose of interrupting the current passing through conductors 79 and 80 when the water in the tank reaches a certain desired degree. This interruption is caused automatically in that thermostatic spring 67 moves with its free end from contact point 70. Thus solenoid 25 is deenergized and causes valve 22 to close.

In our system there are shown two manual switches only. However, it is intended that a number of switches, combined with annunciators, be used in such control system, so that the electro-magnetic valve may be operated from any desired remote place in a dwelling or other buildings.

In the event that a large number of such combined hand operated switches and annunciators are employed, the resistance of the annunicators, the wiring, and the resistance of the second thermoswitch may be so great

that the bulbs of the annunciator would hardly light up. Furthermore, the electric current may be so weakened, that when the second thermoswitch is caused to open, the weakened current would be insufficient for securely holding core 23 in upward position.

For this purpose, we have designed a somewhat modified form of a resistance-bridged thermoswitch 87, shown in Fig. 2 which may be employed instead of the second switch shown in Fig. 1. The casing of the modified switch has an extension 88, attached to which is an insulated binding post 89, having a contact point 90. Binding post 89 connects with binding post 91, by means of conductors 92 and 93, both of which issue into conductor 86, and binding post 94 connects with conductor 79, which latter is interrupted before reaching point 85. A resistance 77′ is shown between binding posts 91 and 94, while to the latter post, a thermostatic spring 78′ is also connected.

In this device, placed conveniently above the gas heater when spring 78 moves downwards, while no heat emanates from the gas heater, contact is made between binding post 94 through spring 78′, to binding post 89, and from there, to conductor 86. Thus, the resistance 77′ is cut out of the circuit. This facilitates feeding both the solenoid and the annunciators by a stronger current unencumbered by the resistance 77′.

In Fig. 1, a specific construction of the electromagnetic valve is shown in which a spacer arrangement 96 is provided between insulating disc 29 and iron member 39. The entire construction of the valve is shown rather diagrammatically, and it is obvious therefore, that constructive changes may be made without departing from the broad scope of this part of our invention.

It is further understood, that all other devices in our system may be mechanically worked out to meet various conditions, and we therefore reserve for ourselves the right to make such changes and improvements within the range of our claims, which are as follows:—

1. An electric valve control system, including an electro-magnetic valve having three terminals, a hand operated control switch having also three terminals, a thermostatic switch having two terminals, and a source of energy having two terminals, one of the valve terminals and one of the hand switch terminals electrically connected with each other and with one source terminal, another valve terminal electrically connected to one terminal of a second thermostatic switch, the other hand switch terminal connected with the second source terminal and the second terminal of the thermostatic switch, and the third terminals of said valve and said hand switch electrically connected with each other directly.

2. An electric valve control system composed of a plurality of elements including an electro-magnetic valve having three terminals, a hand switch and annunciator having also three terminals, two thermostatic switches, one with and the other without a resistance bridge, and each having two terminals, and a source of energy with two terminals, all of said elements electrically connected as follows: one terminal of the hand switch directly with one terminal of the valve, another terminal of the hand switch with one terminal of the source and one terminal of the bridgeless thermoswitch, the other terminal of the valve with the other terminal of said bridgeless thermoswitch, the third terminal of the hand switch with the second source terminal and one terminal of the bridged thermoswitch and the third terminal of the valve with the second terminal of said bridged thermoswitch.

3. An electric valve control system for governing the supply of liquid or gaseous media to burners in heating plants, comprising a plurality of elements including an electro-magnetic supply control valve having three terminals, a remote control hand-operated switch and annunciator also having three terminals, a thermoswitch with two terminals attached to the heating plant, a resistance bridged thermoswitch with two terminals disposed over the burner and an electric source of energy having two terminals, said elements connected by electric conductors as follows: one terminal of the hand switch directly with one terminal of the valve, another terminal of the hand switch with one terminal of the source and one terminal of the bridgeless thermoswitch, the second terminal of the valve with the other terminal of said bridgeless thermoswitch, the third terminal of the hand switch with the second terminal of the source and one terminal of the bridged thermoswitch, and the third terminal of the valve with the second terminal of said bridged thermoswitch, as and for the purpose described.

Signed at New York in the county of New York and State of New York this 17th day of December, A. D. 1926.

LUCAS KRAFT.
LEOPOLD MAYR.