May 6, 1947. H. T. SPARROW ET AL 2,420,105

CIRCUIT CONTROLLING DEVICE

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Fig. 1.

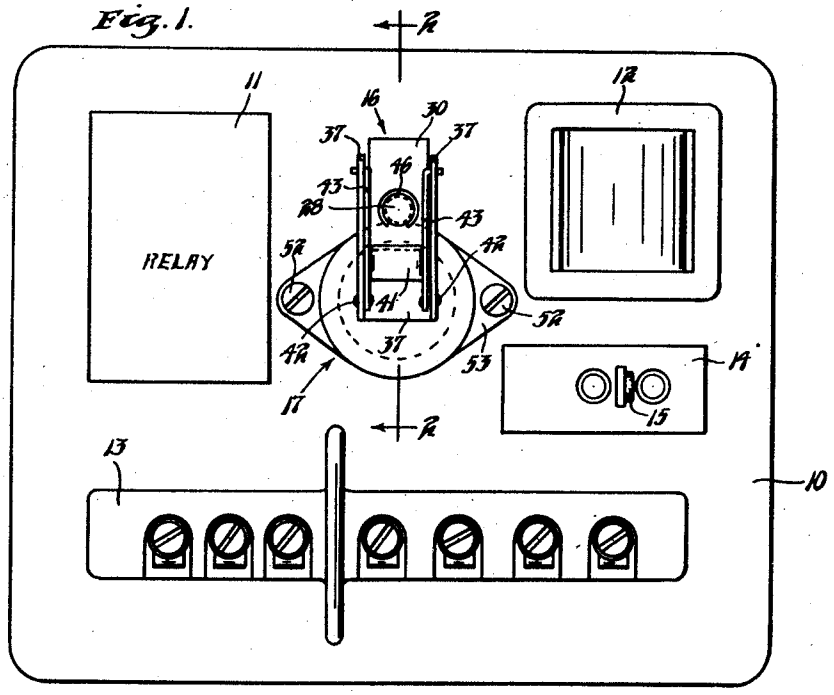

Fig. 2.

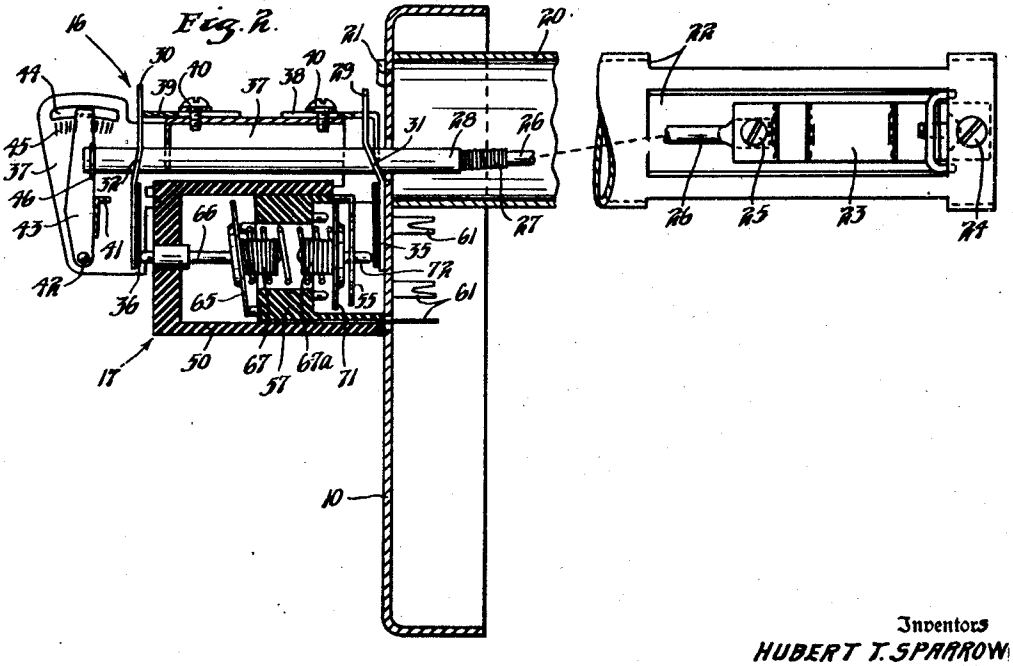

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Fig. 3.

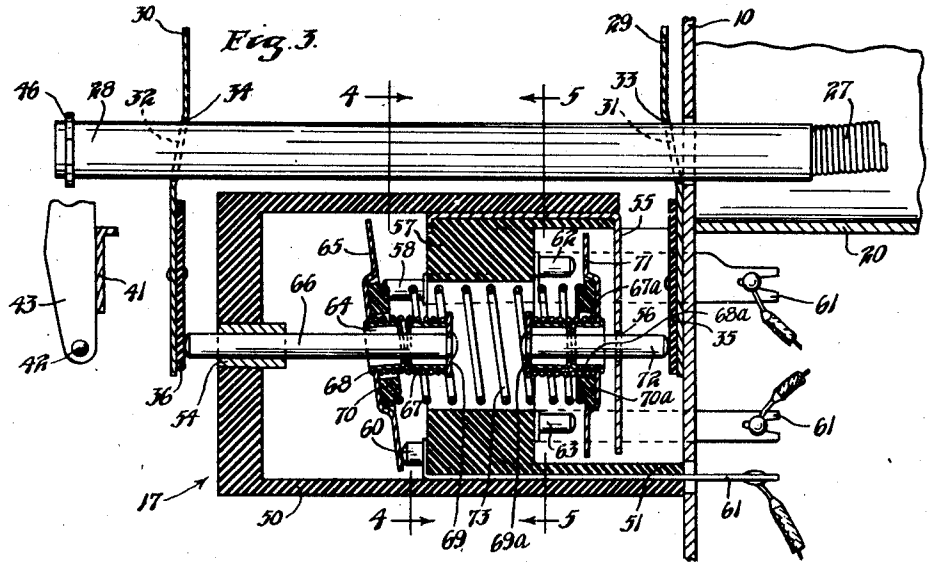


Fig. 4.

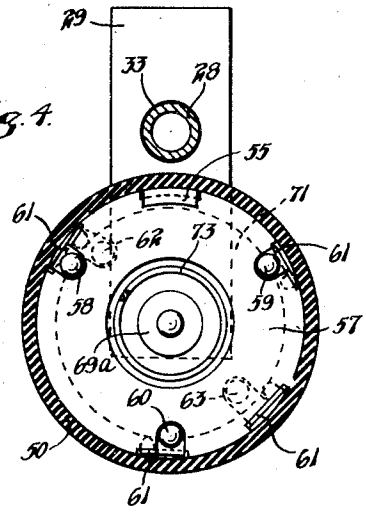
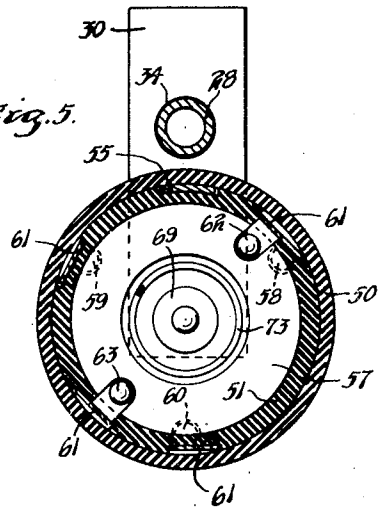


Fig. 5.



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CIRCUIT CONTROLLING DEVICE

Filed Oct. 30, 1944 3 Sheets-Sheet 3

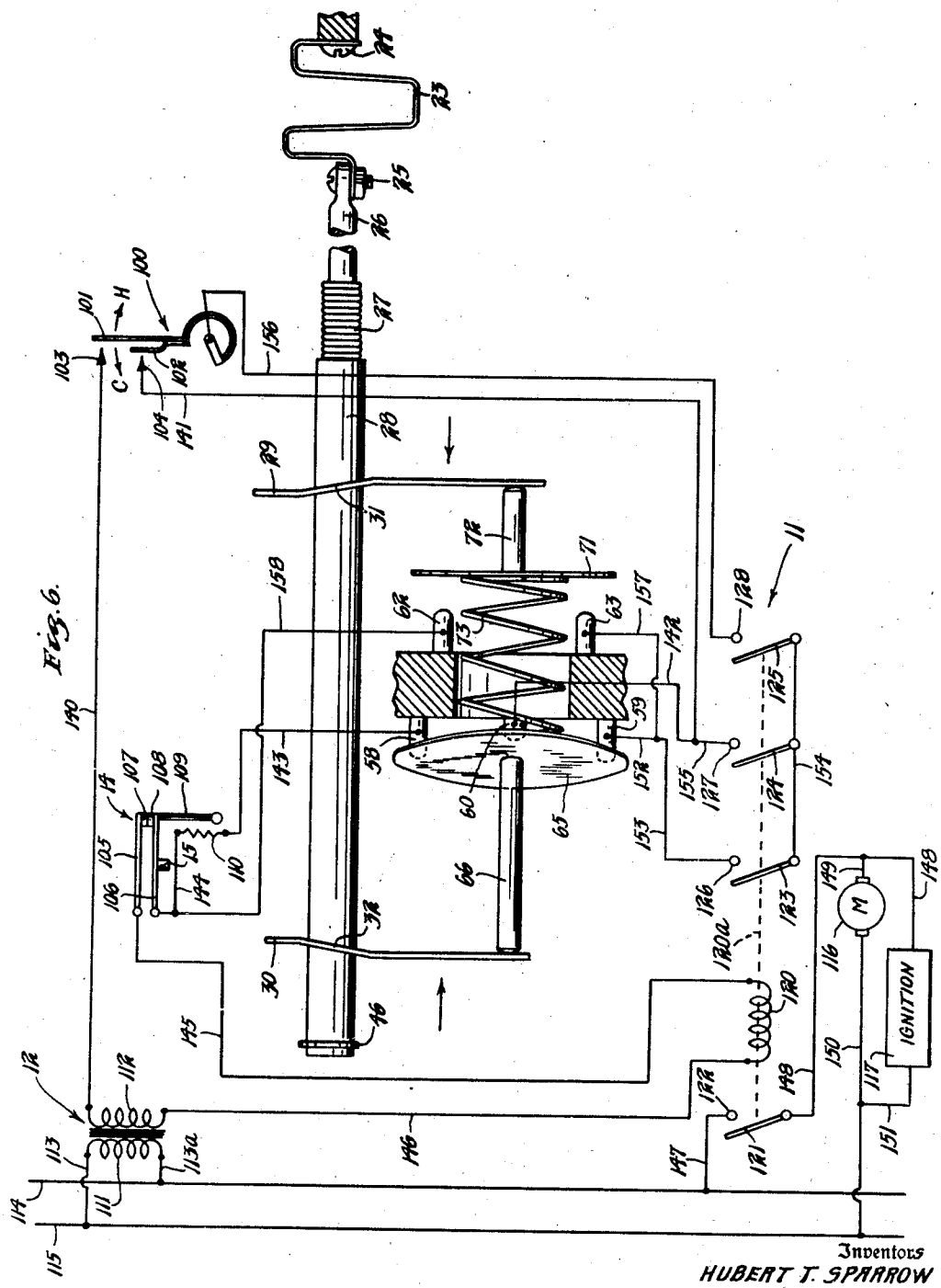

Fig. 6.

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CIRCUIT CONTROLLING DEVICE

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Application October 30, 1944, Serial No. 561,008

13 Claims. (Cl. 200—16)

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Our invention relates to improvements in circuit controlling devices and is adaptable for use in conjunction with a stack switch of a furnace or like device.

Devices of this character are used to advantage with domestic heaters or furnaces in which an electric current is employed to operate a motor and ignition means or, for the operation of other control members of the furnace when it is desirable to vary the controls or circuits depending upon a change of temperature of the gases of combustion passing through the stack. Such devices have a portion made of expansible metal extending within the stack, which expands or contracts with a noticeable change of temperature. The force generated by this action is used to control the operation of the mechanism for opening and closing the circuits to the various electrical devices. Because there are great variations in the temperature existing within the stack of a furnace, as for example, before a flame is established, when the combustion temperature has reached its safe upper limit, and again after the existence of combustion where there has been flame failure or, when the temperature within the combustion chamber has fallen to a point where additional fuel should be added, the device must be capable of giving the desired reaction at the proper time. This result is generally obtained through a slip friction or lost motion mechanism, wherein after the desired switching effect has been obtained, continued movement of the slip friction mechanism in either direction, which may be the result of either expansion or contraction, will not be injurious to either the expansible metal unit or the switching mechanism, the excessive movement of the mechanism being absorbed as lost motion. To be effective, a control device of this type must be highly sensitive to temperature change and the switching mechanism must be capable of acting with a minimum amount of effort.

In the present application, the device is so arranged that in the "cold" contact position, the switch makes contact with three contact points, two of which are situated in a different transverse plane from the remaining contact so that on initial movement the switch is moved away from one of the contacts by the action of the bimetal when it is influenced by a rise in temperature of the spent gases, then on continued movement in the same direction, it successively makes a circuit through a pair of "hot" contact points before opening the remainder of the "cold" contacts. This operation serves to shunt out a

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first circuit and establish a holding circuit through the "hot" contact points. On reverse movement of the operating mechanism, the switch controlling the second or holding circuit is moved to open circuit position and then, after a time lapse, the first switch sequentially assumes its position in engagement with the several "cold" contact points. In the application of this device to a furnace, the sequence of the return of the first switch to its several "cold" contact points is timed to provide a complete break of the operating or holding circuit and a scavenging period of the combustion chamber before re-ignition, so as to prevent a possible explosion of the unburnt fuel, which is present in the combustion chamber from the original operation of the fuel supplying mechanism.

Although the application in this instance is explained in conjunction with a fluid fuel burning furnace, it will be understood by those skilled in the art, that it is applicable to other uses where the control of electric circuits or other pilot means are dependent upon a change of condition, which change will cause the expansion, contraction, or movement of a mechanism.

The principal object of my invention is to provide an improved circuit controlling means which will become operative upon the change of a condition.

Another object is to provide a circuit switching device operable upon a change of condition for providing sequential and simultaneous switching upon movement in one direction, and a complete opening of the circuit followed by a successive remaking of the original circuit on movement in the other direction.

Other objects and advantages will become apparent from the specification and appended drawings, in which

Figure 1 is a plan view of the control panel;

Figure 2 is a cross section of the device taken on the line 2—2 of Figure 1, showing the relationship between the expansible metal unit and the switching mechanism;

Figure 3 is a detail view of an enlargement of the switching mechanism;

Figure 4, taken on the line 4—4 of Figure 3, is a cross section of the "cold" contact points;

Figure 5, taken on the line 5—5 of Figure 3, is a cross section of the "hot" contact points, and

Figure 6 is a schematic drawing of an oil burner control system employing the device of the present invention.

Referring now to the drawings in which like

reference numerals indicate the same parts, in Figure 1, reference numeral 10 is employed to indicate a panel upon which the various mechanisms are affixed. Suitably mounted on panel 10 is a conventional relay 11, a conventional transformer 12, a conventional terminal receiving member 13, and a safety cut-out switch 14 having a manual reset member 15. Also shown in Figure 1 is an actuating mechanism indicated by the general reference numeral 16 whose function is to operate a switching mechanism indicated by the general reference numeral 17.

Referring now to Figure 2, tube 20 is suitably mounted on the rear of the panel 10 and secured thereto by flanged portions 21. The tube 20 is intended for mounting in the stack of an oil burning furnace or the like with suitable flanges (not shown) and is provided with a series of longitudinal apertures 22 whereby the temperature of the spent gases of combustion may come in contact with a temperature responsive actuating member. A bimetallic element 23 built in the form of a lazy W and seen in profile in Figure 6, is suitably mounted at one end of the tube 20 by a screw 24. At its other end of the bimetallic element is fastened by a screw 25 to a rod 26 which extends through the tube 20 toward the base member 10. Because of the angular disposition between the rod 26 and the actuating member 23, a spring 27 is mounted on the upper end of rod 26 and serves as a form of universal joint between the rod 26 and an actuating tubular shaft 28 which extends through the panel 10. A pair of switch actuating clutches 29 and 30 are situated on the shaft 28 to provide a switch actuating mechanism which will be described hereinafter. Each of these members 29 and 30 has a bent portion 31 and 32 and each of the members also has an aperture 33 and 34 at the bent portions 31 and 32 whereby the members 29 and 30 are mounted in a slip-frictional manner on the shaft 28. Insulating strips 35 and 36 are riveted on the members 29 and 30 respectively.

The construction of the members 29 and 30 having bent portions 31, 32 and apertures 33, 34, is to provide slip frictional engagement with the shaft 28. When shaft 28 is moved in one direction, as for example, to the left as seen in Figure 2, members 29 and 30 will each be in frictional engagement with the shaft and will move in unison with it until their further movement is individually prevented by stopping or limiting means; thereafter, shaft 28 is free to continue movement through the apertures 33, 34. However, on reverse movement of shaft 28 the members 29 and 30 will again move in unison with the shaft until movement in the new direction is again arrested, after which shaft 28 is again free to continue its further movement through the apertures 33 and 34. By this arrangement the members 29 and 30 can each be moved a sufficient distance to accomplish their individual function and further movement of shaft 28 will result in lost motion, without danger of damaging the members or the switching mechanism which they control.

The structure indicated by the general reference numeral 16 consists of a generally U-shaped bracket 37 which is suitably mounted on the panel 10. The bracket 37 is provided to laterally confine the switch actuating clutches 29 and 30 and to provide certain means for limiting the extent of movement of these actuating clutches. A pair of slidably adjustable stop members 38 and 39 are fastened to the bracket 37 by screws 40. These members are provided to limit the extent of movement in one direction of the clutches 29 and 30 and are each provided with a slot whereby their respective positions on bracket 37 may be made adjustable. An adjustable stop member 41 is hingedly mounted on pin 42 between the respective sides of bracket 37 to limit the extent of movement of clutch 30 in an outward direction. Thus the clutch 30 which is extended to have a greater range of movement than clutch 29 is limited in its movement in one direction by the yoke 41, and in the other direction by the stop member 39. A lever 43 which constitutes a manually adjustable extension of stop member 41 extends through an aperture 44 in bracket 37 to indicate its position on an index 45. A washer 46 is clamped on the end of the actuating shaft 28 and serves to prevent accidental separation of the clutch 30 from the shaft.

The switching structure indicated by the general reference numeral 17 and shown in enlarged form in Figure 3, consists of a hollow casing 50 and an inner tubular member 51. The members 50 and 51 are formed of insulating material and are secured to the panel 10 by means of screws 52 extending through the flanged portions 53 of the members 50 and 51 (shown in Figure 1). The casing 50 is provided with a bushing 54 and the inner member 51 is provided with a disk 55 having an aperture 56. The bushing 54 and aperture 56 are intended to provide bearing surfaces for certain moving parts of the switch to be disclosed later. The member 51 is provided with a thick annular portion 57 which serves as a contact supporting member. Radially disposed about the outer end of portion 57 are three contact points 58, 59 and 60 (see Figure 4), which are insulatingly mounted and connected to individual metallic conductors 61. It may be observed in Figure 3 that contact points 59 and 60 are of substantially the same length but contact point 60 is shorter in length than the others, which is provided for a purpose to be disclosed later. On the inner side of the annular portion 57 (see Figure 5) are provided two contact points 62 and 63 which are also connected to individual conductors 61 in the same manner as contacts 58, 59, and 60. The first plurality of contacts 58, 59, and 60 constitute a combination hereinafter referred to as the "cold contacts" and are engageable by one switch, while contacts 62 and 63 constitute a second combination hereinafter referred to as the "hot contacts" and are engageable by a second switch.

Mounted within the casing 50 and adjacent the cold contacts is a disk switch 65 which has a central aperture 64. The switch 65 is arranged to be resiliently mounted on a rod 66 which extends through the aperture 64. To accomplish this, a spring 67 is fastened at one end to a bushing 68 which fits within the aperture 64 and at the other end the spring is fastened to collar-like structure 69 which engages the end of rod 66. This arrangement permits the switch 65 to be moved by the rod 66 and permits a certain amount of wobbling movement, furthermore after the switch has engaged the contacts, further movement of the rod causes expansion of spring 67 as a form of lost motion and which also provides pressure on the contacts without injury to the switch or the contacts. Insulation 70 is positioned within an indented portion of the disk 65. A similarly shaped switch disk 71 is mounted on

rod 72 within the enclosure formed by portions 55 and 57 and adjacent the hot contacts 62 and 63. Switch 71 is provided with insulation 70a and is resiliently mounted with spring 67a, bushing 68a, and collar 69a in the same manner as switch 65. An expansion spring 73 is positioned between switches 65 and 71 and is intended to maintain the two switches in spaced relation to each other and to provide one means of moving the two switches.

The operation of the switch is as follows: Assuming the bimetal 23 shown in Figure 2 is cool, the actuating mechanism, represented by the shaft 28 will be at rest at the extreme right portion of its range of movement. The actuating clutches 29 and 30 are engaged with the rods 66 and 72 and will be held in spaced relation by the tension of spring 73. Switch disk 65 is resiliently held in engagement with the cold contacts by spring 67 and because contact 60 is shorter or situated on a different transverse plane with respect to the direction of movement of the switch as related to the other contacts 58 and 59, said switch 65 will be in tilted or angular position. The switch disk 71 is at this time held away from the hot contacts by the expansion spring 73. On an impulse caused by a change of condition, as by a rise of temperature of the spent gases passing through the stack, the bimetal 23 would expand, transmitting its movement through rod 26 and spring 27 to shaft 28. When the shaft 28 moves to the left as shown in Figures 2 and 3, the switch actuating clutches 29 and 30, which are in frictional engagement with the shaft 28, will move in unison therewith. As rod 72 receives pressure from actuator 29, the force is initially transmitted through spring 73 to switch 65, and on the first increment of movement, causes switch 65 to move away from its tilted position wherein it engages contacts 60, 58 and 59, into a flat position where it only engages the latter two contacts. As the movement of the shaft 28 continues, as by a continued expansion of the bimetal 23, switch 71 will then move into engagement with contacts 62 and 63. This action, however, takes place while switch 65 is still engaged with contacts 58 and 59, and in fact takes place while switch 65 is moving from a tilted to a horizontal position with respect to the cold contact points. Thereafter on continued movement, switch 65 becomes disengaged from contacts 58 and 59. The purpose of this arrangement is to provide a sequential or step by step operation of switch 65 with respect to contact 60 and then later with contacts 58 and 59 and also to provide a successive operation of the two switches with respect to contacts 58, 59 and 62, 63. The closure of switch 71 with contacts 62 and 63 establishes an operating circuit which will be disclosed later, but for the time being it is sufficient to point out that switch 71 will remain in engagement with contacts 62, 63 as long as the combustion temperature maintains the bimetal 23 in an expanded condition. For safety reasons it is essential that when the temperature within the combustion chamber descends, switch disk 71 must break engagement with the hot contacts before switch disk 65 again engages the cold contacts. Therefore, as the bimetal 23 contracts, the first increment of movement of the actuators to the right, as shown in Figures 2 and 3, causes switch disk 71 to move away from contacts 62, 63, and thereafter as the movement continues switch disk 65 will initially engage contacts 58, 59 and then finally move into its tilted position to engage contact 60.

Referring now to Figure 6, the switching mechanism and its coacting parts are shown in schematic relation to the other essential parts of a combustion system including a motor and ignition means, together with a conventional form of space thermostat, the latter being normally positioned in the space to be heated.

The space hermostat 100 is shown as a conventional thermostat having two blades 101 and 102. Blade 101 is positioned to cooperate with contact 103 carried by conductor 140, and blade 102 is positioned to cooperate with contact 104 carried by conductor 141.

The safety switch 14 is provided with blades 105 and 106 having contacts 107 and 108. Blade 106 is held in engagement with blade 105 by a bimetallic blade 109. A heating element 110 is positioned adjacent the bimetal 109 and is provided to radiate and conduct heat to the bimetal 109 thus causing it to warp to the right and separate blade 106 from blade 105, in the event that the circuit through the heating element 110 exists for an excessively long period of time. This is a conventional method of breaking the circuit in the event of ignition failure. When the blades have been separated as by the warping of the bimetal 109, to prevent the continuation of an unsafe condition, they will not, on cooling, replace themselves. To accomplish this an actuator 15 is provided. When the bimetal 109 has cooled, manual movement of the actuator 15 brings the contacts 107, 108 into engagement and permits bimetal 109 to assume its normal position supporting the blades 105, 106.

The step-down transformer 12 is provided with a primary coil 111 and a secondary coil 112 and is intended to provide low voltage current for the operation of various portions of the control mechanism. Conductors 113 and 113a connect the primary coil 111 to line voltage conductors 114, 115 which convey line voltage electric current (from a source not shown).

The control device is intended for controlling the line voltage circuit furnished by the conductors 114, 115 for the operation of any electrically controlled fuel burning furnace having electrical ignition means. As there are many commercially available forms of these structures, they are diagrammatically illustrated as a motor 116 and ignition means 117.

The relay 11 is intended for controlling numerous circuits of both line and low voltage currents and is provided with an induction coil 120 which when energized, through an armature movement indicated by the dotted line 120a causes switch 121 to engage contact 122 to provide line voltage to the motor 116 and ignition means 117. It also causes switches 123, 124, and 125 to engage contacts 126, 127 and 128 to provide low voltage circuits between the several elements of the control device.

Assuming the elements to be in the position shown in Figure 6, the temperature in the controlled space is above the minimum requirements and the thermostat is inclined in the direction of the legend H which indicates a satisfied condition, and the motor 116 and ignition means 117 are inoperative. Now assume the temperature in the controlled space descends below that for which the thermostat is set. The thermostat blades will then incline in the direction of the legend C. Initially blade 101 will engage contact 103 but because the circuit does not include

the thermostat blade 102 and contact 104 the circuit cannot be completed. However, on a slightly further drop in temperature, blade 102 will engage contact 104, which will cause the establishment of an operative circuit which may be traced as follows: from the secondary coil 112 of transformer 12 through conductor 140 and contact 103, blades 101 and 102 of thermostat 100, contact 104, conductors 141 and 142 to contact 60, switch 65, contact 58, conductor 143, heating element 110, conductor 144, blade 106, contacts 108, 107 and blade 105 of the safety switch 14, thence through conductor 145 to coil 120 and thence through conductor 146 back to the secondary 112. Energization of inductance coil 120 will cause closure of switch 121 with contact 122 to establish a line voltage circuit for the operation of the motor and ignition means, which may be traced as follows: from conductor 114, to conductor 147, contact 122, switch 121, conductor 148 to the ignition device 117, to conductor 151, to conductor 115, and by branch 149 to motor 116, thence by branch 150 and conductor 151, to conductor 115, to complete the circuit for the operation of the motor and ignition means. Simultaneous with the closure of the line voltage switch, switches 123, 124 and 125 move into engagement with contacts 126, 127, and 128 to complete low voltage circuits to be explained later.

As the temperature of combustion gases increase, the bimetal 23 expands and the shaft 28 and actuating clutches 29 and 30 to move to the left as seen in the several figures of the drawing. With the first increment of movement, switch 65 moves from its tilted position away from contact 60. This action causes conductor 142 to become inoperative with the latent purpose of preventing a rapid remaking of the circuit in the event of flame failure but has no immediate effect upon the circuit since current may now pass across switch 65 between contacts 58 and 59 and complete the circuit through conductors 141, 155, contact 127, switch blade 124, conductor 154, switch blade 123, contact 126, conductor 153, conductor 152. With the continued movement of the actuating mechanism 17, switch 71 engages contacts 62 and 63. It should be understood that at the instant switch disk 71 engages contacts 62 and 63, switch 65 is still engaged with contacts 58 and 59, however, substantially immediately thereafter switch 65 does disengage from contacts 58 and 59 but the time delay is only sufficient to provide a proper overlapping of the two switching actions. The purpose of this switching action was to shunt out the heater 110 of the safety switch 14 whose purpose is to break the circuit in the event of failure of ignition, and establish an operating circuit which may may be traced as follows: from secondary 112, conductor 140, contact 103, blade 101 of thermostat 100, conductor 156, contact 128, switch blade 125, conductor 154, switch blade 123, contact 126, conductors 153 and 157, contact 63, switch disk 71, contact 62, conductor 158, safety switch blade 106, contacts 108, 107, blade 105, conductor 145, induction coil 120, and conductor 146 to the other side of secondary coil 112 of transformer 12.

Should there be flame failure resulting from any cause after combustion has been established, and while the space thermostat 100 is still calling for heat, the bimetal 23 will commence to contract and through the connecting linkage will cause the actuating mechanism 17 to move to the right as seen in the several figures. At this

stage it would be highly undesirable to permit the immediate reformation of the starting circuit through switch 65 for the reason that the unburned fuel remaining in a gaseous state, might cause an explosion. Therefore, with the first increment of movement of the actuating mechanism caused by retraction of the bimetal 23, the switch 71 moves away from contacts 62 and 63 to disrupt the circuit. When the circuit is broken the relay 11 moves to an inoperative position opening switch 121 from contact 122 to thereby cause the motor 116 and ignition means 117 to become inactive. It will also cause switches 123, 124, and 125 to move away from their respective contacts 126, 127 and 128 to thus disrupt the operating circuit. As the switch 65 then continues its movement to the right, it will first engage contacts 58 and 59, but this will not complete a circuit even though the thermostat 100 is still calling for heat and the blades 101 and 102 are engaging contacts 103 and 104 because it is essential that the switch 65 engage contact 60 before this action can take place. Thus, the step by step movement of the switch 65, with respect to contacts 58, 59, and 60, provides a sufficient time lapse to enable the unburned gases to escape from the furnace before the complete circuit can be remade. This period of time is commonly referred to as the recycling period and in the present device it may be made adjustable for the particular application, by moving the yoke 41, positioned near the outer end of bracket 37. This member adjusts the distance which the clutch 30 must travel during the heating period and therefore the distance which it must travel on the return movement. However, in the event that this distance is short, the further movement of the switch 65 in assuming its tilted position against contact 60 will prevent an immediate remaking of the starting circuit which therefore accounts for the reason that the contact 60 is shorter in length or positioned on a different transverse plane than contacts 58 and 59.

In considering the switching mechanism and its coacting parts, it will be evident that a combination of sequential and successive actions takes place which may have wider use than in the single disclosure of this application; therefore, I do not wish to be limited to the single use disclosed herein, but rather only by the full extent of the appended claims.

We claim as our invention:

1. A circuit controlling device, comprising, a contact supporting member, three contacts mounted in spaced relation to each other on one side of said supporting member, one of said contacts being spaced on a different transverse plane than the remainder, a single switch adapted to collectively engage all three of said contacts, and said switch being resiliently mounted for engaging and/or disengaging said contacts in a series of sequential steps.

2. In a circuit controlling device, comprising, a contact supporting member, three contacts mounted on one side of said supporting member, one of said contacts being disposed on a different transverse plane than the remainder, a first switch adapted to collectively engage all three of said contacts, another contact mounted on the opposite side of said supporting member, a second switch located on the opposite side of said supporting member from said first switch and being adapted to engage said other contact, means for moving said first and second switches in unison

with relation to their respective contacts, and means for moving said first switch in a step by step sequence with respect to the several transverse planes in which said three contacts are situated.

3. In a circuit controlling device, comprising, a contact supporting member, a plurality of contacts mounted on one side of said supporting member, one of said contacts being disposed on a different transverse plane than the remainder, a first switch adapted to collectively engage all of said plurality of contacts, another contact mounted on the opposite side of said supporting member from said plurality of contacts, a second switch located on the opposite side of said supporting member from said first switch and being adapted to engage said other contact, a resilient connection between said first and second switches for maintaining said switches in spaced relation with each other, means for moving said switches in unison with relation to their respective contacts, and resilient means connecting said first switch and said first named means for moving said switch in a step by step sequence with respect to the transverse planes in which said plurality of contacts are situated.

4. In a circuit controlling device, comprising, a contact supporting member, a first plurality of contacts mounted on one side of said supporting member, a first switch adapted to engage said first plurality of contacts, a second plurality of contacts mounted on the opposite side of said supporting member from said first plurality of contacts, a second switch adapted to engage said second plurality of contacts, means for moving said switches in unison with relation to their respective contacts, said supporting member having an aperture, means passing through the aperture in said supporting means which is connected at its opposite ends to said two switches and is operative upon movement of said switches in one direction to move said second switch into engagement with said second plurality of contacts before said first switch has completely disengaged from said first plurality of contacts, and said means being operative on reversal of movement of said switches to move said second switch away from said second plurality of contacts before said first switch has completely engaged said first plurality of contacts.

5. In a circuit controlling device, comprising, a contact supporting member, a first plurality of contacts mounted on one side of said supporting member, one of said contacts being located on a different transverse plane than the remainder, a second plurality of contacts located on the opposite side of said supporting member from said first plurality of contacts, a first switch and a second switch for respectively engaging said first and second plurality of contacts, first and second switch moving members slip frictionally connected to an actuating member for moving said switches with relation to their respective contacts in response to movement of said actuating member and means including a resilient member connecting said first switch and said first switch moving member to move said first switch in a step by step sequence with respect to those contacts which are situated in different transverse planes.

6. In a circuit controlling device, in combination, a contact supporting member, a first plurality of contacts mounted on one side of said member, one of said contacts being mounted at a different distance from said supporting member than the remainder of said contacts, a second plurality of contacts mounted on the opposite side of said supporting member, a first switch and a second switch adapted to respectively engage said first and second pluralities of contacts, resilient means located between said switches for biasing said switches in spaced relation with each other, a rod resiliently attached to each switch, a pair of frictionally mounted actuators for cooperating with said resiliently attached rods to move said switches with relation to said contacts, said actuators having a first position in which said first switch is in tilted engagement with said first plurality of contacts and said second switch is disengaged from said second plurality of contacts, and means for moving said actuators to disengage said first switch from a portion of said first plurality of contacts and successively engage said second switch with said second plurality of contacts before said first switch is disengaged from the remainder of said first plurality of contacts.

7. In a circuit controlling device, in combination, a contact supporting member, a first plurality of contacts mounted on one side of said member, one of said contacts being mounted at a different distance from said supporting member than the remainder of said contacts, a second plurality of contacts mounted on the opposite side of said supporting member, a first switch and a second switch adapted to respectively engage said first and second pluralities of contacts, resilient means located between said switches for biasing said switches in spaced relation with each other, a rod resiliently attached to each switch, a pair of frictionally mounted actuators for cooperating with said resiliently attached rods to move said switches with relation to said contacts, said actuators having a first position in which said second switch is in engagement with said second plurality of contacts and said first switch is disengaged from said first plurality of contacts, and means for moving said actuators to disengage said second switch from said second plurality of contacts before said first switch commences to successively engage said first plurality of contacts.

8. In a circuit controlling device, comprising, a contact supporting member, a plurality of contacts extending from said supporting member, one of said contacts extending a different length from said supporting member than the remainder, a movable conductor for transmitting current between said contacts, an actuating member for moving said conductor with relation to said contacts, a resilient member connecting said conductor about its center to said actuating member in such a manner as to provide angular tilting movement of said conductor about its center with respect to said actuating member, said conductor being adapted to assume a tilted position with respect to said actuating member when in engagement with all of said contacts, and said resilient connection being adapted to move said conductor away from said contacts in a step by step sequence when said actuating member moves away from said contacts.

9. In a circuit controlling device, comprising, a tubular supporting member, a plurality of contacts radially disposed about the periphery of said tubular member, one of said contacts being situated on a different transverse plane than the remainder, a switch for simultaneously engaging all of said contacts, said switch having an aperture therein which coincides with the tubular

portion of said supporting member, an actuating rod positioned in the aperture of said switch, and resilient means associated at its opposite ends with said actuating rod and said switch whereby when said switch is moved in the direction of said plurality of contacts it will engage a portion of said contacts in one transverse plane and will then assume a tilted position to engage the remainder of said contacts.

10. A switching device, comprising, a body member having an aperture therein, a contact mounted on said body member adjacent said aperture, a movable switch member adapted to cooperate with said contact, said switch member having an aperture which coincides with said body aperture, an actuating rod extending through the aperture in said switch member, and resilient means associated at its opposite ends with said switch and said actuating rod whereby after said switch has engaged said contact continued movement of said actuator produces lost motion.

11. In a circuit controlling device, comprising, a contact supporting member, a plurality of contacts extending from said supporting member, one of said contacts extending a different length from said supporting member than the remainder, a movable conductor for transmitting current between said contacts, an actuating member for moving said conductor with relation to said contacts, a resilient member connecting said conductor about its center to said actuating member in such a manner as to provide angular tilting movement of said conductor about said actuating member, and said conductor when moved in the direction of said supporting member completely engages all of said contacts in a succession of steps which includes tilting about its center on said actuating member to engage said one contact whose length from said supporting member differs from the remainder.

12. In a circuit controlling device, a supporting member, a first contact mounted on one side of said supporting member, a second contact mounted on the opposite side of said supporting member from said first contact, a first and second switch mounted on opposite sides of said supporting member for cooperating respectively with said first and second contacts, a movable actuating rod located adjacent said supporting member, a first and second switch actuating members slip frictionally mounted on said rod and cooperating with said switches in such a manner that upon movement of said rod in one direction one of said switches is moved into engagement with its respective contact and the other switch is moved away from its respective contact.

13. In a circuit controlling device, a supporting member, a pair of contacts each of which is mounted on respectively opposite sides of said supporting member, a pair of switches each of which is located on opposite sides of said supporting member and adapted to cooperate with a respectively opposite contact, connecting means located between said pair of switches for maintaining said switches in spaced relation to each other, a movable actuating member located adjacent said supporting member, and a pair of switch moving members slip frictionally connected to said actuating member and being positioned with respect to said switches that upon movement of said actuating member for a predetermined distance both of said switches are moved simultaneously with respect to their cooperable contacts.

HUBERT T. SPARROW.
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Number	Name	Date
2,175,720	Miller	Oct. 10, 1939
2,159,503	Denison	May 23, 1930
2,191,742	Miller	Feb. 27, 1940