R. L. FEARN, JR.

THERMALLY CONTROLLED ELECTRIC SWITCH.

APPLICATION FILED FEB. 12, 1920.

1,380,049.

Patented May 31, 1921.

4 SHEETS—SHEET 1.

Fig. 1.

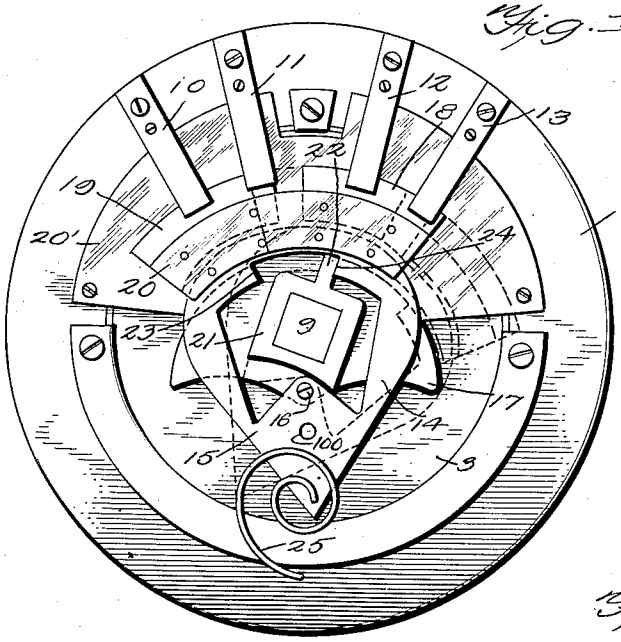


Fig. 3.

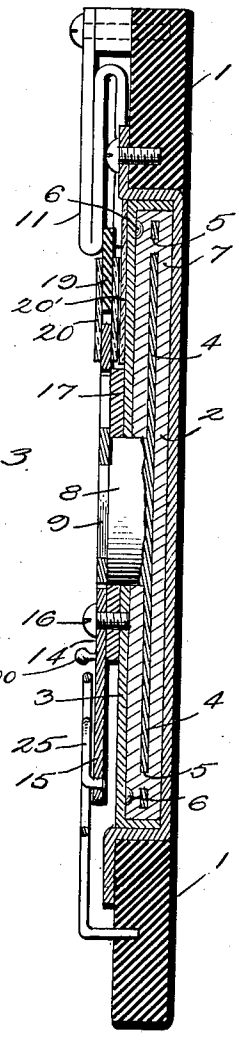
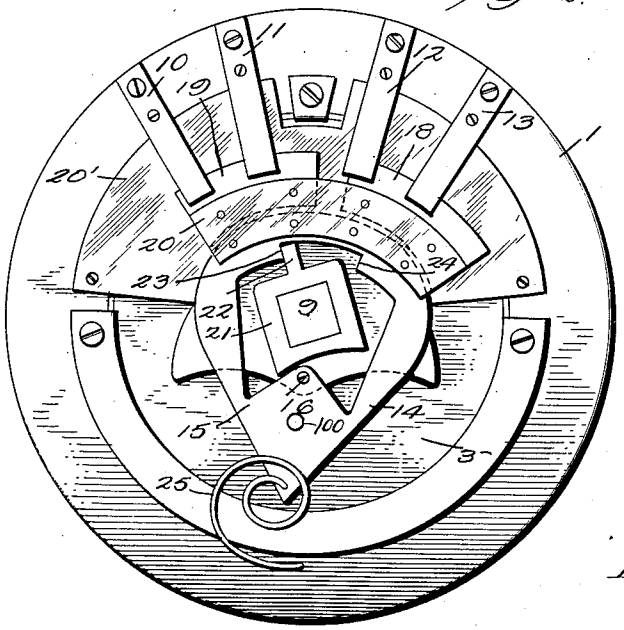


Fig. 2.



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Attorney

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Fig. 4.

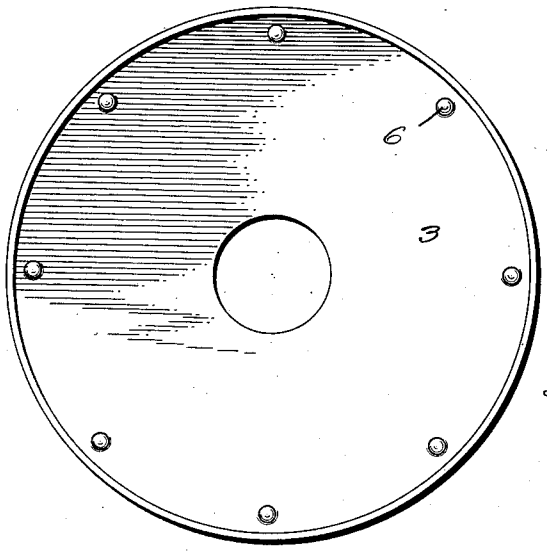


Fig. 5.

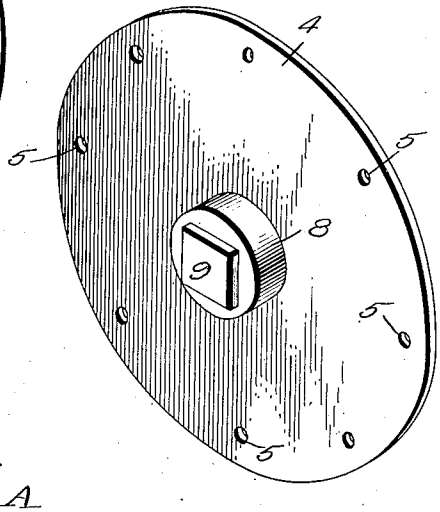
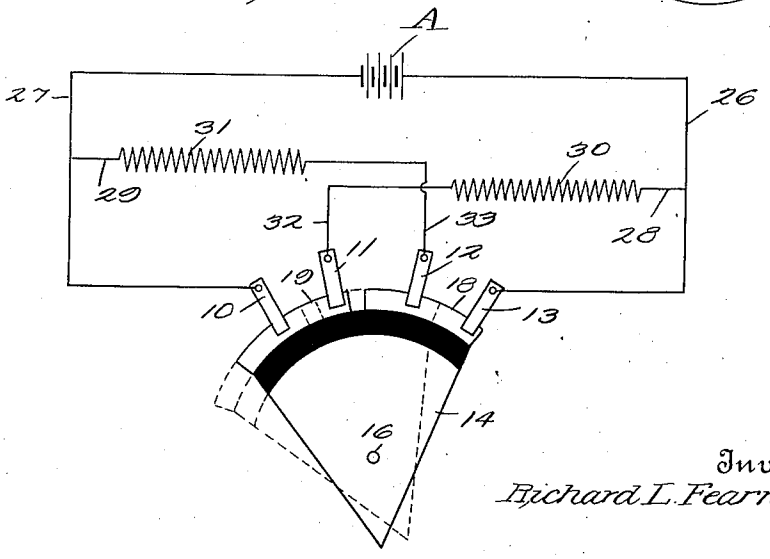


Fig. 6.



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4 SHEETS—SHEET 3.

Fig. 7.

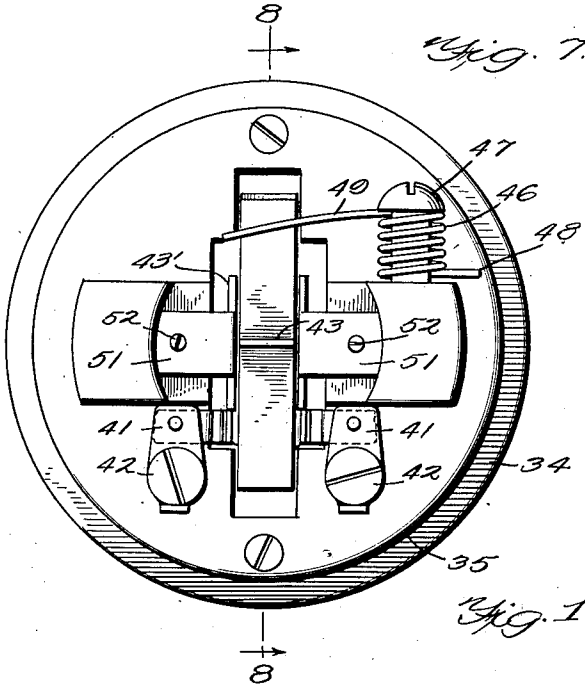


Fig. 9.

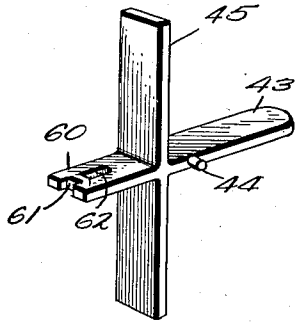


Fig. 10.

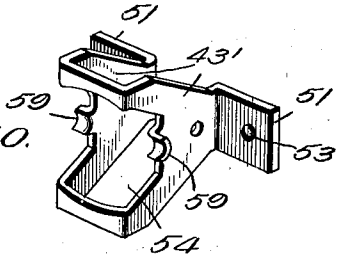


Fig. 8.

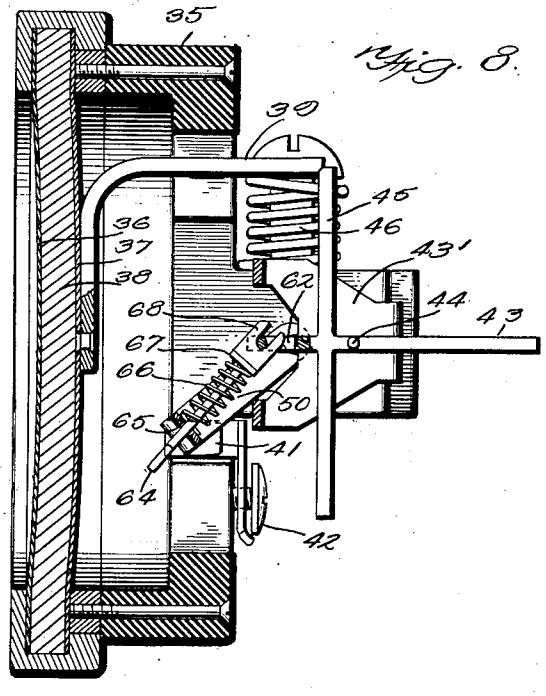
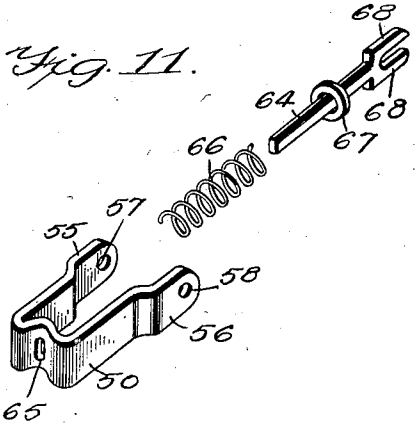


Fig. 11.



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4 SHEETS—SHEET 4.

Fig. 12.

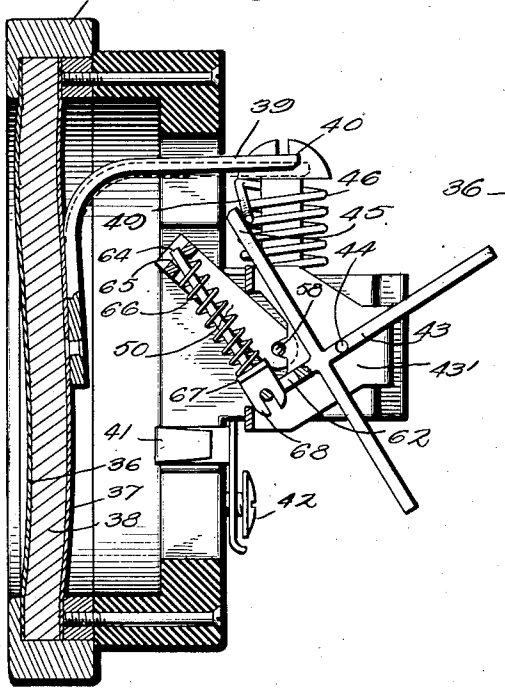


Fig. 13.

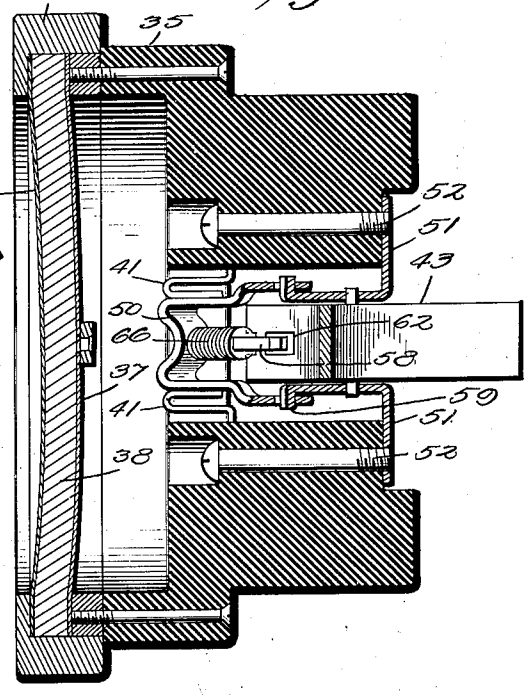


Fig. 15.

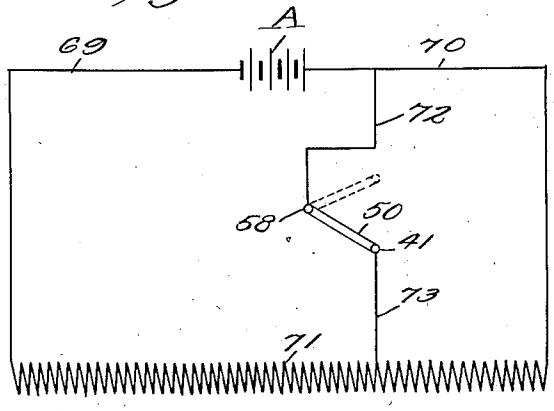
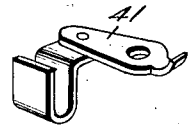


Fig. 14.



Inventor

Richard L. Fearn Jr.,

By Ch. Parker

Attorney

UNITED STATES PATENT OFFICE.

RICHARD L. FEARN, JR., OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO NATIONAL ELECTRICAL SUPPLY COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA, A CORPORATION OF VIRGINIA.

THERMALLY-CONTROLLED ELECTRIC SWITCH.

1,380,049. Specification of Letters Patent. Patented May 31, 1921.

Application filed February 12, 1920. Serial No. 358,251.

To all whom it may concern:

Be it known that I, RICHARD L. FEARN, Jr., a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Thermally-Controlled Electrical Switches, of which the following is a specification.

This invention relates to thermally controlled electrical switches, and it comprises a contact member, releasable means for maintaining the contact member in a fixed position, means for moving said contact member to a second position when said releasable means is operated, and a fusible alloy adapted to control the operation of the releasable member, said switch being manually operable to throw said contact member from its first position to its second position, all as more fully hereinafter set forth and as claimed.

At the present time, there are a number of thermally controlled electrical switches in use wherein a circuit is broken by the melting or fusing of an alloy when a predetermined temperature is reached. These devices are applicable for use as fire alarms and other types of signals wherein the melting or fusing of the alloy breaks a circuit or establishes one through a signal element, or wherein the fusible element separates or closes two contact members which are spring pressed toward or away from each other and which close or open a circuit when the fusible element melts. These devices are not applicable to a temperature regulator wherein the amount of current supplied or the amount of resistance in circuit may be varied when a predetermined temperature is reached.

In the present invention I have devised a switch which may be set to furnish a maximum amount of current, or a maximum quantity of heat, referred to herein after as "high heat" having means for automatically cutting off the portion of the current supplied (or a portion of the heat furnished) when a certain temperature is reached thus throwing the device into "low heat." The device is capable of manual operation and may be shifted from high heat to low heat at any time.

The contact member, which is thrown from one position to another when the switch is changed from high heat to low heat, is held in high heat position by suitable mechanism against the action of a spring. When a predetermined temperature is reached the fusible substance melts releasing the mechanism holding the contact member and permitting it to move to low heat position.

In the accompanying drawings I have shown several advantageous embodiments of this invention.

In this showing Figure 1 is a plan view of a rotary switch showing the contact member in high heat position to the left of the center.

Fig. 2 is a similar view showing the contact member in high heat position to the right of the center.

Fig. 3 is a transverse sectional view of the switch shown in Figs. 1 and 2.

Fig. 4 is a plan view of the inner face of the cover of the casing in which the alloy is placed.

Fig. 5 is a perspective view of a rotating disk which is arranged in the casing and surrounded by the alloy.

Fig. 6 is a diagrammatic illustration of the circuit used with this type of switch.

Fig. 7 is a plan view of another type of switch having a pivoted contact member.

Fig. 8 is a sectional view on the line 8—8 of Fig. 7.

Fig. 9 is a detailed perspective view of the operating lever.

Fig. 10 is a detail perspective view of the bearing member.

Fig. 11 is a detailed perspective view of the pivoted contact member.

Fig. 12 is a sectional view similar to Fig. 8 showing the switch in low heat position.

Fig. 13 is a transverse sectional view at right angles to Fig. 12.

Fig. 14 is a detailed perspective view of one of the contacts carried by the switch and Fig. 15 is a diagrammatic illustration of the circuit employed with this type of switch.

Referring to Figs. 1 to 6 of the drawings, in the form shown therein, the switch comprises a base 1 of insulating material in which is mounted a metallic casing 2 having a cover or closure 3. Within the casing there is arranged a rotating disk or plate 4 (see Fig. 5) provided with openings 5. The cover is provided with projections 6 ar-

ranged eccentrically of these openings. The casing is filled with a substance, preferably metal, 7 adapted to melt or fuse at a predetermined temperature. The alloy entirely surrounds the rotating plate as shown. The shaft 8 projects from the rotating disk and extends through the cover. As shown this shaft is provided with a squared end 9. Mounted on the face of the switch are a plurality of contacts 10, 11, 12 and 13. These contacts are adapted to be connected to the source of current in a manner to be described and are connected to each other by a movable contact member generally designated by the reference numeral 14.

As shown the movable contact member consists of a plate 15 rotatably mounted on the casing and secured thereto by screw 16. It is spaced therefrom by a spacing plate 17. Suitably secured to plate 15 are a pair of contact strips 18 and 19 separated from the remainder of the contact element by insulation 20. A strip of insulation 20′ is arranged beneath the contact strips. The center of the plate is cut away as shown and is adapted to receive a trip member 21 carried on the square end of the shaft 8. This trip member is provided with a spring finger 22 engaging shoulders 23 and 24 of the contact plate. A spring 25 is secured to the casing and to the contact plate, the spring being adapted to move the plate from the center position shown in full lines in Fig. 1 to the dotted line position illustrated in Fig. 6.

The connections and arrangement of the electrical circuit for employing a switch of this character are shown in Fig. 6 of the drawings. In this figure, a source of electric current is indicated by the letter "A" to which is connected a pair of conductors 26 and 27. These conductors are connected to the two contacts 13 and 10. Branch wires 28 and 29 are connected to the conductors, and electrical heating elements 30 and 31 are connected to these wires. The heating element 30 is connected to the contact member 11 by conductor 32 and the heating element 31 is connected to contact member 12 by conductor 33. When the contact member is in the full line position illustrated in Figs. 1, 2 and 6 of the drawing current passes through conductor 27, wire 29, heating unit 31, conductor 33, contact 12, contact strip 18 and contact 13 to the conductor 26. At the same time, current passes from the conductor 27 through contact 10, contact strip 19, contact 11, conductor 32, heating unit 30, and wire 28, thence to the conductor 26. The two heating units are thus in parallel taking a maximum amount of current and giving a maximum amount of heat. When the switch is operated, to move the contact plate to either the dotted line position illustrated in Fig. 1, or the dotted line position illustrated in Fig. 6, the contact strip 19 or 18, as the case may be, connects the contacts 11 and 12 and all other connections between the four contacts are broken. Under such conditions current flows from conductor 27 through heating unit 31 to the contact 12, through the contact strip 18 or 19 to contact 11, thence through the heating unit 30 to conductor 26. Under such conditions the two heating units are arranged in series, and the current reduced thereby furnishing a less amount of heat or "low heat."

In the form illustrated in Figs. 7 to 14 of the drawings, the base 34 receives the supporting member 35 which is made preferably of insulating material. Arranged between the base and the supporting member are a pair of diaphragms 36 and 37. These diaphragms are made of resilient or spring metal and are normally convex upon their upper surfaces. The alloy 38 is arranged between the diaphragms and a trip member 39 is secured to the upper face of the inner diaphragm. As shown, this member is provided with a beveled end 40. A pair of contacts 41 are suitably arranged upon the supporting member. The construction of the contacts is shown in detail in Fig. 14 of the drawings. The contact members are secured to the supporting member by screws 42. A lever 43 is pivoted in a bearing member 43′ secured to the supporting member. The construction of the bearing member is shown in detail in Fig. 10 of the drawings. This lever is provided with an arm 45 normally resting upon the beveled end 40 of the trip member. A spring 46 is secured upon a screw or bolt 47, carried by the supporting member. One end of the spring bears against the supporting member at 48 and the other end 49 bears against the arm 45. A contact strip 50 (see Fig. 11) is pivoted to the bearing member 43′. The bearing member is provided with a pair of ears 51, which are secured to the supporting strip by suitable fastening elements 52 passing through the supporting strip and through openings 53 formed in the ears. The body of the bearing member is cut away as at 54 to permit movement of the contact strip and the arms 55 and 56 of the contact strip are provided with openings 57 and 58 which are received on bearings 59 arranged on the bearing member. The operating lever is provided with an extension 60 the end of which is slotted at 61. The extension is further provided with an opening 62 arranged in alinement with the slot. A pin 64 is arranged within the contact strip 50, the outer end of the pin passing through an opening 65. A coiled spring 66 is arranged between the contact strip and a collar 67 slidably mounted on the pin. The end of the pin is forked and the forked ends 68 are received in the slot 61 and opening 62 of the operating

lever. The connection between the pin and the operating lever is eccentric of the pivots of the contact strip 50 so that when the operating lever is moved upon its pivot the spring 66 is compressed until the inner end of pin 64 passes the center line of the pivot. When the lever is moved farther, the contact strip is thrown from the position illustrated in Fig. 12 of the drawings, to the position illustrated in Fig. 8, closing the circuit between the two contacts 41.

The electric circuit used in connection with this type of switch is diagrammatically illustrated in Fig. 15 of the drawings. In this figure the letter "A" represents a source of current to which are connected conductors 69 and 70. These conductor members are connected to the opposite ends of a heating unit 71. When the current passes from the source of current "A" through conductor 69, heating unit 71, and through conductor 70 to the source of current, the maximum resistence is in circuit reducing the current, giving low heat. The contact strip 50 is then in the position shown in Fig. 12 of the drawings, the arm 45 having been released from the trip member 39. The contact members 41 are diagrammatically illustrated in Fig. 15 and the movable contact 50 is diagrammatically illustrated as a switch arm. Contacts 41 are connected to the conductor 70 and to a point between the two ends of the electrical heating unit 71 by conductors 72 and 73 respectively. When the contact strip 50 is in the full line position illustrated in this view corresponding with Fig. 8 of the drawings, a portion of the heating unit is cut out, thus increasing the current in the heating unit and increasing the degree of heat.

The operation of the form shown in Figs. 1 to 6 of the drawings is as follows:

When the switch is in the position illustrated in Fig. 1 of the drawings, spring 25 tends to move the contact plate 14 and its associated parts to the position shown in dotted lines in Fig. 6 of the drawings. This is prevented by the engagement of shoulder 24 and finger 22. When the degree of heat reaches the predetermined point and alloy 7 is melted, the contact plate 14 and the rotating disk are moved to the dotted line position shown in Fig. 6 by the action of spring 25. This movement breaks the connection between the contacts 10 and 11 and between the contacts 12 and 13 and establishes connection between contacts 11 and 12 by contact strip 18. The heating units 30 and 31 are then arranged in series reducing the current and furnishing a low degree of heat. When the alloy melts and the contact plate 14, and the spring 25, revolve, the trip member 21 is moved from the position illustrated in Fig. 1 of the drawings to the position illustrated in Fig. 2 of the drawings by the pressure exerted upon the spring finger 22 due to its engagement with shoulders 24. This rotates the disk 4 which is freely rotatable when the alloy is melted.

When the switch is again set for high heat, the spring finger 22 bears against shoulders 23 as shown in Fig. 2 of the drawings overcoming the pressure of the spring 25 which tends to move the contact plate 14 to the dotted line position shown in Fig. 1. The alloy 7, being solid until the predetermined temperature is reached, prevents rotation of disk 4 and thus holds the parts in set position. However, when the alloy melts the resistance to the pressure of the spring 25 is removed and the contact plate 15 is moved to the right or left, as the case may be, to break the connections between the pairs of contacts at each side and establish connection between the center contacts.

The device is manually operable at all times to change the switch from one position to the other. A suitable handle 100 is attached to the contact plate 15 and this plate is freely movable on its pivot 16, independently of the rotating disk. When the switch is in the high heat position shown in Fig. 1 and it is to be changed to low heat the plate 15 is rotated to the dotted line position. To return to high heat the operation is reversed. When the switch is in the position shown in Fig. 2, it may be readily changed to the low heat position shown in dotted lines in Fig. 6 by rotating the disk in the opposite direction and may be readily returned to high heat position.

In the form shown in Figs. 7 to 15 of the drawings, spring 46 normally tends to force arm 45 downwardly to the position illustrated in Fig. 12 of the drawings, to break the connection between the contacts 41 which short circuit part of the heating unit. The diaphragms 36 and 37 are made of spring material and are normally convex upon their upper faces as illustrated in Fig. 13 of the drawings. When the switch is set as illustrated in Figs. 7 and 8 of the drawings, the pressure of spring 46 is transmitted to the diaphragms through the trip member 39. At normal temperature, the alloy 38 is hard and the pressure of spring 46 is resisted. However, when the predetermined temperature is reached and the alloy melts, the pressure causes the diaphragms to give inwardly, permitting the trip member to move sufficiently to release arm 45. When this occurs, the contact member 50 is moved to the position illustrated in Fig. 12 of the drawings, breaking the connection between the contacts 41 and throwing the entire resistance unit 71 into circuit. When the entire resistance unit is in circuit the current is decreased thus decreasing the degree of heat.

This switch is also manually operable to

permit change from high heat to low heat or vice versa at any time. As shown, the trip member 39 is provided with a beveled end 40 which engages the beveled end of arm 45 with sufficient force to overcome the action of spring 46. However, if additional pressure is applied to lever 43, the arm 45 will be moved past the trip member 39 and contact strip 50 moved from the position shown in Fig. 8 to the position shown in Fig. 12, and it may be returned to high heat position by forcing the arm 45 past the trip member 39 and seating in on the beveled end 40.

From the above description of the construction and operation of these two forms of my invention, the principle will be readily understood. The invention is not limited to the two forms herein illustrated, but various different types of switches may be employed. The arrangement of contact members in each form of the invention and the connections to the electric circuit and heating units form no part of the invention as such arrangements are optional and the same results can be obtained with many different constructions. The invention herein described consists of a thermally controlled switch having a contact member adapted to assume either one of two positions with releasable means for maintaining said contact member in one of said positions and means for moving said contact member to the second position, together with thermally controlled means for controlling said releasable means, the switch being manually operable and being resettable.

It is understood that the term "alloy" as used herein, is not limited to its ordinary meaning, but includes any composition or material, metal or non-metal which is solid at normal temperatures and has a melting point substantially the same as the degree of heat desired. Thus, the casing may be filled with paraffin, wax or similar materials and a pure metal, such as lead, may be employed instead of an alloy.

The various uses to which the switch may be adapted are too numerous to mention but it is especially adapted for use in connection with electric heating devices wherein an initial high heat is desired to raise the temperature of the material being heated, and a constant supply of heat of a lesser degree is desired to maintain the material at the proper temperature during continued heating.

The device may be employed as a temperature regulator in a room, the coils 30 and 31 or the coil 70 being used to heat the room, and the alloy or other substance being of a composition that will melt at the temperature at which the room is to be maintained. If the room is cold the device is arranged for high heat and the coils are of sufficient capacity to raise the temperature in the room. When the desired temperature is reached, the alloy melts and the device is thrown into low heat furnishing just sufficient heat to maintain the temperature of the room at the desired point.

The device may also be employed in connection with various types of electrical heating apparatus such as glue pots, domestic cookers, etc. Such devices are generally made double-walled with the heating coils arranged between the walls. The switch is best arranged so that it will be subject to the same degree of heat as the contents of the vessel. When the material heated is raised to the proper temperature by the high heat arrangement, the alloy is melted and the switch moves automatically to low heat.

In either of the instances mentioned, it is necessary to place the switch where it will be subjected to the same temperature as the device or object being heated, to properly function.

What I claim is:

1. A resettable, thermally controlled switch comprising a base, a casing carried by the base, a fusible alloy arranged in said casing, said alloy being solid at normal temperature, a contact member arranged on said base, releasable means for maintaining said contact member in one position, and means for moving said contact member to a second position, said releasable means being adapted to release said contact member when said alloy fuses.

2. A resettable, thermally controlled switch comprising a base, a casing carried by the base, a fusible alloy arranged in said casing, said alloy being solid at normal temperature, a contact member arranged on said base, releasable means for maintaining said contact member in one position, means for moving said contact member to a second position, said releasable means being adapted to release said contact member when said alloy fuses, and manually operated means for moving said contact member from its first position to its second position.

3. A resettable, thermally controlled switch comprising a base, a casing carried by the base, a fusible alloy arranged in said casing, said alloy being solid at normal temperature, a contact member arranged on said base, releasable means for maintaining said contact member in one position, and a spring for moving said contact member to a second position, said releasable means being adapted to release said contact member.

4. A resettable, thermally controlled switch comprising a base, a casing carried by the base, a fusible alloy arranged in said casing, said alloy being solid at normal temperature, a contact member arranged on said base, a trip member mounted on said casing and adapted to engage said contact member to

maintain it in one position, and means for moving said contact member to a second position, said means being adapted to release said contact member.

5. A thermally controlled switch comprising a base, a casing carried by the base, a rotatable member arranged within the casing, an alloy arranged in the casing and entirely surrounding said member, said alloy being solid at normal temperature, a shaft projecting from said rotatable member and extending through the casing, a plurality of contacts arranged on the face of the casing, a rotatable contact member arranged on said casing, contact strips carried by said contact member and adapted to connect said contacts, a spring secured to the casing and to said rotatable contact member, and a trip member arranged on the end of said shaft and engaging said movable contact member to prevent rotation when said alloy is solid.

6. A thermally controlled switch comprising a base, a casing carried by the base, a rotatable disk arranged within the casing, an alloy arranged in the casing and entirely surrounding said disk, said alloy being solid at normal temperature, a shaft projecting from said rotating disk and extending through the casing, a plurality of contacts arranged on the face of the casing, a rotatable contact member secured to the face of the casing, contact strips carried by said rotatable contact member and adapted to connect said contacts, a spring secured to the casing and to the contact member, and a trip member arranged on the end of said shaft engaging said movable contact member to prevent its rotation when said alloy is solid.

In testimony whereof I affix my signature in the presence of two witnesses.

RICHARD L. FEARN, JR.

Witnesses:
CHAS. O. REED,
W. M. JEWELL.