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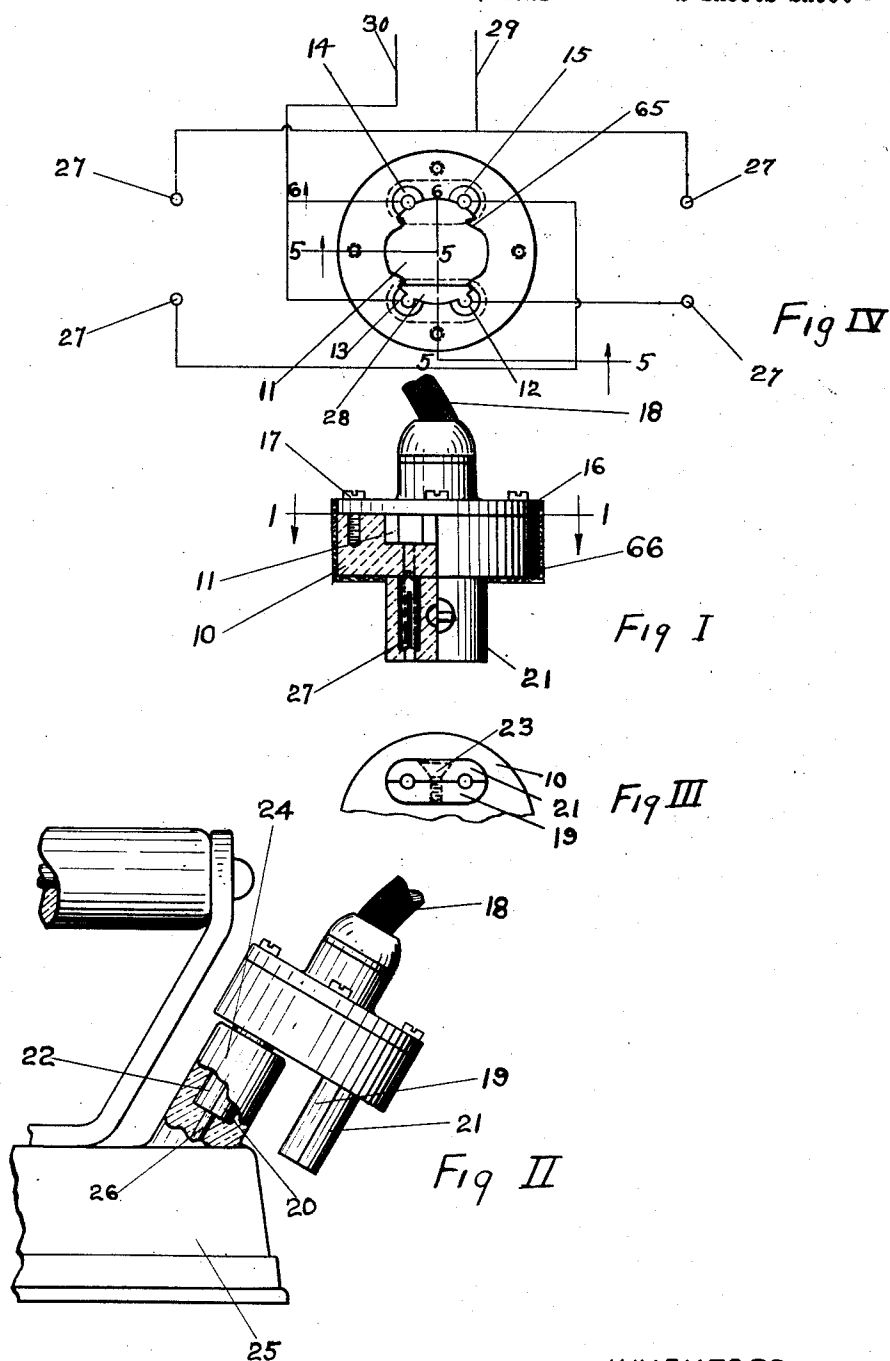
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R. S. BLAIR ET AL

TEMPERATURE CONTROLLED SWITCH

Filed June 8, 1921

2 Sheets-Sheet 1



INVENTORS

Robert S. Blair
Burling D. Wells.

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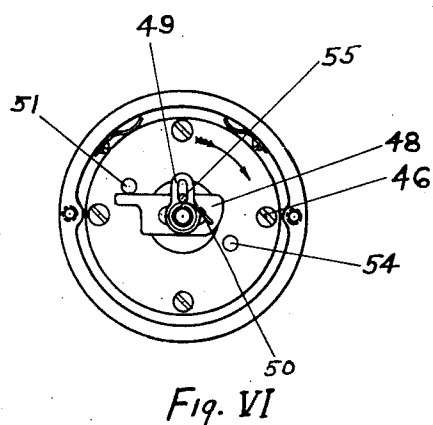
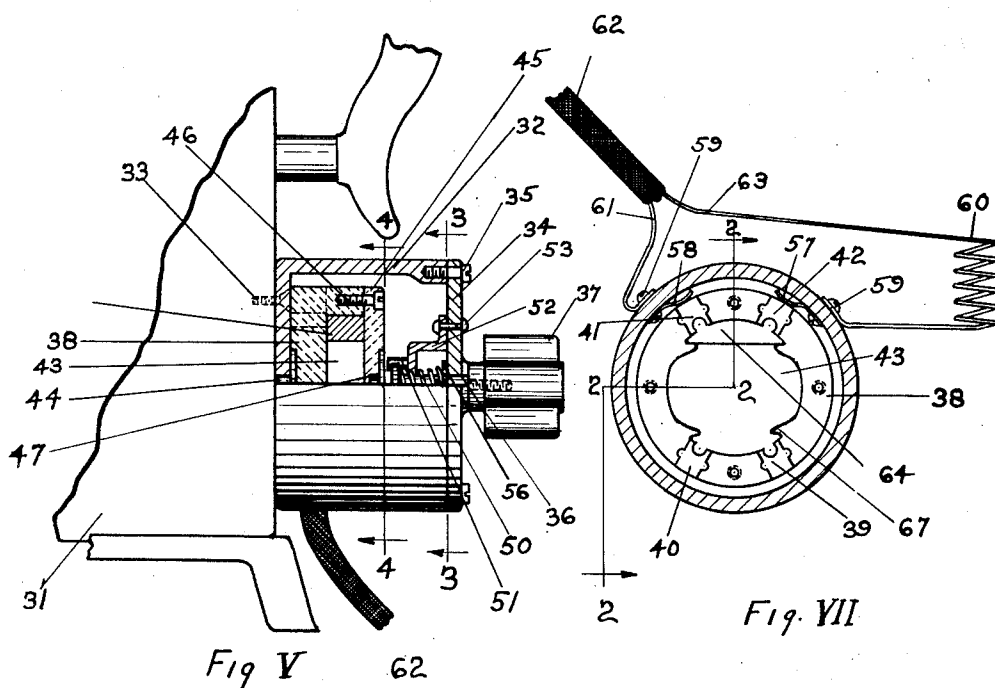
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Robert S. Blair
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UNITED STATES PATENT OFFICE.

ROBERT S. BLAIR, OF SOUND BEACH, AND BURLING D. WELLS, OF DANBURY, CONNECTICUT; SAID WELLS ASSIGNOR TO SAID BLAIR.

TEMPERATURE-CONTROLLED SWITCH.

Application filed June 8, 1921. Serial No. 475,945.

To all whom it may concern:

Be it known that we, ROBERT S. BLAIR and BURLING D. WELLS, citizens of the United States, and residing at Sound Beach and Danbury, respectively, in the county of Fairfield and State of Connecticut, have invented a new and Improved Temperature-Controlled Switch, of which the following specification is a full disclosure.

10 This invention relates to fusible switch construction and with regard to certain features more particularly to switches containing a fusible element suitable for use on electrically heated appliances such as percolaters and flat irons.

One of the objects thereof is to provide a fusible switch simple in construction and reliable in operation. Another object is to provide an automatic switch to safeguard from overheating electric flat irons and similar electrically heated appliances which due to their construction will overheat if the electric current is supplied to them for too long a period of time. Another object is to construct an automatic switch to prevent the overheating of electrically heated appliances such as percolaters, egg boilers and similar appliances used for heating liquids should the liquid contained therein entirely evaporate while heat is being applied, by cutting off the supply of electric current after a maximum temperature has been attained. Another object is to provide a fusible switch which will automatically prevent the continued application of too great an electric current for too long a time to an electrically heated appliance by interrupting the circuit at the proper moment. Another object is to provide a fusible switch which can be turned on again a short time after it has automatically interrupted the electric circuit and not require renewal of any of its elements in so doing. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly consists in the features of construction, combinations of elements and arrangements of parts which will be exemplified in the structure hereinafter described and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings in which is shown one of the various possible embodiments of this invention, Figure I is a

side elevation of a plug connection such as is commonly used for connecting flexible electrical conductors to flat irons and other electrically operated appliances, part of the plug body being broken away along the line 5, 5, 5, 5 and a part of one of the plugging pieces thereon being broken away along the line 5, 5, 5, 6, 6, the view being taken in the direction as shown by the arrows in Figure IV. Figure II is a side elevation of the attachment end of an electric flat iron showing the plug connection shown in Figure I inserted into the receptacle of the electric flat iron. Figure III is a plan view of one of the plug extensions of the plug connection shown in Figure I the view being taken looking upward towards the bottom. Figure IV is a diagrammatic representation of the plug body in plan showing the internal connections of the plug connection shown in Figure I, the view being taken along the line 1—1 in the direction as indicated by the arrows. Figure V is a side elevation of the lower part of an electrically heated cooking utensil having attached thereto a fusible switch, a section of the casing and of the internal mechanism having been broken away along the line 2—2 in Figure VII to enable a clear view of the internal mechanism of the fusible switch, the view being taken in the direction as indicated by the arrows in Figure VII. Figure VI is a right hand end elevation in section of the fusible switch shown in Figure V, the section being taken along the line 3—3 in the direction as indicated by the arrows in Figure V. In Figure VII there is shown a right hand end elevation in section of the fusible switch shown in Figure V the section being taken along the line 4—4 in the direction as indicated by the arrows. The heating element of the cooking utensil shown in Figure V is diagrammatically represented by the small coil shown in Figure VII.

Similar reference characters refer to similar parts throughout in the several views of the drawings.

Turning now to Figure I we have at 10 a plug body made of heat resisting material which at the same time must be non-conductive to electric currents, provided with a circular recess 11 in its upper end and inserted in the plug body 10 around the circumference of the circular recess 11

are four metal inserts such as 12 and 13, 14 and 15 the surfaces of which are flush with the surface of the circular recess 11 and the upper surface of the plug body 10 as shown in Figures I and IV. A layer of asbestos 66 insulates the plug body 10 from external heat. As shown in Figure IV the metal inserts 12, 13, 14 and 15 are provided with depressions opening into the circular recess 11, the depressions are so formed that any material which may be cast into them would be securely gripped therein upon solidifying due to the fact that the overall dimensions of the depressions are greater at the center of the metal inserts than at the point at which the depressions connect with the circular recess 11. The cover plate 16 constructed of material similar to that used in the plug body 10 is secured to the upper surface of the plug body 10 by screws such as 17 which are tapped into holes in the plug body 10. Thus when the cover plate 16 is securely screwed down upon the plug body 10 the circular recess 11 becomes practically air and dust tight. The cover plate 16 serves as an anchorage for the flexible cord 18 through which electric current is supplied to the apparatus. Turning now to Figure II it will be seen that the lower end of the plug body 10 is provided with two plugging pieces 19 and 20 the inner halves of these plugging pieces are integral with the plug body 10 and have two detachable halves 21 and 22 secured to their outer surfaces by means of screws such as 23. The plugging pieces 19 and 20 are so shaped so that when the removable pieces 21 and 22 are screwed thereon the assembled member is of such shape as to readily be inserted into a receptacle 24 on the electrically heated flat iron 25. The receptacle 24 on the electrically heated flat iron 25 is provided with a pair of metal projections such as 26 which slip into a pair of corresponding recesses in the end of the plugging piece 20 and frictionally engage and make electrical contact with the pair of metal sleeves such as 27 which are retained in recesses within the plugging pieces 20 and 19. These metal sleeves such as 27 are split so as to make use of the elasticity of the material of which they are constructed when they are pressed into connection with the metal projections 26 in the receptacle 24 and as their diameter is greater than the diameter of the hole in the end of the plugging pieces 20 and 19 leading to the recess in which they are retained it is impossible for them to be removed from the recess except by removing the screws 23 and thus taking off the removable pieces 21 and 22 from the plugging pieces 19 and 20 thus releasing the metal sleeves such as 27. The construction of metal sleeves 27 and their method of insertion in the plugging pieces 19 and 20 is clearly shown in Figure I. Turning now to Figure IV which shows the manner in which the metal sleeves 27 in the ends of the plugging pieces 19 and 20 are connected to the metal inserts 12, 13, 14 and 15 in the plug body 10 and to the flexible cord 18 which is anchored in the cover plate 16. The metal inserts 12, 13, 14 and 15 are arranged symmetrically with respect to a line passing through the center of the circular recess 11 in the plane of the paper in the drawing of Figure IV, that is with the center line just mentioned passing directly above the two plugging pieces 19 and 20 and midway between the recesses in which the metal sleeves 27 are enclosed. As is to be seen in Figure IV the two inserts 12 and 13 which are directly above one of the plugging pieces 20 which are on the lower side of the plug body 10 and are at a lesser distance apart than the distance between their centers and the centers of the other pair of metal inserts 14 and 15 which are above the other plugging piece. A small mass of easily fusible metal 28 such as an alloy of antimony, bismuth and lead sufficient in quantity when fused and resting in the lower part of the circular recess 11 as shown in Figure IV to extend from the metal insert 12 to the metal insert 13 and upon solidifying in this position form a firm mechanical and electrical connection between them by virtue of being securely dovetailed into the recesses therein, projections such as 65 on the inside surface of the circular recess 11 insure that the bridge of fusible metal between the pair of metal inserts 12 and 13 must thoroughly fuse before breaking the circuit. The two conductors 29 and 30 of the flexible cord 18 are connected to the internal mechanism of the plug body 10 as follows: The conductor 30 is connected to the two left hand metal inserts 13 and 14 while the other conductor 29 is connected to one of the metal sleeves 27 in each of the two plugging pieces 19 and 20, the relationship of the two metal sleeves such as 27 to the plugging pieces 19 and 20 is as shown in Figure IV. The other metal sleeve 27 in the left hand plugging piece is connected to the metal insert 15 and the remaining metal sleeve such as 27 in the right hand plugging piece is connected to the insert 12. From the connections shown in Figure IV it will be seen that whenever one of the plugging pieces 19 and 20 is inserted into the receptacle 24 on the electrically heated flat iron 25 that closed electric circuit will be formed with the heating element contained therein and the flexible cord 18 provided that the plugging piece which is inserted into the receptacle 24 is the one which is in circuit with the pair of metal inserts 12 and 13

shown in Figure IV which are electrically connected to each other by the mass of easily fusible metal 28. The air space between the casing 32 and cylindrical casing 38 serves as insulation against external heat.

Turning now to Figure V we have attached to the base of the electrically heated cooking utensil 31 a casing 32 made of material possessing a high thermal conductivity by means of flat headed screws such as 33 tapped into the body of the electrically heated cooking utensil 31. On the open end of the casing 32 there is secured a cover plate 34 by means of screws such as 35 tapped into the body of the casing 32 and journaled into the cover plate 34 perpendicular to the plane of the two parallel surfaces is keyshaft 36 on the outer end of which is threaded a button 37 made of insulating material, the keyshaft 36 is provided with a shoulder at the end of the threaded portion at its right hand end which shoulder the button 37 screws up against thus becoming locked upon the keyshaft 36 whenever the button 37 is turned in a clockwise direction as the end of the keyshaft 36 is provided with a right hand screw thread, the direction of rotation is that as described when looking at the apparatus shown in Figure V from the right hand side. A cylindrical casing 38 made of insulating material which has a high thermal conductivity is provided with a circular recess 43 in one face thereof and four fuse terminals 39, 40, 41 and 42 are cast into the walls of the cylindrical casing 38 with their inner ends in line with the sides of the circular recess 43 and their outer ends forming a part of the exterior surface of the cylindrical casing 38 which is provided with a stub shaft 44 which is cast into the left hand face thereof and a projecting end thereof journaled into the casing 32 and serves as a bearing supporting the cylindrical casing 38 in the casing 32. The cylindrical casing 38 has secured to the face which contains the circular recess 43 a plate 45 by means of screws such as 46 tapped into the body of the circular casing 38 and a metal insert 47 is cast into the outer surface of this plate and so located that a rectangular slot which lies in the part of the metal insert 47 where it projects beyond the outer surface of the plate 45 containing a slotted latch 48 has its center in line with the center of the stub shaft 44 and the keyshaft 36. The keyshaft 36 is journaled at its left hand end in the metal insert 47 in the plate 45 and has coiled concentrically thereon in between the cover plate 34 and arm 49 which is integral with the keyshaft 36, a spiral spring 50 the right hand end of the spiral spring 50 is passed through a hole in the keyshaft 36 and its other free end is hooked into a hole in the slotted latch 48. The slotted latch 48

has a slot located in the center of its surface with the width of the slot just sufficient to allow the keyshaft 36 to freely pass there-through and of sufficient length to allow the slotted latch 48 to slide over to the right far enough so that the left hand end of it will clear the stud 51 which is mounted in the bracket 52 riveted to the cover plate 34 by rivets such as 53. A second stud 54 is located diametrically opposite from the stud 51 and at the same distance from the center of the keyshaft 36. The arm 49 has a slot at its outer end radially arranged and engaging with a stud 55 in the slotted latch 48 which is clearly shown in Figure VI. The spiral spring 50 reacting against a washer 56 which is placed around the keyshaft 36 in between the ends of the spiral spring 50 where it passes through the hole in the keyshaft 36 and the cover plate 34, presses the arm 49 and the keyshaft 36 of which it is a part over to the left as shown in Figure V and pressing the arm 49 up against the slotted latch 48 securely holds it and the keyshaft 36 in their proper places in the metal insert 47.

Turning now to Figure VII we have two metal contacts 57 and 58 secured to the inner surface of the casing 32 by the bolts such as 59 which at their outer ends are connected with the end of the heating unit 60 of the electrically heated cooking utensil 31 and one of the conductors 61 of the flexible cord 62, the other conductor 63 of the flexible cord 62 is connected to the other end of the heating unit 60. In the recess 43 in the circular casing 38 there is contained a mass 64 of easily fusible metal which is shown in Figure VII solidified in contact with the fuse terminals 41 and 42 by reason of having solidified in the grooves in the inner ends of these fuse terminals, projections such as 67 make certain that the mass of fusible metal 64 must thoroughly fuse to break the circuit.

The action of the two forms of fusible switch as above described is substantially as follows: Turning now to Figure II which shows a fusible plug connection inserted into the receptacle 24 on the electrically heated flat iron 25, the two metal projections such as 26 extending up through the two openings in the plugging piece 20 form frictional electrical contact with the metal sleeves 27 which are retained in the recess in the plugging piece 20 as shown more clearly in Figure I. If electrical current is now supplied to the flexible cord 18 it will be transmitted to the mass of fusible metal 28 enclosed in the recess 11 in the body of the plug connection 10 and thence to the heating element contained in the electrically heated flat iron 25 by way of the connection formed between the metal sleeves 27 and the two metal projections such as 26 providing that the proper plugging piece which may be either 19 or 20 has

been inserted into the receptacle 24. The path of the current in passing through the fusible plug connection is more clearly shown in Figure IV and is substantially as follows: As will be seen by observation of the diagram of connections as shown in Figure IV there is a mass of fusible metal 28 in contact with the metal inserts 12 and 13 and forming a good path for the electric current between the two metal inserts 12 and 13. The left hand insert 13 is connected directly to the conductor 30 which is one of the conductors of the flexible cord 18 while the right hand insert 12 is connected to one of the sleeves such as 27 which lies in one of the plugging pieces 19 or 20. The apparatus has been so designed that the two metal inserts 12 and 13 which are bridged over by the mass of fusible metal 28 lie immediately above the plugging pieces which should be inserted into the receptacle 24 on the electrically heated flat iron 25 in order to supply current to it which in this case is the plugging piece 20. The other metal sleeve such as 27 which is located in the plugging piece 20 and which is diagrammatically represented at the right hand of the diagram in Figure IV is connected directly to the other conductor 29 in the flexible cord 18. From the above diagram as described it will be seen that with the plugging piece 20 inserted into the receptacle 24 on the electrically heated flat iron 25 there is a closed electric circuit leading from the conductor 30 to the metal insert 13 thence across to the metal insert 12 through the bridge formed by the mass of fusible metal 28 and thence to the metal sleeve 27 which is located in the plugging piece 20 and thence over the heating elements in the electrically heated flat iron 25, which heating element is not shown in the drawing and from there back to the other metal sleeve 27 and therefrom to the other conductor 29 of the flexible cord 18. Returning now to Figure II it will be seen that the plug body 10 of the apparatus above described slopes downwardly towards the right so that whenever the mass of fusible metal 28 which is located in the upper end of the recess 11 in the plug body 10 becomes molten will tend to flow downward into the lower part of the recess 11 and solidify there in contact with the other pair of metal inserts 14 and 15 which lie immediately above the plugging piece 19. If for any reason the temperature of the electrically heated flat iron 25 increased to a point above which it is safe the plug body 10 and the receptacle 24 will also become quite hot due to the conduction of heat from the body of the electrically heated flat iron 25 thereto through the receptacle 24 which has been designed with very heavy walls to facilitate the conduction of the heat therefrom to the plug body 10 and the metal projections 26. The temperature which the plug body 10 reaches will always be somewhat below the temperature of the electrically heated flat iron 25 due to the time required for the heat to travel to it through the receptacle 24 and the plugging piece 20 but the mass of fusible metal 28 has been chosen of such composition that it will fuse and break the electrical connection between the metal inserts 12 and 13 whenever the electrically heated flat iron 25 assumes a temperature beyond which it is desired that the temperature shall not increase. The recess 11 may be made very nearly air tight in the construction as shown in Figure I, thus there will be slight tendency for the mass of fusible metal 28 contained therein to oxidize after it becomes molten. The mass of fusible metal 28 having become molten and having run down into the lower end of the recess 11 it will solidify there forming electrical contact between the other pair of metal inserts 14 and 15 as the electrically heated flat iron 25 cools off permitting the plug body 10 to cool off also now that the electric circuit has been interrupted and no more current is supplied. It is quite probable during the use of the above described electric flat iron that the user will not notice that the circuit has been broken and that the electrically heated flat iron is cooling off for quite an appreciable time thus permitting the mass of fusible metal 28 to become thoroughly solidified, but when the user finally does perceive that the electrically heated flat iron 25 is cooling off the user will by withdrawing the plugging piece 20 from the receptacle 24 and inserting the other plugging piece 19 therein re-establish the supply of current continuing the use thereof as long as may be desired. From the above it will be seen that there is provided a fusible switch which will automatically break the circuit whenever the temperature of the article to which it is attached becomes too great but will not interrupt the circuit during the use of the article described as the temperature of the electrically heated flat iron will not usually become too great as long as it is used for pressing damp articles but should it be set aside upon its stand for an appreciable length of time the temperature will rapidly increase and the fusible switch will interrupt the circuit thus protecting the apparatus from damage due to overheating. Turning now to Figure V which shows a switch containing a fusible element mounted upon the base of an electrically heated cooking utensil such as 31 and to Figure VII which shows the circular casing 38 which contains a mass of fusible metal 64 which bridges over the space between the terminals 41 and 42 and in connection with the metal contacts 58 and 57 in contact therewith and the bolts such as 59, a closed electric circuit is formed therethrough

and the flexible cord 62 and the heating unit 60 contained in the electrically heated cooking utensil 31. The composition of the mass of fusible metal 64 has been chosen so that the temperature which it and the circular casing 38 and the other parts of the fusible switch attain by conduction of heat thereto from the electrically heated cooking utensil 31 is not sufficient to fuse it during the normal operation thereof. If now the liquid contents of the electrically heated cooking utensil 31 should entirely evaporate or dry up the temperature thereof will immediately begin to increase now that the heat required to evaporate the contents thereof is no longer required to supply the latent heat of vaporization and is now available for increasing the temperature of the metal parts of the electrically heated cooking utensil 31 itself. The temperature of the mass of fusible metal 64 and the other parts of the fusible switch mounted on the electrically heated cooking utensil 31 will also increase due to conduction of heat thereto and upon the temperature having reached that degree which is sufficient to fuse the mass of fusible metal 64 it will become molten and falling away from the terminal pieces 41 and 42 will drop down into the lower part of the recess 43 and bridge across the space between the terminals 39 and 40. The electrical circuit through the heating unit 60 having been interrupted the apparatus will at once begin to cool off and having cooled off to the temperature of solidification of the mass of fusible metal 64 a solid connection will be formed between the metal terminals 39 and 40. The user of the electrically heated cooking utensil 31 having noticed that the current has been cut off therefrom and having replaced the liquid contained therein can restore the supply of current thereto by turning the switch button 37. The switch button 37 in turning turns the shaft 36 whereon it is mounted and winds up the spring 50 by reason of one end being inserted through a hole in the shaft 36 while the other end thereof is held by reason of being inserted through a hole in the slotted latch 48 which is prevented from turning by engaging with the pin 51 which is securely fixed in the bracket 52 riveted to the inside of the cover plate 34 by the rivets such as 53. The shaft 36 continuing to turn the lever 49 fastened thereon will turn clockwise and draw the slotted latch 48 over to the right by reason of the slot in the lever 49 engaging with the pin 55 mounted in the latch 48 and having moved the slotted latch over to the right sufficient to clear the pin 51 the slotted latch 48 will revolve in a clockwise direction until it fetches up against the pin 54 which lies diametrically opposite the pin 51 the circular casing 38 revolving therewith during its half of a

revolution. The direction of rotation of the shaft 36 and the switch button 37 is that as shown by the arrows in Figure VI. Turning now to Figure VII it will be seen that one half revolution of the circular casing 38 will bring the other pair of metal terminals 39 and 40 into contact with the metal connections 58 and 57 thus restoring the electric circuit through the heating unit 60, and the flexible cord 62 by reason of the mass of fusible metal having solidified as above described in the contact with the pair of metal terminals 39 and 40. Under this condition of affairs it will be seen that the apparatus is ready for further use and that no matter how many times the mass of fusible metal 64 may fuse and interrupt the circuit the switch button 37 may be turned after the electrically heated cooking utensil has cooled down to that point which permits the mass of fusible metal 64 to re-solidify and be ready for further use.

As various possible embodiments might be made of the above invention and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In electrical apparatus, in combination, an electrically heated device, a fusible member adapted to be heated from the heat of said device means adapted to cut down the current to said device upon said member being fused and means holding said fusible member in position until thoroughly fused.
2. In electrical apparatus, in combination, an electrically heated device, a fusible member adapted to be heated from the heat of said device and means adapted to cut down the current to said device upon said member being fused, said fusible member being arranged in electrical circuit with said device and being interlocked with the parts with which it contacts to aid in supporting it.
3. In electrical apparatus, in combination, a fusible member arranged in the electrical circuit means adapted to rearrange the metal of said member in circuit after it has fused and broken said circuit and a casing enclosing said fusible member comprising heat-insulating means adapted to reduce the escape of the heat therefrom, said fusible member being positioned to be exposed to the heat generated by the apparatus.
4. In electrical apparatus, in combination, an electric circuit comprising a plurality of contacts, a fusible member between two of said contacts adapted upon fusing to disconnect said contacts and form a connection.

tion between contacts not completing the circuit and a device adapted upon actuation to rearrange said last contacts in circuit.

5. In electrical apparatus, in combination, an electrically heated device, a fusible member included in the circuit of said device and positioned to be affected by the heat from said device, means adapted to receive the metal of said member after fusing and a device adapted upon actuation to replace the solidified metal in circuit.

6. In electrical apparatus, in combination, a switch comprising a fusible member and a recess adapted to receive the metal of said member upon fusing and interrupting said circuit, said switch being adapted to restore said circuit by replacing the solidified metal therein.

7. In electrical apparatus, in combination, a rotary switch comprising two pair of contacts, one arranged above the other, means adapted alternatively to bring said pairs of contacts into the circuit of said switch, a fusible member connecting the upper pair of contacts whereby the circuit may be made and broken by operating said switch, said member upon fusing being adapted to fall into bridging relation to the other pair of contacts and break the circuit between the pair which it bridged before fusion.

8. In electrical apparatus, in combination,

an electrically heated device, a device adapted upon operation to make and break the circuit thereof, said last device comprising a fusible member within the range of heat of said first device and adapted upon fusion to interrupt the circuit thereof.

9. In electrical apparatus, in combination, an electrically heated device, a switch comprising a plurality of contacts, two of which are bridged by a fusible member within the range of heat of said device, said fusible member being adapted upon fusion to fall into a position bridging contacts out of circuit with said device, said last contacts being adapted to be inserted in the circuit of said device by the action of said switch after solidification of said fusible member.

10. In electrical apparatus in combination, an electric circuit comprising a plurality of contacts, and a fusible member between two of said contacts adapted upon fusing to disconnect said contacts and form a connection between others of said contacts not arranged in the circuit, said several contacts being shaped to interlock with said fusible member and support it.

In witness whereof, we hereunto subscribe our names.

ROBERT S. BLAIR.
BURLING D. WELLS.