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(58) Field of search
H1N
H5H

(54) Thermally-sensitive controls

(57) A thermally-sensitive control 1 for an electric heater (not shown) of a container such as an electric kettle or hot water jug includes switch means 18,20 adapted to disable the heater in response to operation of a snap-acting bimetallic actuator 28 consequent upon overheating of the element of the heater such as may occur for example when there is insufficient liquid in the container to cover the element. As an additional safety measure, the control 1 further comprises a slow acting creep bimetal 200 coupled to the switch means and operable to disable the heater upon serious overheating of the element consequent upon failure of the snap-acting actuator 28 in an overheat condition.

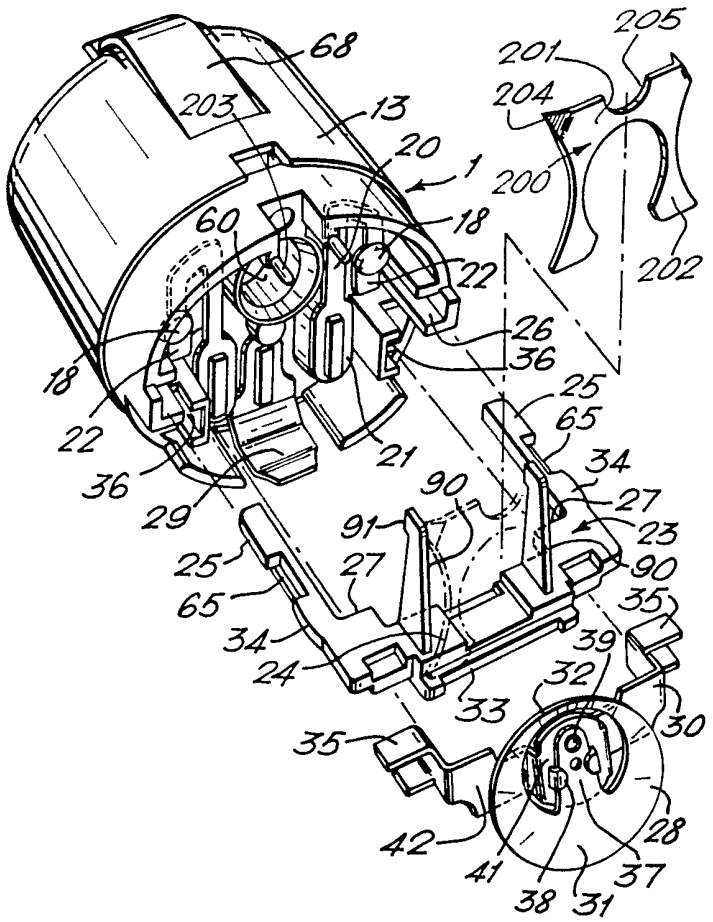

FIG.1.

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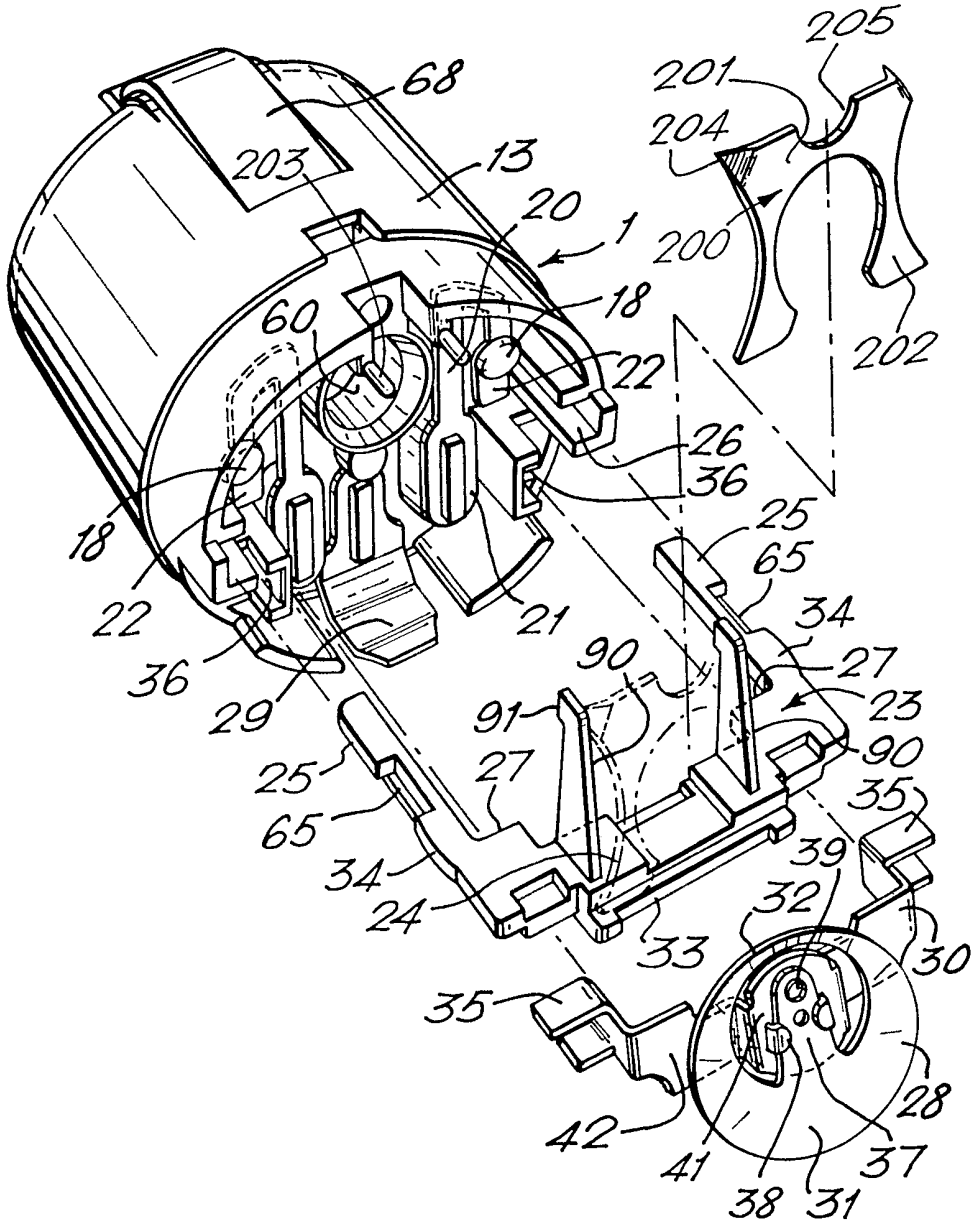
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FIG.1.

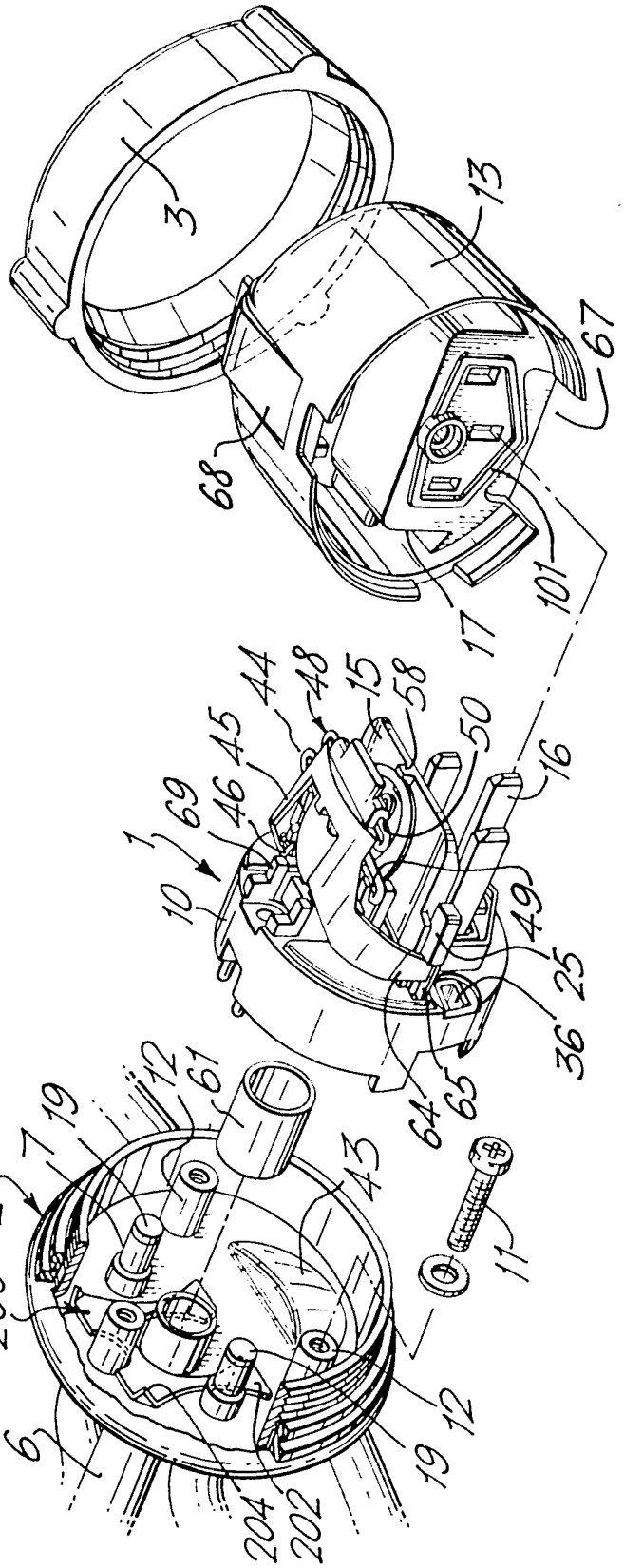
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FIG.2.

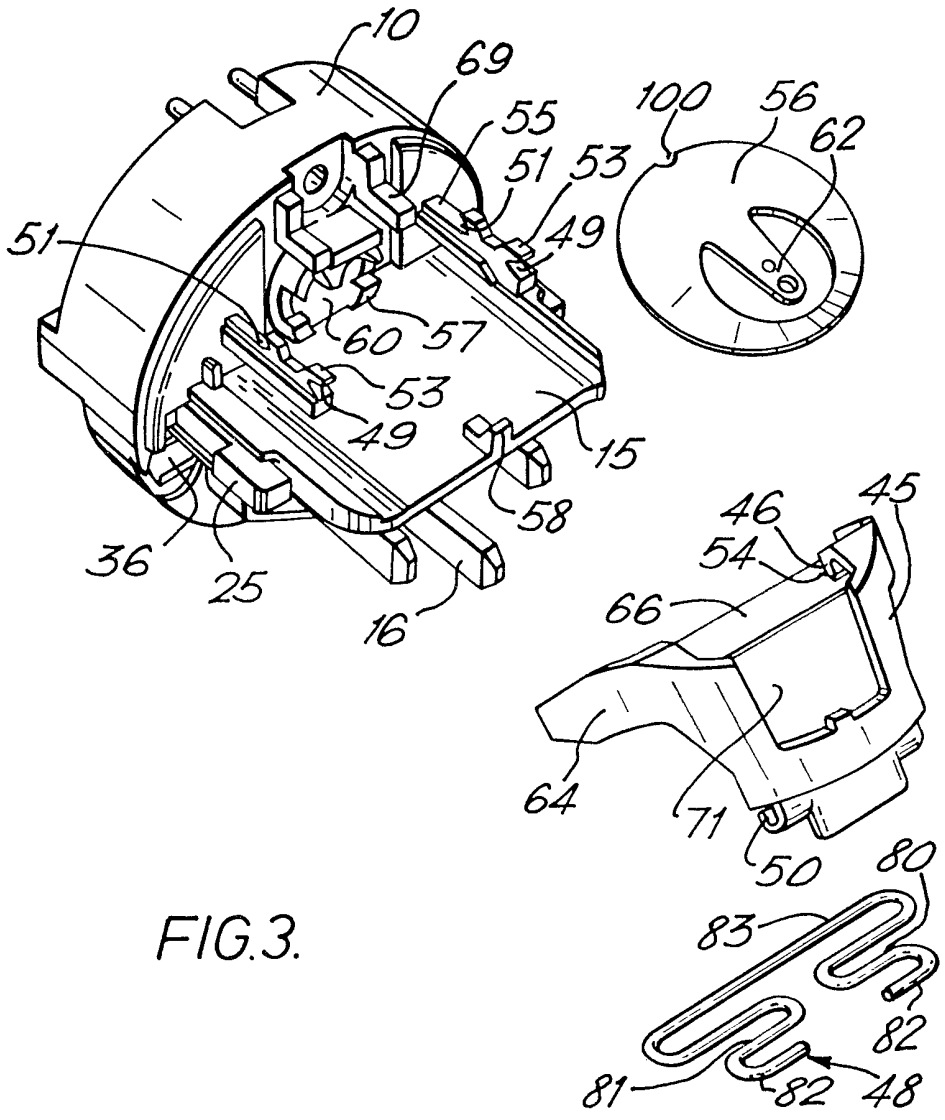
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FIG.3.

FIG.4.

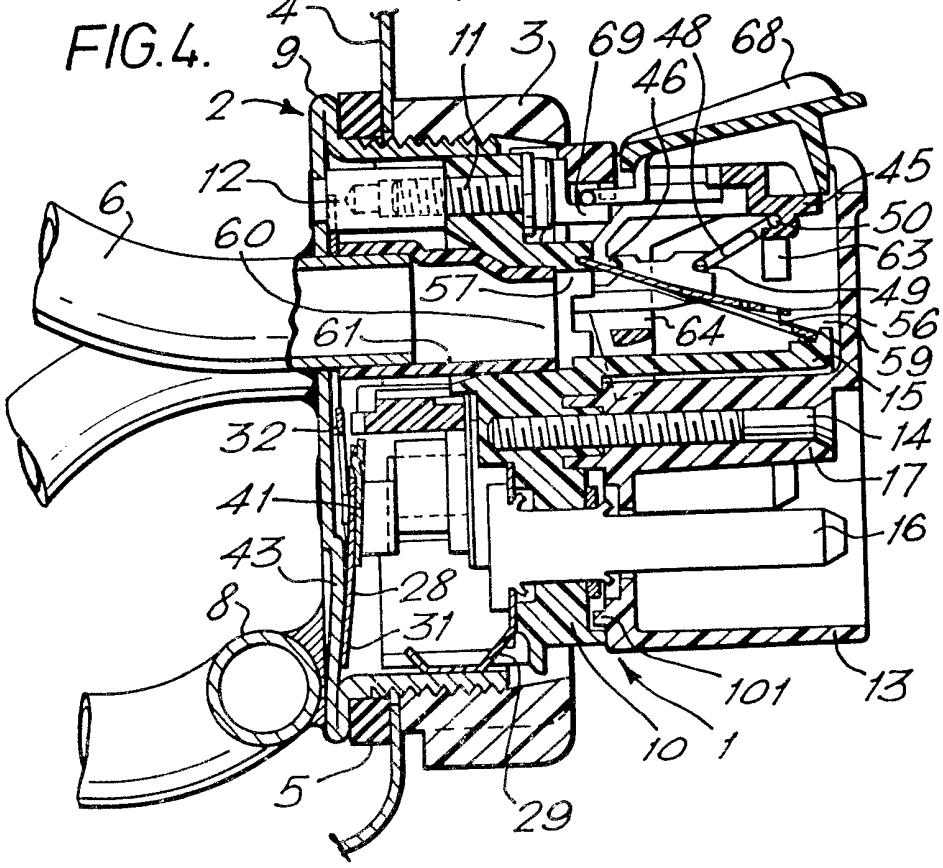
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FIG.5.

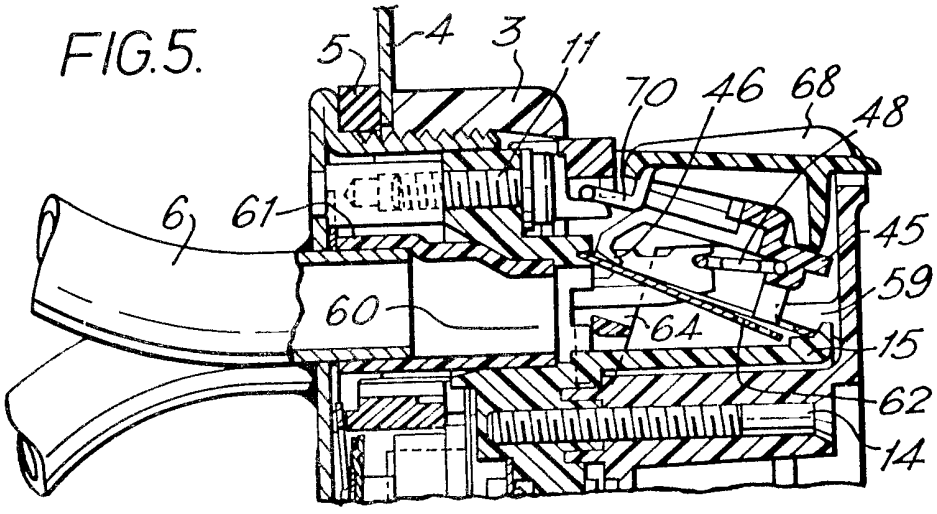
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FIG.6.

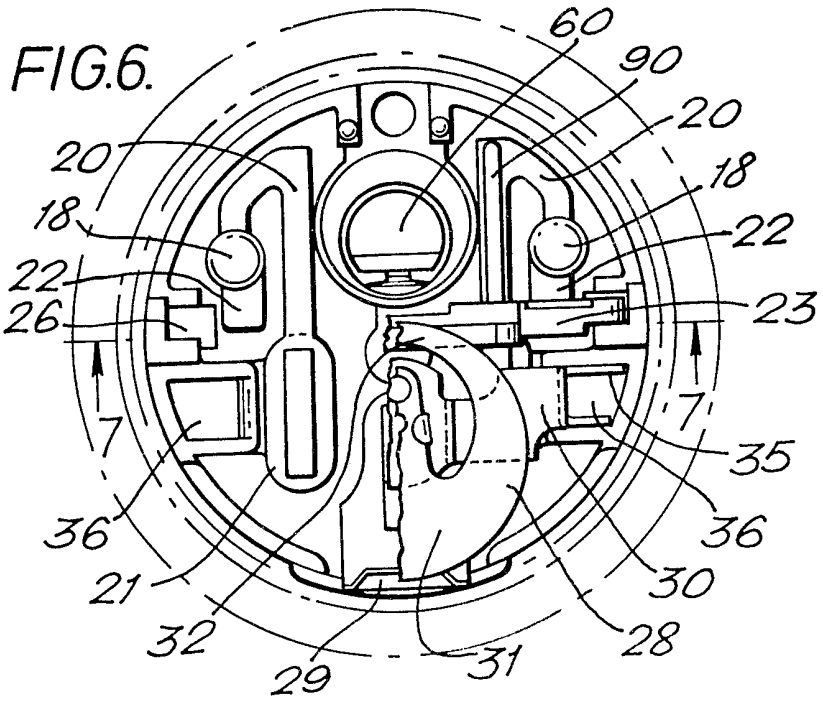
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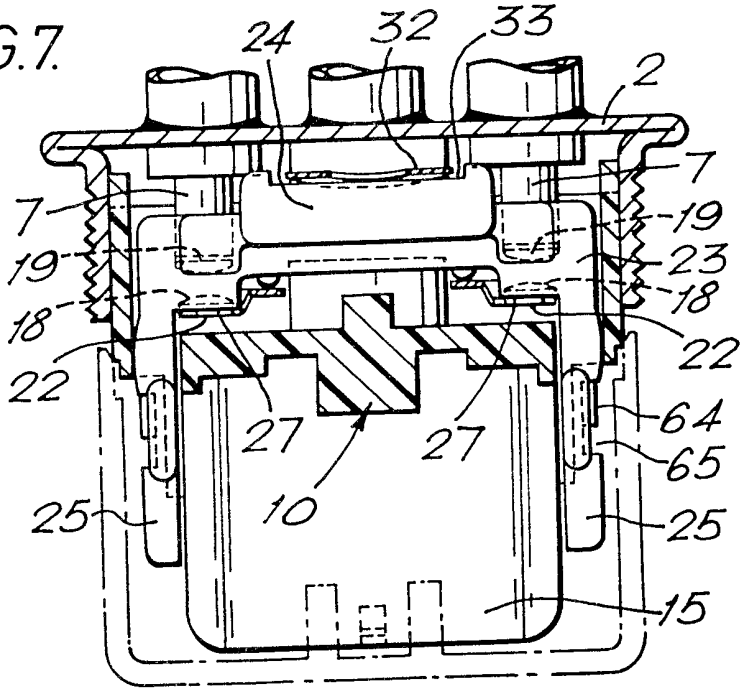
FIG.7.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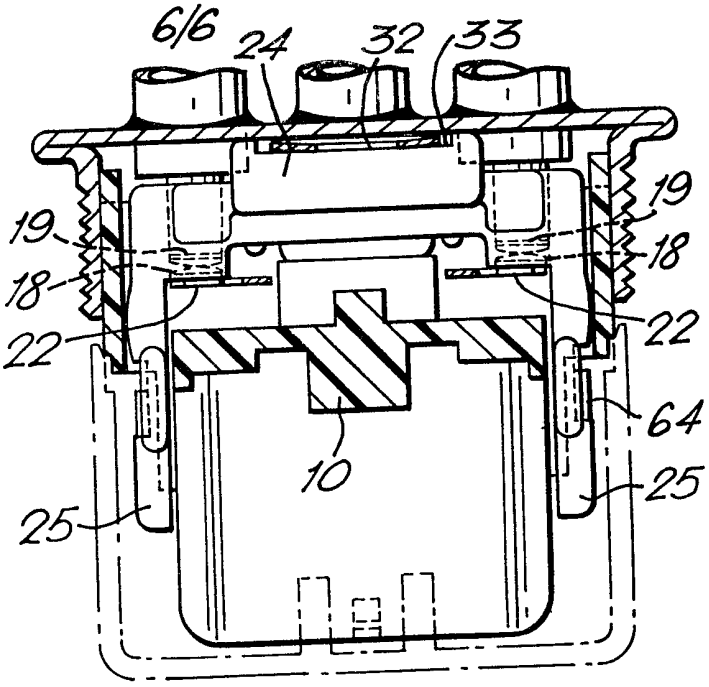

FIG.8.

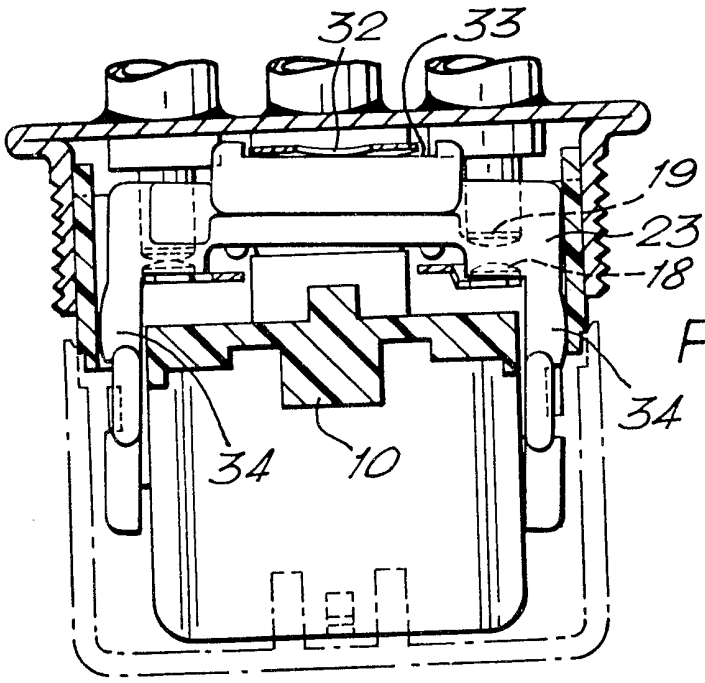

FIG.9.

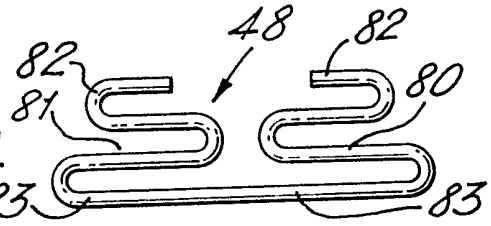

FIG.10.

SPECIFICATION

Thermally-sensitive controls

This invention relates to thermally-sensitive controls for electric heaters of containers such as electric kettles, jugs, urns, pans, coffee percolators, laboratory equipment and the like (hereinafter referred to as "containers of the kind described"). The electric heaters of such containers may either be immersion heaters, or similarly constructed heaters mounted externally to the container in good thermal contact with a wall thereof, for example by being brazed to the underside of the container base. The heating elements of such heaters terminate in so-called cold leads by means of which electrical connections are made to the heater.

Electrical controls for such heaters are well known which include electrical switch means adapted to make electrical contact with the cold leads and operable to interrupt the power supply and thus deenergise the heater upon the element overheating, after for example having been switched on with insufficient liquid in the container to cover the element or having boiled dry. Such an arrangement conventionally includes a set of breakable contacts wired in series with the element, and thermally responsive actuating means, typically a snap-acting bimetallic actuator, effective upon the element overheating to break the contacts and thus deenergise the heater.

Examples of controls as aforesaid are described in British Patent Specifications Nos. 1470366 and 2042269A. In these and in other known arrangements the actuating means is mounted so as to be in good thermal contact with a portion of the element whereby the time delay between overheat occurring and the heater being deenergised is minimised.

However, with such known arrangements failure of the thermally responsive actuating means clearly represents a serious problem since in the event of the container for example boiling dry and as a result the element overheating, the power supply will not be automatically interrupted, and in the absence of manual intervention the element will become hotter and hotter until it eventually burns out. This not only leads to the expense of a replacement element but under certain circumstances can represent a serious safety hazard in that with some containers, for example plastic hot water jugs or kettles with plastic parts, the overheating which occurs before the element burns out can be sufficiently serious to cause melting and in some cases burning of all or part of the container. This problem is also of significance where the control forms part of an appliance which in its general use is likely to be unattended, for example an early morning tea maker or an electric kettle.

It has been proposed to overcome this problem by designing the element to burn out earlier in a serious overheat condition. However, this results in the element being unreliable under normal service conditions, the failure rate of the element being unacceptably high.

According to the invention there is provided a thermally sensitive control for an electric heater of a container of the kind described, said control including electrical switch means effective in use to interrupt the power supply to the heater, the switch means being firstly responsive to a snap-acting bimetallic actuator operable upon overheating of the element, and secondly to a slow acting creep bimetal which is operable upon serious overheating of the element consequent upon failure of said snapacting actuator in an overheat condition.

Thus, as in the case of known controls of this kind, upon the fairly common circumstance of the element overheating as a result of for example having been switched on dry or having boiled dry, operation of the snap-acting bimetallic actuator causes the switch means to interrupt the power supply and thus deenergise the heater. However, with a control in accordance with the invention, in the event of failure of the snap-acting actuator the slow acting creep bimetal acts as an emergency back up and is effective to deenergise the heater so as to prevent dangerous overheating of the element and resulting fire risk in a plastic or partially plastic container discussed above. A creep bimetal is in itself cheap and simple to produce and is robust. Such a bimetal lends itself to incorporation in a control with minimum accommodation complications and with very little increase in cost of the control.

It will be understood that under normal circumstances the snap-acting bimetal will be operable, and in such circumstances the creep bimetal remains inactive, and indeed is intended to do so during the normal active life of the control. Accordingly, in a preferred embodiment of the invention the operating temperature of the creep bimetal is purposefully chosen such that following operation of the switch means, and deactivation of the heater, subsequent over-shoot heating of the control resulting from the residual heat in the element following switch off is sufficient to render the control inoperative. Where the control is formed partly for example from a thermoplastic material, the arrangement may be such that the said overshoot heating is sufficient to cause physical deformation of certain parts of the control such that contacts of the switch means are held open following operation of the creep bimetal thus preventing subsequent operation. Alternatively, a fusable link may be incorporated which is wired in series with the element and is adapted to fuse and isolate the element from the power supply

as a result of the overshoot heating. In either case subsequent operation of the heater is prevented until the faulty control is replaced.

The creep bimetal may take any convenient form, for example a dual steel bimetal, and may be mounted in any convenient manner, either for example to the control or container, or to the heater itself. In a preferred embodiment, the control is adapted for use with an immersion heater having a heating element carried by a head which is securable in a watertight manner in or adjacent an opening in the container wall. In this embodiment the creep bimetal is advantageously mounted so as to be in good thermal contact with part of the heater head. In one advantageous embodiment the creep bimetal is generally U-shaped comprising two leg portions joined by a bridge or margin portion. Such a bimetal may conveniently be mounted by means of the bridge portion such that the legs are free to be displaced and operate the switch means upon serious overheating of the element.

The switch means may take any convenient form and could for example include two sets of contacts wired in series, a first set being breakable in response to operation of the snap-acting actuator and a second set being breakable in response to operation of the creep bimetal. Alternatively, a single set of contacts may be provided which are breakable in response to operation of either the snap acting bimetal or the creep bimetal. In a preferred embodiment however two sets of contacts are provided which are independently breakable in response to operation of either the snap-acting actuator or creep bimetal. The provision of independently breakable contacts is significant from the safety point of view in that should one set become welded together, for example due to the contact surfaces corroding, then the other set will still open to deenergise the heater in the event of the element overheating.

The snap acting bimetal and the creep bimetal are preferably coupled to the switch means by means of a mechanical link member.

The snap acting actuator may take any convenient form, for example a stressed sheet of bimetal with a generally domed configuration and a central tongue such as that described in British Patent No. 1542257. Such an actuator is adapted to snap between two oppositely dished configurations at certain critical temperatures.

In a preferred embodiment the control further comprises a second snap-acting bimetallic actuator coupled to the switch means and exposed, in use of the control, to steam or vapour resulting from liquid within the container boiling and effective to open the switch contacts during boiling. The second snap-acting bimetallic actuator is preferably coupled to the switch means by means of an over-centre spring mechanism which is movable upon operation of the actuating member from a first stable position wherein the switch means is closed to a second stable position wherein the switch means is open, via an unstable dead centre position conventionally, a knob is provided to enable manual resetting. In this embodiment the arrangement is preferably such that operation of the creep bimetal, upon failure of the first snap acting actuator, trips the overcentre mechanism, and the aforementioned over shoot heating of the control caused by residual heat in the element causes sufficient deformation of the working parts of the control to prevent manual resetting and subsequent operation. Thus it will be immediately apparent to the user that the control is faulty and needs to be replaced.

In a preferred form of the invention the control is adapted for use with an immersion heater and has an outer periphery of less radial extent than a peripheral portion of the immersion heater head so as to be passable through an opening in the wall of an associated container in or adjacent which the head is adapted to be secured. Thus, the preferred control may if desired be sold mounted to an immersion heater for user fitting as as a universal replacement. Such an arrangement forms the subject of British Patent Specification No. 2112209.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1 is an exploded perspective view of a control taken from the side of the control which in use is secured to the head of an immersion heater.

Figure 2 is an exploded perspective view of the control illustrated in Figure 1 taken from the opposite side of the control and showing the immersion heater head.

Figure 3 is a perspective view similar to Figure 2 with certain parts of the control removed.

Figure 4 is a cross-sectional view taken from one side of the control of Figures 1 to 3 mounted to the head of an immersion heater showing the overcentre spring mechanism in the deactivated position.

Figure 5 is a view similar to Figure 4 but showing the overcentre mechanism in the operational position.

Figure 6 is an elevational view, partly broken away, of the end of the control adapted to be secured to the immersion heater head.

Figure 7 is a cross-sectional view taken along line 7-7 in Figure 6 showing the switch contacts open. Figure 8 is a view similar to Figure 7 but showing the switch contacts closed.

Figure 9 is a view similar to Figures 7 and 8 but showing one contact open and one

closed.

Figure 10 is a plan view of the over centre spring for the control illustrated in Figures 1 to 9.

Referring firstly to Figures 1 to 5, a thermally-sensitive control 1 is mounted on the head 2 of an electric immersion heater. The cup-like head 2 is retained in a water-tight manner in an opening formed in the wall 4 of an associated container by means of an externally threaded retaining ring 3 which urges a peripheral flange 9 of the head 2 against the inside of the wall 4 compressing a resilient O-ring seal 5 therebetween as shown in Figure 4. The immersion heater head 2 carries a tube 6 for the egress of steam from the interior of the containter which tube is brazed to the head and extends, in use, above water level within the container. The immersion heater comprises two cold leads 7 and a hot return 8 which passes underneath the cold leads 7 and is brazed to the head 2 so as to be in good thermal contact therewith. The low position of the hot return 8 enables the container to boil small quantities of liquid if desired.

The control 1 comprises a body portion 10 of thermo-plastic material, mounted snugly within the head 2 by means of three bolts 11 which engage threaded female studs 12 brazed to the inside of the head, and a cover member 13 which is secured to the body portion 10 by means of a single central fixing bolt 14. The body portion 10 includes a horizontal shelf member 15 which lies close to the central longitudinal axial plane of the control 1 and defines at the side of the body portion remote from the head, upper and lower segmental volumes of the control lying respectively above and below the central horizontal axial plane of the control. Three terminal pins 16 are secured to and extend through the body portion 10 and include a live pin, a neutral pin and an earth pin for connection to a female socket connector to supply mains electrical power to the heating element. The end portions of the pins 16, which extend parallel to and are disposed below the shelf member 15, are arranged in a triangular relationship with the central or earth pin lying below the live and neutral pins. The cover member 15 defines a shroud 17 which surrounds the pins 16 and is shaped so as to snugly receive a standard socket connector.

The live and neutral pins are each connected to a respective cold lead 7 via switch means including a pair of breakable contact sets, each pair including a movable contact 18 and a stationary contact 19 mounted directly to a respective cold lead 7. The movable contacts 18 are mounted towards the free ends 22 of respective generally 'U'-shaped leaf springs 20 formed from resilient metallic strip material. The leaf springs 20 extend upwardly adjacent the side of the body portion 10 facing the head from the bases of the respective live and neutral terminal pins and are secured thereto by means of apertured base portions 21 of the leaf springs 20 which surround the base portions of the pins. During normal operation of the heater, the leaf springs 20 urge the movable contacts 18 against the respective stationary contacts 19 and electrical power may be supplied from the live and neutral terminal pins to the element. The earth pin, by virtue of its disposition towards the outer periphery of the control, is conveniently electrically connected with the head 2 by means of a metallic spring clip 29 which is secured to the base of the pin and directly engages the inside of the head 2.

A generally "U" shaped link member 23 of moulded plastics material lies in a horizontal plane of the control slightly below the switch contacts 18, 19 and includes a transverse arm 24 disposed between the body portion 10 and the head 2, beneath the contacts, and two spaced longitudinal arms 25. The longitudinal arms 25 extend through the body portion 10 and are slidably mounted in axially directed channels 26 formed on either side of the body portion 10 close to the outer periphery thereof. The transverse arm 24 of the link member 23 includes two stepped abutments 27 at either end thereof adjacent the longitudinal arms 25 which abutments 27 are adapted to engage respective free ends 22 of the leaf springs 20 whereby movement of the link member 23 in a direction away from the head 2 causes the free ends 22 of the springs 20 and the respective movable contacts 18 to be displaced in a direction away from the head 2 thereby opening the contacts and interrupting the power supply to the heater. In addition, two vertical abutment arms 90 extend upwardly from the link member transverse arm 24 which are provided with abutment surfaces 91 adapted for engagement with the uppermost portions of the respective leaf springs 20. Upon displacement of the link member 24 away from the head, the abutment surfaces 91 engage the leaf springs slightly after engagement thereof by the abutments 27 and urge the contacts further apart.

A first snap-acting bimetalic actuator 28 of the sort described in British Patent Specification No. 1,542,252 is mounted on a stainless steel bridge member 30 as described in more detail below and overlies the bases of the terminal pins 16. A lower peripheral portion 31 of the actuator 28 is held in good thermal contact with wedge-shaped protrusion 43 formed on the inside of the head 2 towards the bottom thereof adjacent to the point where the hot return 8 of the element is welded thereto, and an upper bridge portion 32 of the actuator 28 is adapted for engagement with a central abutment surface 33 formed on the "U"-shaped link member 23. The actuator 28 is calibrated with a nominal

operating temperature of 140°C so as to undergo snap action when the element overheats. Thus, when the element overheats after for example having been switched on dry, the actuator 28 reverses its curvature by snap-action whereupon the bridge portion 32 engages and moves rightwardly, i.e. away from the head, the link member 23 which in turn pushes the movable contacts 18 away from the stationary contacts 19 as shown in Figure 7 so as to cut off the power supply to the heating element.

An important safety feature of the preferred control arises from the fact that the "U"-shaped link member 23 in addition to being slidable in a substantially axial direction is pivotable to a limited extent in its horizontal plane about a vertical axis. Such pivotal movement is accomodated by the outer edges of the longitudinal arms 25 of the link member 23 being contoured within the channels 26 so as to define curved surfaces 34 which abut the outer wall of respective channels 26 therebeing a lateral clearance between the major part of the edges of the arms 25 and the channels 26. Thus, in the event of either pair of contacts 18, 19 becoming welded together after an extended period of use, upon operation of the actuator 28 engagement of the bridge portion 32 thereof with the abutment surface 33 of the link member 23 will cause the link member 23 to pivot about the welded-together pair of contacts and open the remaining pair as shown in Figure 9 thereby deenergising the heater. This additional safety feature is particularly significant where the container forms part of an appliance which in general use is likely to be left unattended for extended periods of time such as, for example, an early morning automatic tea maker.

The stainless steel resilient bridge member 30 includes a pair of spaced lateral flanges 35 projecting from each side thereof which fit snugly within respective generally rectangular apertures 36 formed at either side of the body portion 10 and through which the lowermost two of the body portion mounting bolts 11 extend. As the bolts 11 are tightened, the flanges 36 bear directly against the respective female studs 12 of the head and are firmly clamped between the heads of the respective bolts 11 and the studs 12 within the apertures 36. In this way, the stainless steel flanges 35 act as spacers between the heads of the mounting bolts 11 and the ends of the studs 12 and prevent undue stresses being imparted to the plastic body portion as is bolted to the head. Thus, the body portion may be tightly clamped to the head without the possibility of inadvertently damaging the plastic by overtightening the lowermost bolts.

The bimetallic actuator 28 is mounted to the bridge member 30 by means of its tongue 37 which passes between two folded-over ears 38 of the bridge member 30 and over a folded-up ramp 39 thereof which enters an aperture in the tongue 37. The portion 41 of the bridge member 30 which carries the bimetallic actuator 28 is longitudinally offset from the side arms 42 of the bridge member so as to provide necessary clearance between the periphery of the actuator and the bridge member for the actuator to reverse its curvature by snap-action and to permit the necessary movement of the bridge portion 32 of the actuator. In addition, as seen most clearly in Figure 4, the portion 41 which carries the ears 38 and the ramp 39 is at an acute angle to the vertical wall of the head 2 so as to ensure that lower peripheral portion 31 of the actuator 28 is in intimate contact with the protrusion 43. The actuator 28 is mounted on the bridge member 30 by lifting the bridge portion 32 over the ears 38 while sliding the tongue 37 between the ears 38 and over the ramp 39. Once the ramp 39 enters the tongue aperture 40, the actuator is retained in place. However, should an actuator malfunction during testing of the control, it may conveniently be replaced simply by deforming the free end of the tongue clear of the end of the ramp and there is no need to replace any of the other parts of the control.

The stainless steel bridge member 30, having a relatively low thermal conductivity and heat capacity, minimises heat-loss from the actuator 28 and as such the actuator reacts quickly to overheating of the element.

As shown in Figures 1 and 2 there is further provided a generally U-shaped slow acting creep bimetal 200, for example a dual steel bimetal, which comprises a bridge or margin portion 201 and two downwardly depending legs 202. The bimetal 200 is mounted by means of its bridge portion 201 which is firmly clamped against the heater head by means of projections 203 formed on the control body. The bimetal 200 is located by means of flanges 204 which engage the peripheral wall of the head and a cut-away portion 205 which engages around the uppermost of the mounting studs 12. The legs 202 extend either side of the steam tube 6 and terminate adjacent the link member 23.

The bimetal 200 has a nominal operating temperature of 200°C, i.e. 60° higher than the snap-acting actuator 28. Thus under normal circumstances, that is when the actuator 28 is operable, the creep bimetal remains effectively inactive, even if the heater is switched on dry or the container boils dry. However, should the actuator 28 fail for some reason then in the event of an overheat condition occurring the legs 202 of the bimetal 200 are gradually displaced away from the head until they engage the link member 23 and thereby open the switch contacts. In the preferred embodiment, the back up bimetal 200 is effective to open the switch contacts

approximately 35 seconds after the failure of the snap-acting bimetal 200.

In a preferred embodiment, the bimetal 200 is, when the heater is not in use, slightly concave towards the head. Thus during normal operation, heating of the bimetal 200 simply causes it to flatten slightly. However, in a serious overheat condition the curvature reverses such that the legs engage and operate the link member.

In the illustrated embodiment an overcentre spring mechanism 44 is disposed above the shelf member 15 on the side of the body portion remote from the element head i.e. above the axial horizontal plane of the control. The mechanism 44 includes a lever member 45 having a generaly semi-cylindrical profile so as to fit snugly within the upper segmental space of the control. The lever member 45 is pivotably mounted to the body portion by means of two knife edges 46 formed integrally with the member 45 which engage in respective pivot notches 51 formed respectively in spaced arms 47 extending from the body portion 10 in a direction parallel to the shelf member 15. An overcentre spring 48 extends between notches 49 formed at the free ends of the arms 47 and notches 50 formed in the lever member 45 in the end thereof remote from the knife edges 46 and biases the knife edges 46 into engagement with the pivot notches 51. As illustrated in Figure 10, the wire spring 48 is a combined double spring and includes two U-shaped portions 80,81 disposed in back-to-back relation. Each U-shaped portion interconnects a pair of generally parallel arms 82,83 one of which arm 83 is common to both U-shaped portions. The spring imparts a symmetrical biasing force on the lever member 45 and is sufficiently low rate to adequately accommodate the pivotal movement of the member 45. The lever member 45 is pivotable between a first stable position as shown in Figure 5 wherein a lower surface of the lever member 45 engages stops 53 formed on the free ends of the arms 47 and a second stable position shown in Figure 4. In moving from the first stable position to the second, the lever member 45 passes through an unstable dead centre position in which the spring notches 49, 50 and the knife edges 46 all lie in a common horizontal plane.

A second snap-acting bimetallic actuator 56 similar to the actuator 28, but having a nominal operating temperature of 80°C is located below the lever member 45 and lies at an acute angle to the shelf member 15 between the arms 47 which engage the outer periphery of the actuator 56 and serve to locate the actuator laterally. The base of the actuator 56 rests on support members 57 of the body portion and is retained longitudinally by a projection 58 at the end of the shelf member which abuts the bridge portion of the actuator 56. A small cut-out 100 is provided on the outer periphery of the actuator and is engaged by a small projection on the control to prevent rotation of the actuator. During assembly, the actuator is simply dropped into position and is later secured in place when the cover member 13 is mounted by means of flanges 59 thereof which extend over the bridge portion of the actuator 56 thereby clamping it to the shelf member 15.

Steam or vapour resulting from liquid within the container boiling is transmitted to the actuator 56 via an aperture 60 formed in the body portion 10. The steam tube 6 is sealed to the aperture 60 by means of a silicone rubber sleeve 61 one end of which is stretched over the end of the tube 6 and the other end of which is pushed into the aperture 60. The upper wall of the aperture 60 is upwardly tapered at the side adjacent the head.

Upon liquid within the container boiling, steam or vapour impinges on the steam sensitive bimetallic actuator 56 which then reverses its curvature by snap-action so that its tongue 62 engages and bears upwardly against a post 63 extending downwardly from the lever member 45 thus tripping the lever member 45 from its first stable position to its second stable position. The lever member 45 includes two downwardly projecting legs 64 which extend either side of the shelf member 15 and terminate within notches 65 formed in the longitudinal arms 25 of the "U"-shaped link member 23. A strengthening bridge 66 extends between the legs 64 and passes between the body portion arms 47 and shelf member 15. Thus, upon the lever member 45 being tripped from its first stable position to its second stable position the legs 64 thereof engage the ends of the notches 65 and pull the link member 23 rightwardly away from the element head and open the switch contacts as described above. The effect is that when the liquid within the container boils the actuator 56 trips the lever member 45 from its first to its second position thereby opening the switch contacts and de-energising the heating element.

As described above, the steam or vapour is shielded from the electrical components on the side of the body portion facing the head by means of the resilient sleeve 61. On the lower side of the body portion, the terminal pins 16 are shielded from steam and from condensed liquid by the shelf member 15 and by the cover member shroud 17. Liquid condensing on the shelf member 15 runs off the member at each side into a perhipheral passage defined between the shroud 17 and the outer wall of the cover member 13. An aperture 67 is provided at the base of the cover member to allow condensed liquid within the peripheral passage to drain out of the control. The shroud forming portion of the cover mem-

ber cooperates with the body portion to form a capillary seal 101 therebetween to prevent liquid seeping into contact with the terminal pins.

A knob 68 is pivotably mounted above the lever member 45 for manually resetting the control after the overcentre mechanism has been tripped as a result of liquid within the container boiling. The knob 68 is mounted by means of a flange 70 thereof which is held between a shoulder 69 projecting from the body portion and part of the cover member. When the knob 68 is pressed downwardly, the lever member 45 is returned to its first position thus allowing the movable contacts 18 to move into contact with the respective stationary contacts 19 and the electrical power supply to the element can be resumed.

Upon movement of the link member in response to operation of the switch-on-dry actuator 28, the lever member is tripped slightly after the contacts are opened. Thus, if an attempt is made to energise the heater with no liquid in the container by manually holding the knob in the closed position, the actuator 28 will cycle causing the contacts to repeatedly open and close thus preventing serious overheating of the element.

In the event of failure of the switch-on-dry actuator 28, the consequent operation of the creep bimetal 200 in an overheat condition is also effective to trip the lever member to the off position, and this again occurs slightly after the contacts are opened, i.e. as a result of overshoot heating of the bimetal resulting from residual heat remaining in the element and head after switch off. However, where the actuator 28 has failed and the heater has reached a sufficiently high temperature to operate the creep bimetal 200, continued overshoot heating of the control after the lever has been tripped is sufficient to cause slight deformation of the plastic operative parts of the control and thus prevent subsequent resetting of the trip lever and use of the heater until the faulty control is replaced.

The embodiment of the control illustrated herein is particularly suitable for sale ready-mounted to the immersion heater a replacement element for user-fitting. However, the illustrated control may serve solely as a switch-on-dry protector unit simply by omitting the over-centre mechanism and associated actuator.

CLAIMS

1. A thermally-sensitive control for an electric heater of a container of the kind described, said control including electrical switch means effective in use to interrupt the power supply to the heater, the switch means being firstly responsive to a snap-acting bimetallic actuator operable upon overheating of the element, and secondly to a slow acting creep bimetal which is operable upon serious overheating of the element consequent upon failure of said snap-acting actuator in an overheat condition.

2. A thermally-sensitive control as claimed in claim 1 wherein the operating temperature of the creep bimetal is such that following operation thereof to disable the heater, the subsequent over-shoot heating of the control resulting from residual heat in the element is effective to render the control inoperative thereafter.

3. A thermally-sensitive control as claimed in claim 2 wherein said over-shoot heating causes physical deformation of certain parts of the control.

4. A thermally-sensitive control as claimed in claim 3 further comprising a second snap-acting bimetallic actuator exposed in use to steam or vapour resulting from liquid within an associated container boiling and coupled to the switch means via a resettable over-centre spring mechanism, the arrangement being such that operation of the creep bimetal upon failure of the first snap-acting actuator is effective to trip the over-centre spring mechanism whereby the switch contacts are opened, subsequent over-shoot heating due to residual heat in the element causing sufficient deterioration of the parts of the control to prevent resetting of the over-centre the mechanism.

5. A thermally-sensitive contraol as claimed in claim 2 including a fusable link wired in series with the element and adapted to fuse and isolate the element as a result of over-shoot heating.

6. A thermally-sensitive control as claimed in any preceding claim wherein the creep bimetal is adapted to be mounted in good thermal contact with the head portion of an associated immersion heater.

7. A thermally-sensitive control as claimed in any preceding claim wherein the creep bimetal is generally U-shaped and comprises two leg portions joined by a bridge or margin portion, the bimetal being mounted in use by means of said bridge or margin portion such that the legs are free to be displaced and operate the switch means upon serious overheating of the element.

8. A thermally-sensitive control as claimed in any preceding claim wherein the creep bimetal comprises a dual steel bimetal.

9. A thermally-sensitive control substantially as herein described with reference to the accompanying drawings.

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