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THERMALLY-SENSITIVE CONTROLS

This invention relates to thermally-sensitive
5 controls for electric heaters of liquid heating
containers such as water heating kettles and jugs, urns,
coffee percolators, laboratory equipment and the like,
such containers being referred to hereinafter as
"containers of the kind described". The heaters of such
10 containers may be in the form of immersion heaters or
similarly constructed heaters mounted externally of the
container e.g. by being brazed to the underside of the
container base. The heaters traditionally terminate in
so-called cold leads by means of which electrical
15 connections may be made to the heating element.
Thermally-sensitive controls for such heaters are
well-known which include thermally-responsive actuating
means, such as a bimetallic actuator, mounted in the
proximity of the heating element and operable to open
20 switch means of the control so as to interrupt the power
supply to the heater in the event of over-heating
consequent upon the heater boiling dry or having been
switched on with insufficient liquid therewithin to
cover the element. The bimetallic actuator of such a
25 control is typically arranged in thermal contact with a
so-called hot return part of the element and connected
to the switch means via a mechanical coupling such as a
push rod.

Thermally-sensitive controls of this type are also
30 known which comprise a second bimetallic actuator
positioned in use adjacent a steam outlet aperture
formed in a side or top wall of the associated container
so as to be exposed to steam or vapour egressing from
the container during boiling. The second actuator is
35 coupled to the same or further switch means of the
control via an over-centre spring mechanism the
arrangement being such that the power supply to the

element is disabled upon boiling. A control of this type may thus have a body portion mounting for housing the first bimetallic actuator and clamped in use in the proximity of the heater, and a part projecting upwardly to adjacent the steam outlet aperture of the container and mounting the second bimetallic actuator and the associated overcentre spring mechanism. Thermally-sensitive controls having this general configuration are well known and are described, for example, in British patent specification No. 1,470,367. With such thermally-sensitive controls it is desirable to achieve a fast response time of the steam sensitive bimetallic actuator to ensure that the heater is disabled sufficiently rapidly upon boiling. In known controls of the general configuration discussed above the steam-sensitive bimetallic actuator is usually located in a partly enclosed chamber defined beneath a hood portion which extends over the steam outlet aperture of the container whereby steam accumulates in the vicinity of the actuator and a portion therefore impinges and condenses thereon. The latent heat released thus actuates the bimetallic actuator which trips the spring mechanism to disable the heater.

With such an arrangement there is a limit on the response time of the bimetallic actuator owing to the time taken for sufficient steam or vapour to accumulate in the region of the actuator, particularly where overall design requirements for the control dictate that the bimetallic actuator cannot be located immediately adjacent the steam outlet aperture of the container. A further problem with known arrangements concerns the amount of condensation collecting beneath the hood portion which can undesirably run down onto other parts of the control.

Viewed from one aspect the invention provides a thermally-sensitive control for an electric heater in or for a container of the kind described, the control

comprising a body portion mounted in use to a part of
the heater or container, said body portion having
mounted thereon a thermally-sensitive actuating means
arranged, in use, in thermal contact with a part of the
5 element of the heater, means for making electrical
contact with the cold leads of the heater for the supply
of electrical power to the heater, and electrical switch
means actuatable to interrupt the power supply to the
heater in response to operation of the
10 thermally-sensitive actuating means consequent upon the
element of the heater overheating, the control further
comprising a steam or vapour sensitive bimetallic
actuator mounted vertically on an upwardly extending
body part of said control, said bimetallic actuator
15 being coupled to the same or to a further electrical
switch means of the control via an overcentre spring
mechanism of the control and arranged to interrupt the
power supply to the heater upon liquid within the
container boiling, wherein a unitary member fabricated
20 separately from the rest of the control and comprising a
collar and a hood portion is mounted, in use, over said
steam or vapour sensitive bimetallic actuator, said hood
portion having a generally inverted U-shaped cross-
section, which, at one end, extends, in use, over a
25 steam or vapour outlet aperture of said container, and
said collar having an upwardly facing opening and being
configured to matingly engage, in use, over said
upwardly extending body part of said control on which
said actuator is mounted, the arrangement being such
30 that, in use, upon boiling of liquid within the
container, steam or vapour egressing from the container
via said outlet aperture establishes a convection
current which flows along said hood portion and upwardly
through said collar opening, the upward flow of steam or
35 vapour impinging on at least part of the bimetallic
actuator.

Such an arrangement leads to certain advantages
over known controls of this general type as discussed

above which rely on steam accumulating and condensing in a chamber. Firstly, the response time is improved since the convection current carries a continuous flow of steam more quickly to the actuator. This improvement is of particular significance where overall design requirements for the control preclude the actuator from being mounted immediately adjacent the steam outlet aperture. Secondly, the reset time for the actuator may be shortened, since after boiling has ceased the effect of the convection current is to draw a flow of cold air across the actuator so that it is more quickly returned to below its critical operating temperature than with known arrangements. Thirdly, the amount of condensation collecting within the collar and hood member is reduced, since a major part of the steam is discharged upwardly via the opening and as a consequence of the more rapid response achieved. Fourthly, the amount of condensation collecting on the bimetal is reduced which reduces the tendency of condensation to "mask" i.e. insulate the bimetal and thus lengthen the response time and/or the subsequent reset time.

Moreover, the use in the present invention of a separate collar and hood portion member allows the member to be adapted to be fitted to an existing control without the need substantially to otherwise modify the control.

The body part, e.g. of plastics, preferably extends upwardly from the said body portion and mounts the overcentre spring mechanism, as well as the bimetallic actuator and the associated collar and hood portion. Such a body part may be formed integrally with the main body portion, or may be fabricated separately so that the control consists of two principal parts which are adapted to be assembled together when the control is mounted to a heater or container.

In a preferred arrangement, the said upwardly facing opening of the collar may be used to locate the collar and hood portion member on a top portion of said

upwardly extending body part of the control with said top portion extending in mating engagement through the opening.

5 The bimetallic actuator is spaced somewhat from the steam or vapour aperture and the convection current established through the upwardly facing opening is effective to draw a continuous flow of steam or vapour from the outlet aperture and along the underside of the hood portion to the actuator.

10 In a preferred embodiment the bimetallic actuator is in the form of a sheet of bimetal of dished or domed configuration adapted to reverse its curvature, preferably by snap action, at a certain critical temperature upon exposure to steam or vapour.

15 The actuator is orientated in a generally vertical plane so that the convection flow of steam or vapour is parallel to the plane of the actuator. In such an embodiment the actuator may extend partly through the upwardly facing opening.

20 In a preferred such arrangement, a peripheral wall of the collar closely surrounds the actuator, and the collar effectively constitutes a chimney in which the vertically orientated actuator is located, the chimney communicating with the hood portion which projects forwardly from said chimney and extends over the steam or vapour outlet aperture.

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

30 Figure 1 is a partly schematic cross-section of a water boiling container incorporating a thermally-sensitive control in accordance with the invention;

 Figure 2 is a perspective view of a steam convecting member which forms part of the control shown in Figure 1; and

35 Figures 3a and 3b are respectively underside plan and end views on an enlarged scale of the member shown

in Figure 2.

Referring firstly to Figure 1 there is shown part of a water boiling container in the form of kettle 1 incorporating an electric immersion heater 2 comprising a heating element 3 carried by a heater head 4. As is conventional the head 4 is mounted in water tight relation in or adjacent an aperture formed in the side wall of the container to form a seal therewith. The element includes a hot return 5 brazed to the head and a pair of cold leads 6 extending through the head as is conventional.

A thermally-sensitive control 7 is mounted adjacent the heater head 4, e.g. by being clamped by means of mounting bolts or studs secured to the head. As is conventional the control 7 includes a thermally-responsive actuating means, such as a bimetallic actuator, mounted in thermal contact with the hot return 5 of the heater and coupled to electrical switch means operable to disable the heater in the event of over-heating. The control includes a connector 8 for mating engagement with a complementary connector of a power supply lead, the connector 8 including terminal pins (not shown) connected to the cold leads 6 of the element 3 via the switch means. To this end the control 7 incorporates suitable means e.g. leaf spring contacts for making electrical connections with the cold leads 6. The parts of the control described thus far are conventional in controls of this type, and the internal configuration may be as described in British Patent Specification No. 2,181,598, for example.

The control further comprises a body part 9 extending upwardly from a main body portion 10 (shown only schematically), the body part 9 mounting an over-centre spring mechanism 11 arranged to co-operate at its lower end with a push rod 12 coupled to a further switch means of the control for disabling the heater, which again may be as described in British Patent

Specification No. 2,181,598. The spring mechanism 11 moves between a first stable condition wherein contacts of the switch means are closed and a second stable condition in which the contacts are open, via an unstable dead centre condition. The details of such a spring mechanism are well known to those skilled in the art, and as is conventional the spring mechanism has associated therewith a push button 13 for manual resetting.

10 The upwardly extending part 9 of the control mounts a second thermally-responsive actuator 14 which is vertically orientated and is shown edge on in Figure 1. The actuator 14 is of the general type described in British Patent Specification No. 1,542,257 and is of a
15 generally domed configuration having a cut out portion defining a central tongue. The actuator 14 is calibrated to reverse its curvature by snap action when exposed to steam or vapour, the tongue of the actuator then
20 engaging an upper part 15 of spring mechanism 11 so as to trip the mechanism to its second condition in which the contacts of the switch means of the control are open and thus the heater is disabled.

As shown in Figure 1 the kettle 1 includes a steam outlet aperture 16 in a peripheral part of its upper
25 wall to permit the egress of steam or vapour during boiling. The control further includes a steam convecting member 17 fitted to the top of the upwardly extending part 9. As shown in Figures 2, 3a and 3b the member 17 includes a hood like portion 18 of inverted
30 U-shaped cross-section which opens into a collar like portion 19. The portion 19 defines an upwardly open chamber in which the bimetallic actuator 14 is located. In the illustrated embodiment the convecting member is matingly engaged over the top of the upwardly extending
35 part 9 of the control and includes tabs 20 which together with a cut away portion 21 formed in the rear wall of the collar 19 co-operate with corresponding

formations on the part 9 of the control so that the convecting member 17 is lodged in the position shown in Figure 1 with the hood portion 18 extending over the steam outlet aperture 16.

5 The collar 19 thus surrounds the actuator which projects partly through the open top end of the collar portion. Accordingly as shown by the arrows in Figure 1 the collar portion 19 effectively acts as a chimney whereby vertical convection currents are established.

10 Thus steam egressing from the container via the aperture 16 passes firstly along beneath the upper wall of the hood like portion 18 before flowing upwardly out via the opening at the top of the chamber defined by the collar portion 19. The upward steam flow impinges on the
15 actuator 14 to cause operation of the actuator and of the over-centre spring mechanism as discussed above. The steam then enters a space enclosed by a hollow handle part 20 of the kettle and can escape via outlet ducts 21.

20 Of course it is possible to envisage other arrangements falling within the scope of the invention.

CLAIMS:

1. A thermally-sensitive control for an electric heater in or for a container of the kind described, the control comprising a body portion mounted in use to a part of the heater or container, said body portion having mounted thereon a thermally-sensitive actuating means arranged, in use, in thermal contact with a part of the element of the heater, means for making electrical contact with the cold leads of the heater for the supply of electrical power to the heater, and electrical switch means actuatable to interrupt the power supply to the heater in response to operation of the thermally-sensitive actuating means consequent upon the element of the heater overheating, the control further comprising a steam or vapour sensitive bimetallic actuator mounted vertically on an upwardly extending body part of said control, said bimetallic actuator being coupled to the same or to a further electrical switch means of the control via an overcentre spring mechanism of the control and arranged to interrupt the power supply to the heater upon liquid within the container boiling, wherein a unitary member fabricated separately from the rest of the control and comprising a collar and a hood portion is mounted, in use, over said steam or vapour sensitive bimetallic actuator, said hood portion having a generally inverted U-shaped cross-section, which, at one end, extends, in use, over a steam or vapour outlet aperture of said container, and said collar having an upwardly facing opening and being configured to matingly engage, in use, over said upwardly extending body part of said control on which said actuator is mounted, the arrangement being such that, in use, upon boiling of liquid within the container, steam or vapour egressing from the container, via said outlet aperture establishes a convection current which flows along said hood portion and upwardly



through said collar opening, the upward flow of steam or vapour impinging on at least part of the bimetallic actuator.

5 2. A thermally sensitive control as claimed in claim 1, wherein the said body part is formed integrally with said body portion.

10 3. A thermally sensitive control as claimed in claim 1 or 2, wherein said body part extends upwardly from the said body portion and mounts the overcentre spring mechanism.

15 4. A thermally sensitive control as claimed in claim 1, 2 or 3, wherein the said upwardly facing opening of the collar is used to locate the collar and hood portion member on a top portion of said upwardly extending body part of the control with said top portion extending in mating engagement through the opening.

20 5. A thermally sensitive control as claimed in any preceding claim, wherein the bimetallic actuator is in the form of a sheet of bimetal of dished or domed configuration adapted to reverse its curvature at a
25 certain critical temperature upon exposure to steam or vapour.

30 6. A thermally sensitive control as claimed in any preceding claim, wherein the actuator extends partly through the upwardly facing opening.

35 7. A thermally sensitive control as claimed in any preceding claim, wherein the peripheral wall of the collar closely surrounds the actuator, and the collar constitutes a chimney in which the vertically orientated actuator is located.



8. A thermally sensitive control substantially as hereinbefore described with reference to the accompanying drawing.

