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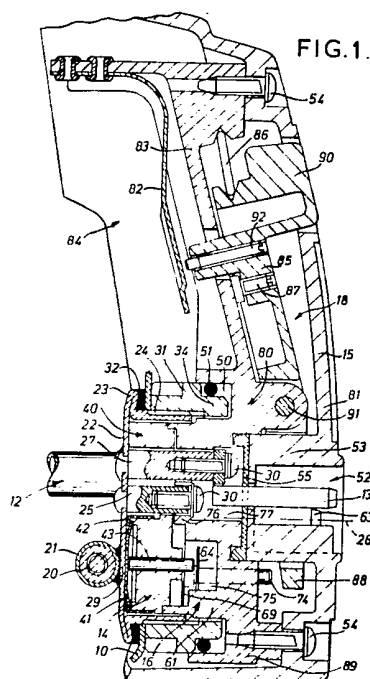
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## (54) Immersion heater assemblies for electric kettles

(57) An immersion heater, for an electric kettle, comprises a metal sheathed element 20 secured to a metal head having an externally threaded extension 24 perpendicular to a main panel 22 to receive a clamping ring 31, wherein elongate posts 25 and 27 extend from the main panel, in a predetermined position relative to the element to receive a first fastener 30 securing switching means 14 to the head and a second fastener 30 securing an earth pin 13 to the head independently of the switching means.



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FIG. 1.

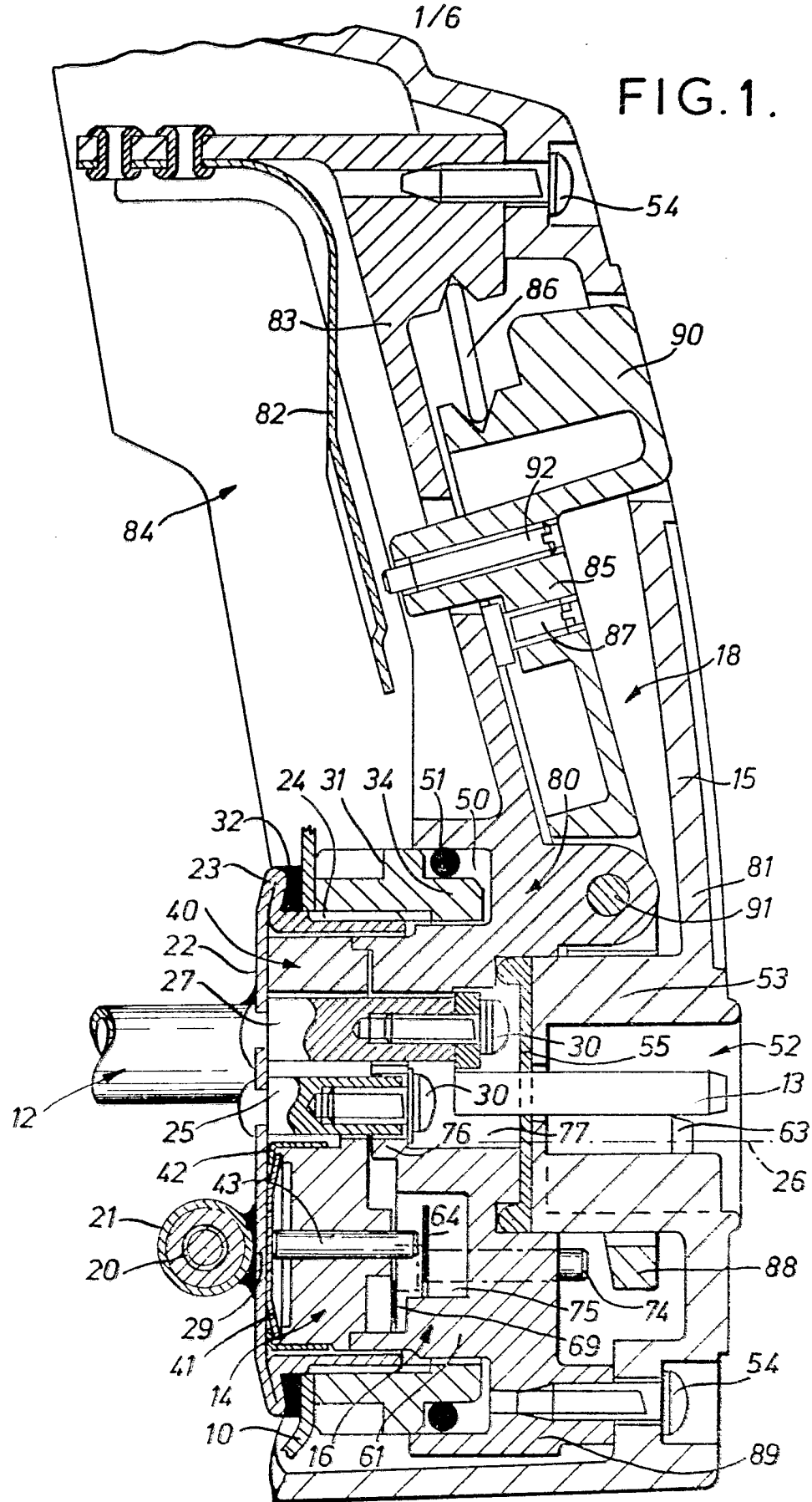


FIG. 2.

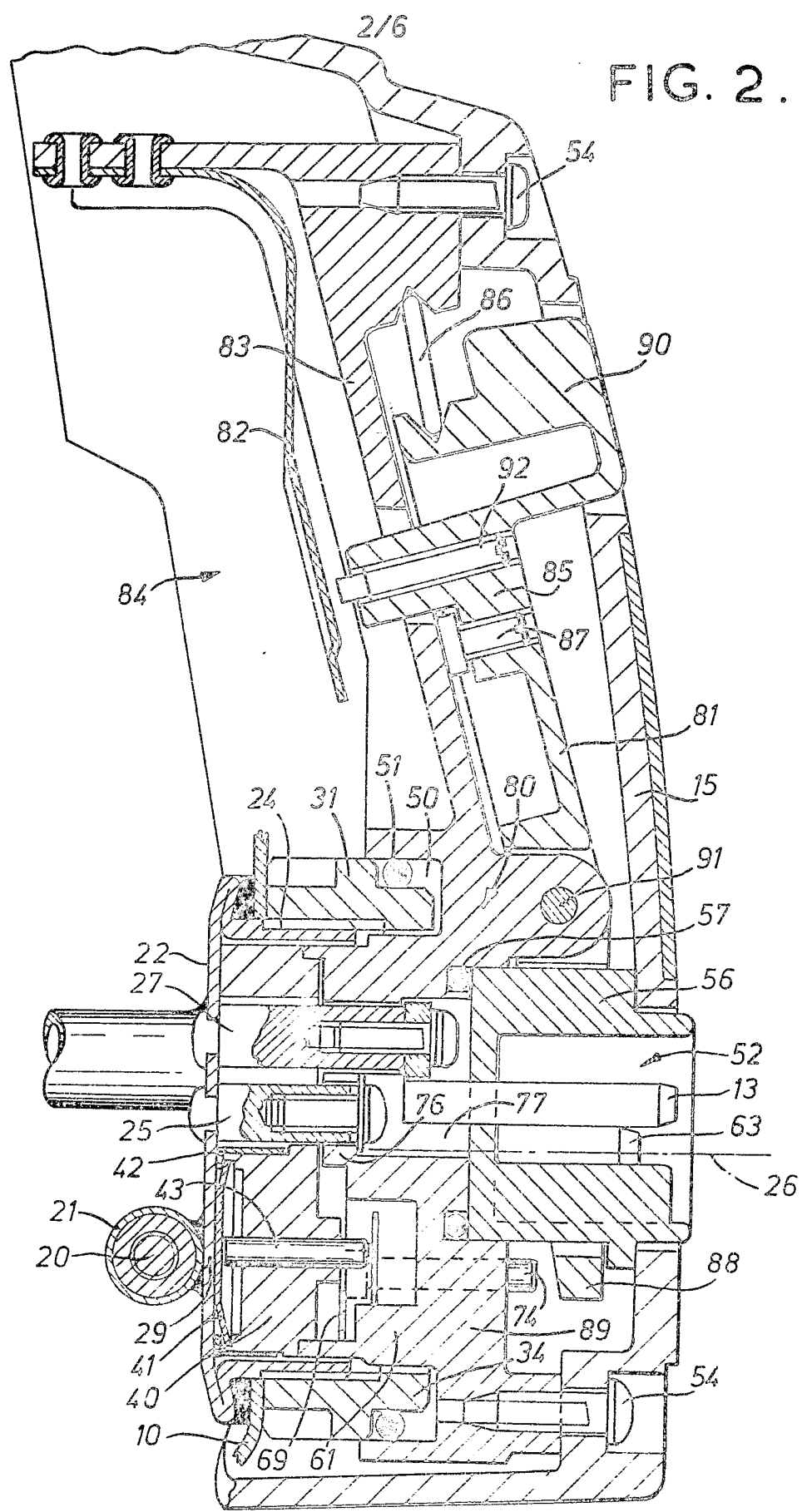


FIG. 3.

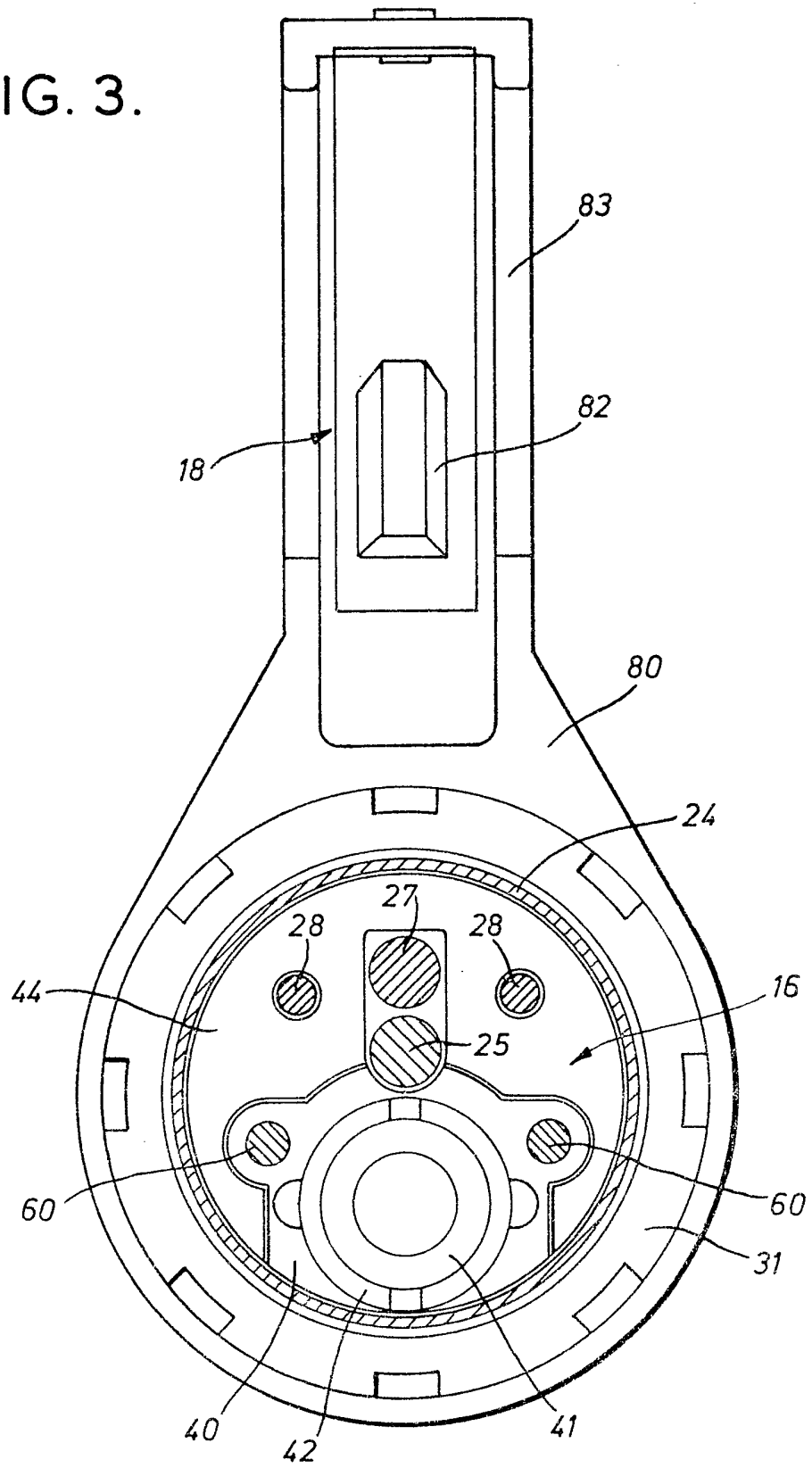


FIG. 4.

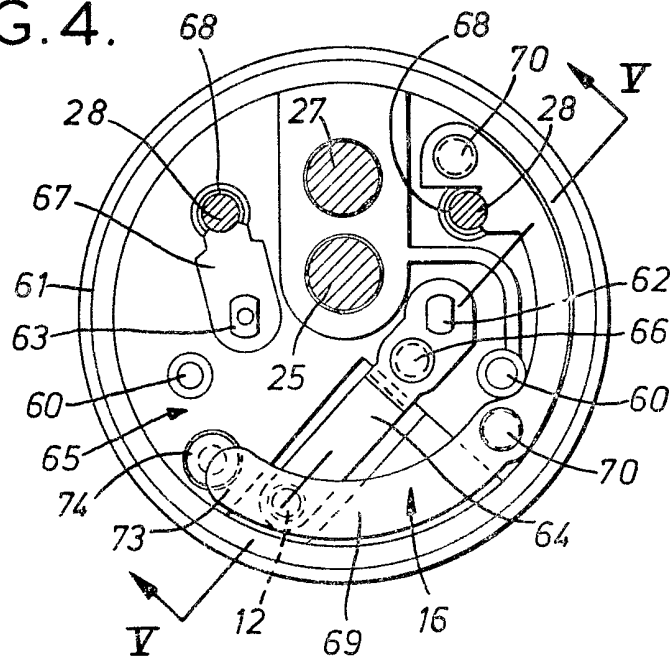


FIG. 5.

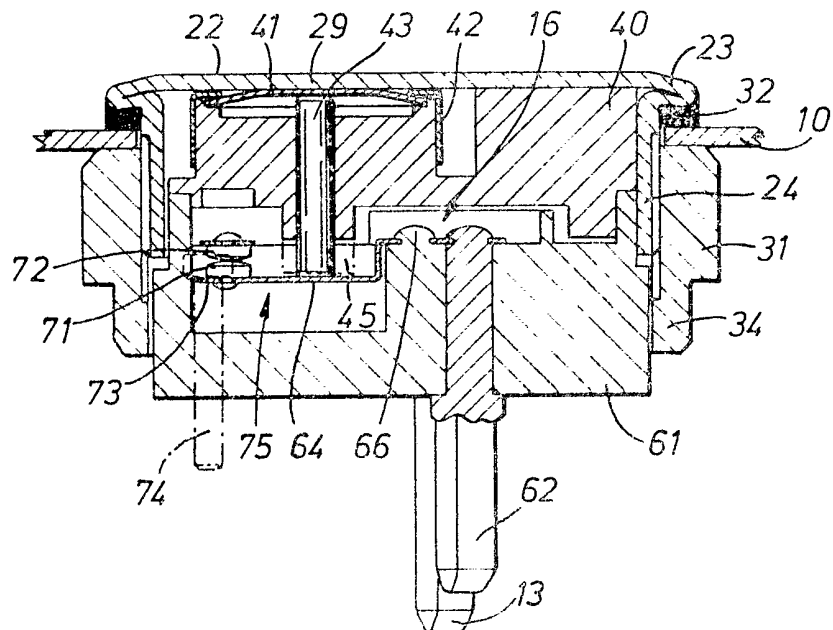


FIG. 6.

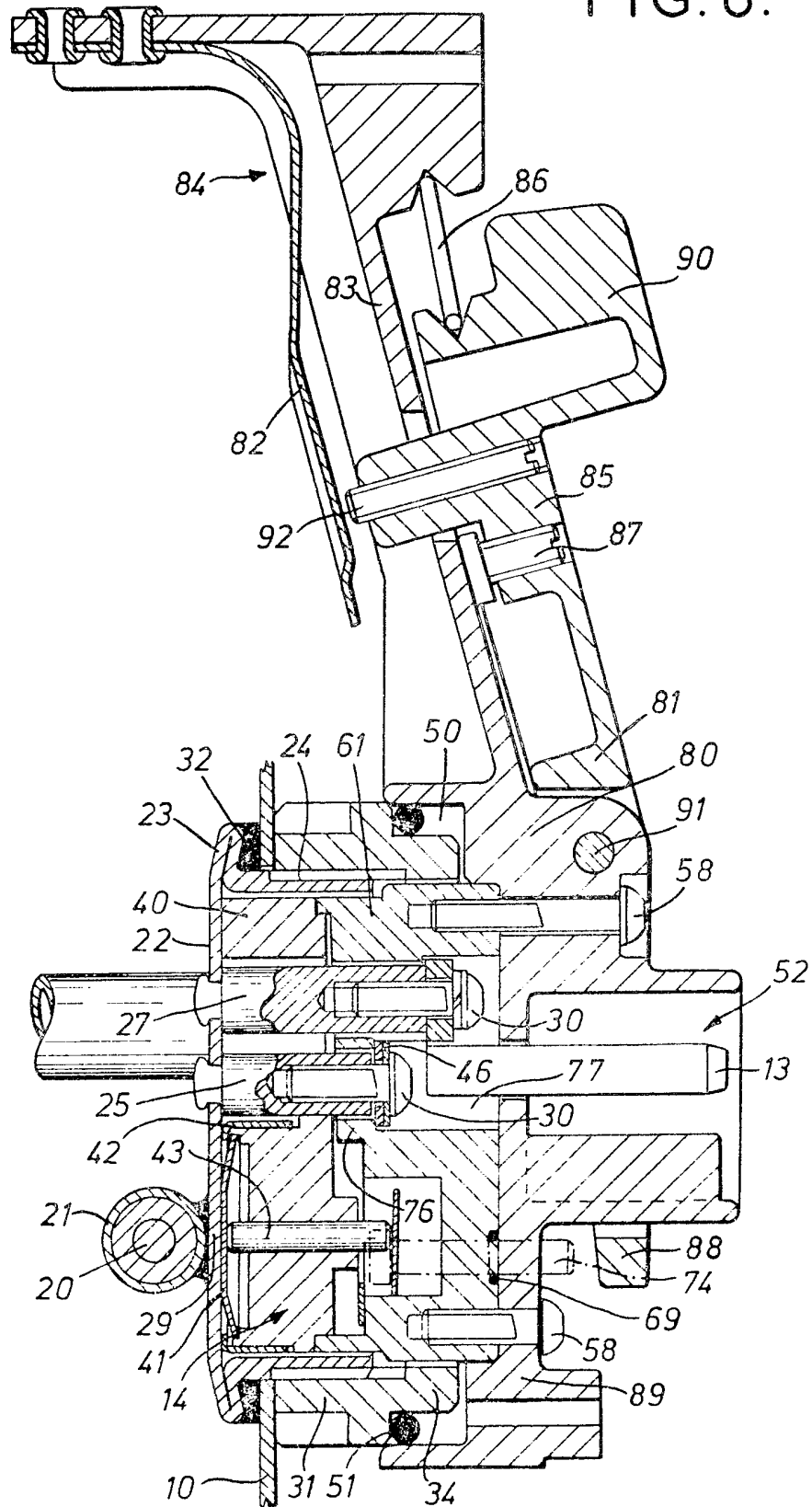
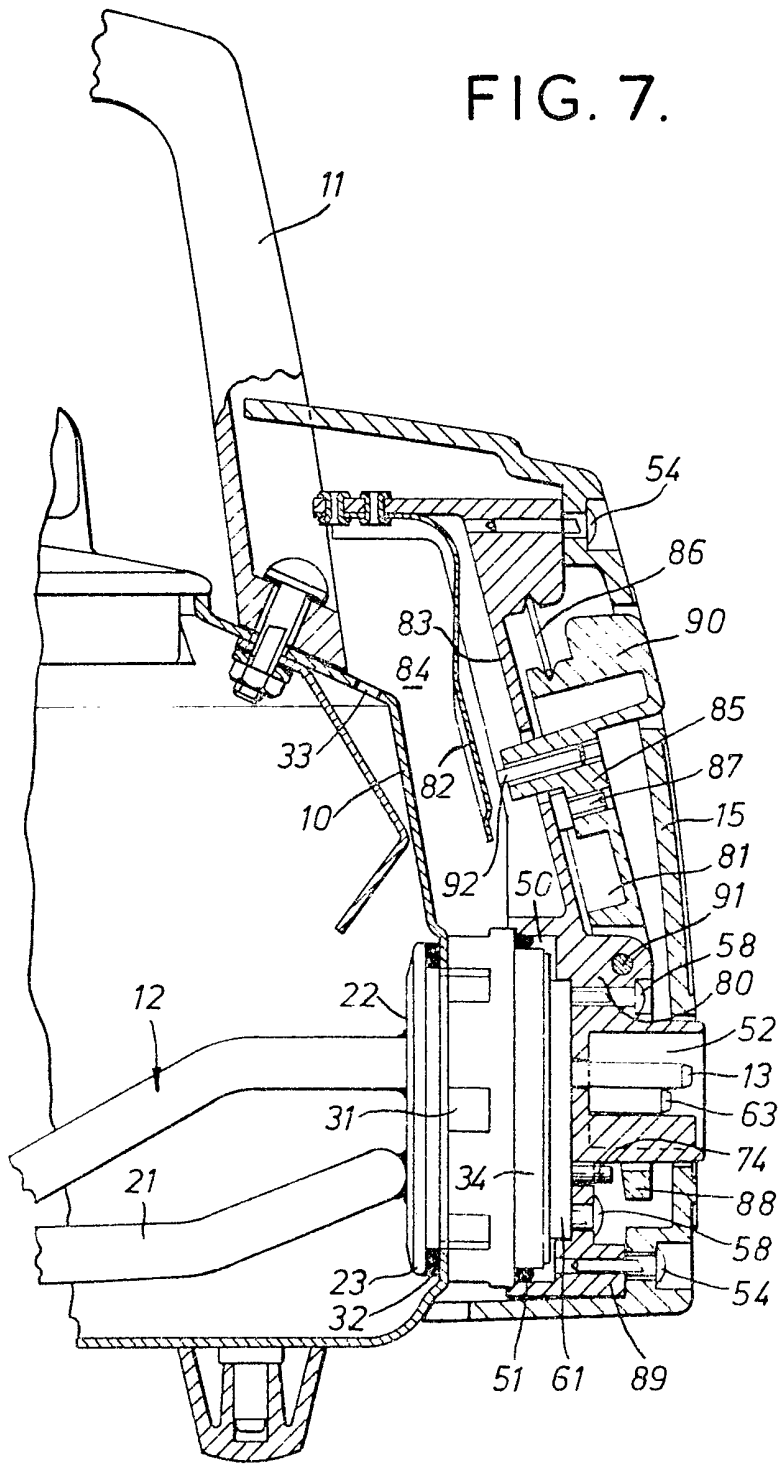


FIG. 7.



## SPECIFICATION

**Improvements relating to immersion heater assemblies for electric kettles**

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This invention concerns electric immersion heaters, for vessels such as electric kettles, of the kind comprising a metal sheathed element secured to a main panel of a metal head, which head has an externally threaded cylindrical extension perpendicular to the main panel to receive a clamping ring for clamping the head to a body of the kettle in known manner. Such immersion heaters are hereinafter referred to as immersion heaters "of the kind described".

The traditional method of fitting such immersion heaters to kettle bodies involves an operation inserting one hand into the kettle to hold the element generally level with the base of the body whilst tightening up the ring with the other hand. This method has the disadvantages of being slow, inconvenient, and not particularly accurate. This last disadvantage does not matter particularly with traditional non-automatic kettles, but if an immersion heater of the kind described is to be employed in an automatic kettle or other form of kettle in which components have to be connected to the head in a predetermined position relative to the kettle, this last disadvantage becomes of major importance.

According to the present invention there is provided an immersion heater of the kind described wherein the head is provided with an elongate post arrangement upstanding from the main panel, which post arrangement is disposed in a predetermined position relative to the element so as to be offset with respect to the axis of the cylindrical extension, which post arrangement is adapted to receive a first fastener for securing switching means to the head and a second fastener for securing an earthing connector to the head independently of the switching means.

The invention includes an immersion heater assembly comprising the immersion heater of the invention, switching means secured to the head by a first fastener engaging the post arrangement, and an earth pin mounted on the post arrangement by a second fastener independently of the first fastener and the switching means.

The post arrangement preferably comprises a first portion which projects a predetermined distance from the main panel to receive the first fastener, and a second portion which projects a different, preferably greater, distance from the main panel to receive the second fastener. Said portions are preferably separate but closely parallel, are preferably intersected by a given radius from the axis, and are disposed at different distances from said axis.

The invention enables the heater to be

inserted into a jig which holds the post arrangement whereby to accurately locate the element relative to the body whilst the clamping ring is tightened, and which absorbs any resultant torque applied to the extension *via* the ring. Furthermore, the invention enables a direct earth connection to be made to the head, which connection is not subjected to any working or other loads *via* the switching means, and is not dependent on the integrity strength (either mechanical or insulation) or tolerances of any component or portion of the switching means; and enables the switching means to be made, located and operated independently of the earthing requirements and any loads applied to the earth connection.

The invention will be described further, by way of example, with reference to the accompanying drawings, wherein:—

85 *Figures 1 and 2* show vertical cross sections through an immersion heater and first and second embodiments of switching means, secured to the body of a kettle:

*Figure 3* shows an inside face of the switching means of *Fig. 1*, with portions of the immersion heater removed, to show portions of the switching means which are common to all of the embodiments of the switching means;

95 *Figure 4* shows an inside face of a mounting and electrical components common to all said embodiments;

*Figure 5* shows a cross section taken on the line V-V in *Fig. 4*, with an element and a steam responsive actuating mechanism removed;

*Figure 6* shows a vertical cross section similar to *Figs. 1 and 2*, and shows a third embodiment of switching means; and

105 *Figure 7* shows a part sectional general arrangement of an automatic kettle incorporating the third embodiment.

The electric kettle body has a wall 10 and is provided with a handle 11, an immersion heater 12, an earth pin connector 13 and a switching means. The switching means comprises an assembly of a dry overload responsive actuating mechanism 14, an electrical connector and switch arrangement 16, a steam responsive actuating mechanism 18, and is provided with a cover 15 or housing.

The immersion heater 12 comprises an element 20 having a metal sheath 21; a metal head having a main panel 22, a peripheral rim 23 and an externally threaded cylindrical extension 24 perpendicular to the main panel; and an elongate post arrangement. As shown in *Figs. 1, 2, 3 and 6* the elongate post arrangement comprises a first portion in the form of a first post 25 which is secured perpendicularly to the main panel above a central axis 26 of the head, and a second portion in the form of a longer post 27 secured to the main panel so as to be parallel with and slightly above the post 25. The free



end parts of the posts are internally threaded to receive the fasteners 30 one of which clamps the earth pin connector 13 directly to the post 27. The ends of the sheath 21 are secured to the main panel so as to leave cold tails 28 of the element projecting into a socket defined by the extension and the main panel, and an intermediate portion of the sheath is secured across one face of the main panel to provide a hot spot 29.

The immersion heater 12 is secured in a predetermined position in the body by a internally threaded clamping ring 31 which is screwed onto the extension 24 so as to clamp the rim 23 and a seal 32 to the wall 10. The alignment of the heater 12 with respect to the body can be maintained as the ring is tightened by locating the kettle in a jig (not shown) which holds the posts 25 and 27 in a predetermined position so as to prevent the head being turned by the turning of the ring.

The dry overload responsive actuating mechanism 14 comprises a moulded member 40 of a heat resistant thermal insulating material, a bimetal 41 of stressed snap-acting dished form located on one side of the member 40 by a cylindrical flanged metal retainer 42, and a push rod 43 which extends perpendicularly from the bimetal through a cylindrical guideway through the member 40 to project from the other side of the member 40. The member 40 is apertured as shown in Fig. 3, to provide passages through which the posts 25 and 27 and cold tails 28 extend, and to receive projections or pegs 60 of the switch arrangement 16. Said one side of the member 40 provides a flat abutment face 44 which confronts and abuts the main panel 22, and is shaped to allow the bi-metal to snap from a convex dished form to a concave dished form, upon being heated to a predetermined temperature by the hot spot 29, to thrust the push rod 43 away from the hot spot.

The electrical connector and switch arrangement 16 comprises a mounting 61 together with a set of switch contacts, and electrical connectors which are arranged on the mounting as shown in Figs. 4 and 5. The connectors comprise a live electrical supply connector pin 62, and a similar neutral pin 63. The pin 62 extends through the mounting and is rivetted over to secure one end of a first spring connector 64 to an inside face 65 of the mounting. Said one end is further held by a projection 66 of the mounting. The neutral pin 63 similarly extends through the mounting and is rivetted over to secure a neutral connector 67 to the mounting which neutral connector has an extension which is clamped to one of the cold tails 28 by a cylindrical collar 68. A second spring connector 69 is secured to the inside face by two projections 70, and similarly has an extension which is secured to the other cold tail by a further

collar 68. The set of switch contacts comprises a first contact 71 mounted on a free end of the connector 64 and a second contact 72 mounted on a free portion of the second spring connector 69.

The first connector 64 is arranged as shown in Fig. 5 so that it can be displaced by the push rod 43 to move the first contact away from the main panel so as to open the contacts, and the second spring connector 69 has an extension 73 which can be moved by a second push rod 74 in a direction towards the main panel so as to open the contacts.

The spring connectors 64 and 69 are arranged so that when the first contact 71 is moved outwards away from the head, the second contact is prevented from following the first contact for more than a slight distance by the extension 73 abutting either the push rod 74 or the mounting adjacent the push rod; and similarly when the second contact is moved inwards towards the head, any movement of the first contact is restricted by the connector 64 abutting the push rod 43, or optionally an extension 45 of the moulded member 40 (shown in broken lines in Fig. 5). Furthermore the contacts are caused to wipe across each other slightly during the initial part of each opening movement and the final part of each closing movement, so as to be self cleaning.

The inside face of the mounting and the other side of the moulded member 40 are shaped to interengage and define therebetween a switch contact chamber 75, and the projections 60 are provided with terminal heads, after assembly, to secure together the mounting and the member 40. The peripheral surfaces of the member 40 and an adjacent portion of the mounting 61 are shaped so as to be a close sliding fit in the socket, and the outside face of the mounting is provided with a recess 77 and an abutment 76 which enables the mounting and member 40 to be clamped to the head by the second of the two fasteners 30, independently of the earth pin connector 13 which is partially accommodated in said recess.

The second push rod 74 of stepped cylindrical form extends through a stepped cylindrical way in the mounting.

The steam responsive actuating mechanism 18 comprises a body 80, a lever 81, and a steam actuable bimetal 82. The body 80 has an upper portion 83 which extends upwards from adjacent the ring 31 so as to confront the wall 10 of the kettle body to define a steam space 84 therebetween as shown in Fig. 7. The bi-metal 82 is mounted, at its upper end on a top part of the upper portion 83 so as to depend within the steam space alongside that side of the upper portion which confronts the wall 10. The lever 81 is pivotally mounted, as hereinafter described, so as to have an upper portion 85 which lies along-

side the other side of the upper portion 83, and a top part of the portion 85 is engaged by a spring 86 which is located by the top part of the body, and is arranged so that the lever 81 is movable between a first stable position in which an abutment 87 of the lever abuts the upper portion 83 and a second stable position in which the abutment 87 is spaced apart from the upper portion 83. The lever has a lower portion 88 which in the first position is spaced apart from the second push rod 74, and in the second position abuts the push rod so as to hold the contacts 72 away from the contact 71, and further abuts a lower portion 89 of the body. As shown in Fig. 7 the upper portion 85 is shaped to provide a knob 90 which projects through the cover 15 to allow the lever to be moved manually to the first position.

The spring 86 is of round wire formed to S or Z shape so as to have top and bottom parallel limbs which are self centring in V or U shaped confronting grooves in the top parts of the body and lever, which limbs are connected by an intermediate transverse limb, and the arrangement is such that the compression on the spring is increased to a maximum when the lever is in an intermediate position between the first and second positions so as to urge the lever out of said intermediate position.

The wall 10 has an upper steam vent 33 which allows steam to pass from the kettle into the steam space 84 so as to heat the bi-metal 82, whereby to cause the bi-metal to bend outwards away from the wall 10 to contact an abutment 92 on the upper portion 85, which abutment extends through an aperture in the upper portion 83 into the steam space, so that the movement of the bi-metal is transmitted to the lever to cause the lever to move to the second position via an unstable intermediate position.

The foregoing description applies generally to all the embodiments shown in the drawings, but these embodiments differ in some details, and in the protection of the switch contact chamber 74 from ingress of steam and water.

As shown in Figs. 1, 2 and 6 the clamping ring 31 is provided with an extension 34 which extends into an annular recess 50 in the body 80, and a sealing ring 51 is compressed between the body and the extension 34 so as to seal the joint therebetween and close the recess 50 whereby to prevent steam, condensate water and flood water, which flows down the steam space 84 from entering the socket in the head and the switch contact chamber 75, furthermore the second push rod 74 is a close sliding fit in the aforesaid way so as to effectively seal the way against ingress of any steam or water which may, upon rare occasions, pass round the body to the side remote from the wall 10, but

if necessary the push rod or way may have a small amount of silicone grease applied thereto to serve as further seal in said way.

In each of the embodiments an outwardly open plug socket 52 is provided to receive an electrical supply connector (not shown), for connecting to the live, neutral and earth pins, 62, 63 and 13 which extend into said plug socket 52.

In the first embodiment shown in Fig. 1 the mounting and body are constituted by a single moulding of electrically insulating material, and the plug socket is provided on an extension 53 of the cover 15, which is secured to the integral moulding by two screws 54 so as to clamp a soft flexible plastics member 55 to the outside face of the integral moulding whereby to provide a seal arrangement which embraces the live, neutral and earth pins and serves to close the recess 77 which is provided in the integral moulding to provide access to and accommodation for the fasteners 30.

In the second embodiment shown in Fig. 2 the mounting and body are again integral, but the plug socket is defined by a hollow moulding 56 of flexible plastics material which serves as a sealing arrangement by embracing the pins and closing the recess 77, this sealing arrangement may optionally include a sealing ring 57 which is trapped between the outside face of the integral moulding and a peripheral portion of the hollow moulding 56.

The hollow moulding is clamped in place by the cover 15.

In the third embodiment shown in Fig. 6 the mounting 61 and the body 80 are separate mouldings held together by screws 58, so as to trap a sealing member 59 around the second push rod to seal the way. The plug socket 52 is formed integrally with the body moulding, and the recess 77 is filled with a sealing material so as to provide a sealing arrangement which closes the recess.

As shown in Figs. 1, 2 and 6 the lever 81 is supported on a pivot 91 which is located on the body 80 above the socket 52, and the lower portion 88 of the lever extends around the plug socket. The abutments 87 and 92 are threaded inserts in the upper portion 85 so as to be presettable or adjustable to determine the first position and to permit the relationship between the lever and the bi-metal 82 to be adjusted or preset so that the switch contacts are opened when the bi-metal 82 reaches a predetermined temperature. These inserts may be locked in position by the application of a sealing compound to the outside face of the upper portion 85 to close the openings in which the outside ends of the inserts are disposed.

The invention is not confined to the foregoing details and many variations are possible within the scope of the invention as defined by the appended claims. For example, a ther-

mal insulating washer 46 may be interposed between the fastener 30 and the abutment 76, as shown in Fig. 6 to minimise heating of the mounting by heat connected from the hot spot along the post 25.

The embodiment shown in Fig. 6 has the advantages that a non-automatic kettle can be constructed, utilising the same immersion heater and dry overload switch means, simply by substituting a simple cover for the steam responsive actuating mechanism and cover 15. The simple cover preferably incorporates the plug socket 52 and the recess 50 to co-operate with the sealing ring 51 and clamping ring 31.

The posts 25 and 27 may have male threaded end parts to receive female fasteners, and may be replaced by a single member, which is secured to the main panel, and which has first and second portions functionally equivalent to these posts.

The invention enables the relative positions of the element, switching means, the cover 15 and the kettle wall and handle 11 to be determined with precision to enable the cover to terminate at or closely adjacent the handle as shown in Fig. 7.

#### CLAIMS

1. An immersion heater, for an electric kettle, comprising a metal sheathed element secured to a main panel of a metal head, wherein said head has an externally threaded cylindrical extension, perpendicular to the main panel, to receive an internally threaded clamping ring, for clamping a wall of the kettle between said clamping ring and an annular rim of the main panel, characterised in that the head is provided with an elongate post arrangement upstanding from the main panel, which post arrangement is disposed in a predetermined position relative to the element so as to be offset with respect to the axis of the cylindrical extension, which post arrangement is adapted to receive a first fastener for securing switching means to the head and a second fastener for securing an earthing connector to the head independently of the switching means.

2. A heater as claimed in claim 1, wherein the post arrangement comprises a first portion which projects a predetermined distance from the main panel to receive the first fastener, and a second portion which projects a different distance from the main panel to receive the second fastener.

3. A heater as claimed in claim 2, wherein the first and second portions are intersected by a single radius from said axis.

4. A heater as claimed in claim 2 or 3, wherein said first portion is longer than said second portion.

5. A heater as claimed in claim 1, wherein the post arrangement comprises a first post which projects a predetermined distance from

the main panel to receive the first fastener, and a second post which projects a different distance from the main panel to receive the second fastener.

6. A heater as claimed in claim 5, wherein the first and second posts are intersected by a single radius from said axis.

7. A heater as claimed in claim 5 or 6, wherein said first post is longer than said second post.

8. A heater as claimed in claim 5, 6 or 7, wherein said posts are parallel.

9. A heater as claimed in any preceding claim, wherein the first and second fasteners are male threaded fasteners and wherein the post arrangement is provided with two parallel internally threaded sockets for said fasteners.

10. A heater as claimed in any preceding claim and substantially as hereinbefore described with reference to the accompanying drawings.

11. An immersion heater assembly comprising an immersion heater as claimed in any preceding claim, switching means secured to the head by a first fastener engaging the post arrangement, and an earth pin mounted on the post arrangement by a second fastener independently of the first fastener and the switching means.

12. An assembly as claimed in claim 11, wherein the switching means is provided with a cover or housing which is fastened to and supported by the switching means.

13. An assembly as claimed in claim 11 or 12, wherein said switching means comprises a mounting on which switch contacts, electrical connectors connected to the element and electrical connectors for receiving a supply of electricity are mounted, together with a dry overload actuating mechanism responsive to overheating of the element to open the switch contacts; and wherein said mechanism is located between said mounting and said main panel by said mounting.

14. An assembly as claimed in claim 12 or claim 13 as appended to claim 12, wherein said clamping ring extends into a recess in said cover, and wherein a sealing ring is clamped between said clamping ring and said cover.

15. An assembly as claimed in claim 12 or claim 13 as appended to claim 12 when mounted on a kettle having a handle, wherein said cover or housing is located in a predetermined position relative to said element to terminate at or adjacent said handle.

16. An assembly as claimed in claim 13 or claim 15 as appended to claim 13, wherein said switching means further comprises a steam responsive actuating mechanism which has a body which is located in a predetermined position relative to the element and which is responsive to the presence of steam to open the switch contacts.

17. An assembly as claimed in claim 16

as appended to claim 12, wherein the cover or housing is supported on said body.

18. An assembly as claimed in any preceding claim as appended to claim 13,  
5 wherein a thermal insulating washer is interposed between the mounting and said first fastener.

19. An assembly as claimed in any preceding claim as appended to claim 13,  
10 wherein the dry overload mechanism comprises a thermal insulating member clamped between the main panel and the mounting, and wherein the post arrangement extends through the thermal insulating member.

- 15 20. An electric kettle incorporating an immersion heater as claimed in any one of claims 1 to 10, or an assembly as claimed in any one of claims 11 to 19.

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