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Liquid heating container

This invention relates to liquid heating containers of the type having an electric heater, such as an immersion heater, arranged therein.

The invention relates in particular to such a container provided with a complementary base unit which defines a receiving area for a lower part of the container and with which the container is adapted to be detachably engaged in use. In such an arrangement the base unit incorporates an electrical connector, typically a socket connector, arranged to be connected with a complementary connector, typically a pin connector, provided in a lower part of the container as and when the container is placed on the base unit whereby electrical power may then be supplied to the heater of the container via the electrical connection thus formed. In this way, it is the base unit rather than the container which is connected to the power supply, and no electrical lead extends from the container when removed from the base unit. Examples of such containers are household electric water heating jugs which have become commonly known as "cordless" jugs.

In traditional electrical kettles, hot water jugs and the like, the head of the heater is arranged in a generally vertical plane adjacent an opening formed in a side wall of the container, the terminal pins extending from the control unit in a generally horizontal direction and being arranged for engagement by a separate, hand-held female socket connector. This arrangement does not however readily adapt for use in conjunction with a "cordless" arrangement in which the socket connector is incorporated in a separate base unit, since there is a need to modify the control unit so that downwardly extending terminal pins are provided for engagement with the socket connector and,

furthermore, with many known configurations of control unit an overcentre spring mechanism for the steam sensitive part of the control is located above the terminal pin connector in a chamber provided in part of the container side wall or in a housing forming part of the handle. Consequently, it is difficult to arrange the overcentre mechanism to cooperate with a part of the base unit (such as in accordance with the first and second aspects of the invention) without complicating the design of the container and/or the control unit.

The invention provides a liquid heating container incorporating an electric heater having an element and a head part clamped in sealing relation adjacent an opening formed in a base wall of the container to a thermally-sensitive control unit underlying said base wall, the control unit comprising downwardly projecting terminal pins which form a terminal pin connector arranged for engagement with a complementary socket connector mounted to a separate base unit with which the lower part of the container is adapted to be detachably engaged in use, the control unit further including a first thermally-sensitive actuating means mounted in good thermal contact with a part of the heater head and coupled to an electrical switch means operable to disable the heater in the event of the element overheating, and a second thermally-sensitive actuating means exposed in use to steam or vapour egressing from the container during boiling and coupled to an electrical switch means via an overcentre spring mechanism having an overcentre lever which is movable by snap-action from a first stable position in which power can be supplied to the heater and a second stable position in which the heater is isolated, the control unit being mounted in a chamber located below the base wall of the container, the container further including an upwardly extending passage which communicates the part of the chamber in which the second thermally

sensitive actuating means is located with an upper region of the container whereby the actuating means is exposed to steam or vapour during boiling as aforesaid.

By means of this arrangement, control units
5 previously used in traditional rather than "cordless" arrangements may be more easily incorporated in a "cordless" container without the need substantially to modify or complicate the design of the control unit. The said base wall of the container may be raised with
10 respect to a lower, external base wall thereof so that the chamber for housing the control unit is defined therebetween. The external base wall may include a recessed portion defining a shroud surrounding the terminal pins, the shroud being shaped for mating
15 engagement over the socket connector of the base unit. In a preferred arrangement the external base wall may include an opening to receive a member of the base unit arranged to cooperate with a part the overcentre spring mechanism during engagement of the container with the
20 base unit and also an actuating arm associated with a reset mechanism of the base unit, as discussed in relation to embodiments of this invention.

In a preferred arrangement the said base wall is only raised with respect to the external base wall of
25 the container across part of the lower region of the container so that a channel is defined around at least part of the periphery of the lower region of the container in which a part of the heater element is located.

30 In a preferred embodiment, the control unit comprises a main body portion clamped to the heater head e.g. by means of screws or bolts and a lateral extension on which the overcentre spring mechanism is mounted.

In a so-called cordless container of this type it
35 is desirable to ensure that, in the event of the container being engaged with or disengaged from the base unit when the base unit is connected to the power

supply, the heater is not energised or denergised by the act of interengaging or disengaging the pin and socket connectors. This can lead to arcing between the terminals of the connectors which can cause premature deterioration thereof in the long term. To this end various isolating switch means have been proposed for the heater which are arranged to be closed only when the container and base unit are interengaged with one another. However, known such arrangements tend to complicate the design of the container or base unit in that an additional set of switch contacts and associated actuating means arranged to cooperate between the base unit and container are required.

Liquid heating containers such as hot water jugs, kettles, etc. are traditionally provided with thermally-sensitive controls incorporating switch means adapted to disable the heater in the event of overheating of the element consequent upon, for example, the container having boiled dry or having been switched on with insufficient liquid therein to cover the element, and, in normal use, in response to liquid within the container boiling. The latter switch means traditionally incorporates an overcentre spring mechanism comprising an overcentre lever arranged to cooperate with a thermally-sensitive actuating means, for example a bimetallic element, exposed to steam or vapour egressing from the container during boiling. The overcentre lever is coupled to a set of switch contacts, and is movable via an unstable dead centre position by snap-action in response to operation of the actuating means from a first stable condition in which the contacts are closed to a second stable condition in which the contacts are open and the heater is thus disabled. A manually operable reset mechanism is also provided so that the user may return the lever to the first position to reenergise the heater. Many different configurations embodying this general arrangement are

well known in the art.

A preferred embodiment therefore provides an electric liquid heating container according to the invention in combination with a base unit which
5 incorporates a member which is arranged to cooperate with a part of the overcentre spring mechanism in such a way that, if the container is initially moved towards engagement with the base unit with the overcentre lever in said first position, the lever is moved to the second
10 position in which the heater is isolated before electrical connection is made between said complementary connectors of the container and base unit, the arrangement of said member and part being such that the lever can thereafter be moved back to the first position
15 to energise the heater when the container is fully engaged with the base unit.

This provides a convenient means for preventing the above-mentioned problem of arcing between the terminals of the connectors, in that the arrangement ensures that
20 switch contacts of the control are always opened to isolate the heater before electrical connection between the connectors is made. Likewise, the member of the base unit and the part of the spring mechanism also cooperate to ensure the lever is in the second position
25 before electrical connection between the connectors is broken. The provision of a member of the base unit arranged to cooperate with a part of the overcentre spring mechanism in this way need not substantially complicate the design of the container or of the
30 control.

The arrangement of the member of the base unit and the cooperating part of the overcentre spring mechanism is such that whilst the spring mechanism is moved to the second or "off" condition during interengagement or
35 disengagement, it can be moved by means of a suitable manually operable reset mechanism, to the first or "on" condition so that the heater of the container is energised once the container is properly engaged with

the base unit. In one embodiment, the said part of the overcentre spring mechanism comprises a generally horizontally extending arm carried by the lever member, and the member of the base unit defines an inclined cam surface or surfaces which cooperate with the arm in such a way as to move the spring mechanism to the second condition if the container is moved into initial engagement with or disengagement from the base unit with the spring mechanism in the first or "on" condition.

10 The movement of said arm is preferably in a generally horizontal direction, a recess being defined beneath the cam surface to permit movement of the arm, and thereby the overcentre spring mechanism, back into the first condition when the container and base unit are fully

15 interengaged.

In a preferred embodiment, the member of the base unit is arranged to project through an opening formed in a base wall of the container into a chamber housing the overcentre mechanism. The generally horizontal arm may

20 be carried by a part which projects downwardly from the overcentre lever member and which may be formed integrally therewith. Preferably, the member of the base unit comprises two spaced apart cam elements defining a central vertical recess therebetween which

25 receives the downwardly projecting part of the overcentre lever, the horizontal arm extending on both sides of such part for engagement with respective cam surfaces on the elements.

As discussed above, there is preferably provided a

30 manually operable reset mechanism for the overcentre spring mechanism, and this may form part of the container, as is traditional in the case of electric kettles and hot water jugs, for example. In this case, the container may incorporate a manually operable reset

35 button or lever which is mechanically coupled to the overcentre spring mechanism by suitable means, as is well-known in the art.

In a preferred embodiment, however, the manually operable reset mechanism for the overcentre spring mechanism forms part of the base unit for the container, the base unit including a reset button or lever adapted to be mechanically coupled to the overcentre mechanism of the control when the container is engaged with the base unit. A releasable coupling is provided between the reset mechanism and the overcentre spring mechanism so that engagement therebetween is made when the container is placed on the base unit. In a preferred embodiment, the reset mechanism incorporates an actuating arm arranged to project upwardly into a chamber of the container housing the overcentre mechanism via an opening provided in a base wall of the container, the actuating arm being adapted for releasable engagement within the chamber with a part coupled to or carried by the overcentre lever. In one embodiment, such a part comprises the aforesaid generally horizontally extending arm carried by the lever member, the upper end of the actuating element including an upwardly facing recess arranged to receive the arm when the container and base unit are interengaged. In such an embodiment, the actuating arm is preferably pivotally mounted about a generally horizontal axis so that its upper end is movable in a generally horizontal direction in response to movement of the reset button or lever which, in this embodiment, may conveniently be coupled to a lower end of the actuating arm by means of a horizontally movable push rod extending from a generally central region of the base unit to adjacent its outer periphery. In the

preferred embodiment discussed above comprising spaced cam elements, the actuating arm is preferably arranged for pivotal movement in the vertical recess defined between said elements and thus engages a central part of the horizontal arm, beneath the downwardly projecting part of the lever member.

In a preferred embodiment there is provided an electric liquid heating container in accordance with the invention and a separate base unit for the container, the base unit providing a receiving area for a lower part of the container and including an electrical connector adapted for engagement with the terminal pin connector of the container when the container is placed on the base unit, wherein a manually operable reset mechanism for the overcentre mechanism and including a manually operable reset button or lever is mounted to the base unit and is coupled or adapted to be coupled to the overcentre lever at least when the container is placed on the base unit. Preferably a releasable coupling is provided between the overcentre lever and the reset mechanism. In this case, the reset mechanism and releasable coupling may take the forms discussed above.

In the above arrangements the form of the thermally-sensitive control incorporating the overcentre spring mechanism may vary, and many different configurations are known. The overcentre spring mechanism forms part of a thermally-sensitive control unit which further comprises another thermally-sensitive actuating means, for example a bimetallic actuator,

arranged in good thermal contact with a part of the heater and operable to open a set of switch contacts to
5 disable the heater in the event of overheating consequent upon the heater having been switched on with insufficient liquid in the container to cover the element or due to the container having boiled dry. Such switch contacts may be additional to or the same as
10 those which cooperate with the overcentre spring mechanism as discussed above. Such control unit also carries terminal pins which constitute a terminal pin connector adapted for engagement with a complementary socket connector of the base unit. Typically, the
15 switch means and other operative parts of such a control unit are carried by a body portion formed of thermo-plastic material, for example, and clamped to the container or to part of the heater itself. In a common such arrangement, the heater is in the form of an
20 immersion heater and includes a head portion clamped in sealing relation to the control unit adjacent an opening formed in a wall of the container, the so-called "cold leads" of the heater extending through the head portion and making electrical contact with suitable terminals of
25 the

control unit whereby electrical power may be supplied to the heater. The element generally also includes a so-called "hot return" part which is e.g. brazed to the head in good thermal contact with the above-mentioned
5 actuating means which is operable to disable the heater in the event of overheating.

The invention is applicable to any form of "cordless" liquid heating container, such as continental style hot water jugs, kettles, coffee percolators and
10 the like.

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

Figure 1 is a partly schematic vertical cross-section of a container and base unit in accordance with
15 the invention;

Figure 1a illustrates, on an enlarged scale, the operative parts of the control unit;

Figure 2 is a view similar to Figure 1 showing the lower part of the container on an enlarged scale and illustrating the overcentre spring mechanism in the
20 "off" condition;

Figure 3 is a schematic view taken in the direction of the arrow III in Figure 2; and

25 Figures 4 and 5 are vertical cross-sectional views illustrating partial conditions of interengagement between the container and base unit.

Referring firstly to Figure 1 a liquid heating container in the form of a plastics hot water jug 1
30 comprises an electric immersion heater 2 a head part 3 of which is clamped in sealing relation adjacent an opening 4 formed in an inner base wall 5 of the container to a thermally-sensitive control unit 6. An O-ring seal 7 is disposed between the heater head 3 and
35 the base wall 5, with the control unit 6 being clamped to the head by means of any suitable means such as mounting bolts engaged with studs (not shown) brazed to

the head, as is traditional.

The inner base wall 5 defines with a lower, external base wall 8 of the container an enclosed chamber 9 within which the control unit 6 is located.

5 The control unit 6 comprises a main body part, formed of two axially interengaged portions 103', 103" defining a chamber 100 therebetween which houses electrical switch means of the control unit. The internal configuration of the control unit may vary, and
10 the person skilled in the art will be aware that many different arrangements for such a control unit are possible. The illustrated control unit is of similar configuration to that described in UK Patent Specification 2181598, although by virtue of the
15 mounting of the heater head to the base wall of the container the control unit is disposed in the generally horizontal plane rather than in a vertical one as is traditional with this sort of control.

As shown in Figure 1a the control unit includes a
20 first thermally-sensitive actuating means, for example a bimetallic actuator 101 of the general type described in British Patent Specification No. 1,542,252, mounted in good thermal contact with a part of the head 3, which part is in turn in good thermal contact with a
25 hot-return 102 of the heater element. As is well-known in the art, the actuator is coupled to a set of switch contacts (not shown) and is operable to isolate the heater from the power supply in the event of overheating consequent upon the heater being energised with
30 insufficient water in the container to cover the element or in the event of the container boiling dry. Such "switch-on-dry" protection is well-known in such a control unit and will not be described further.

As shown in the drawings, the control unit 6
35 further comprises downwardly projecting terminal pins 10 which extend through a shaped shroud 11 provided on the lower base wall 8 of the container. As will be described

in more detail below, the container is provided with a separate base unit 12 which defines a receiving area for the container and with which the container is adapted to be detachably engaged. The base unit 12 incorporates a female socket connector 13 adapted for mating engagement with the shroud 11 and terminal pins 10 of the container, and including terminals 14 arranged for engagement with respective ones of the terminal pins 10 when the container and base unit are interengaged. The terminals 14 are connected by a lead (not shown) to a source of mains power, whereby electrical power may be supplied to the heater via the terminals 14, the pins 10 and the switch means of the control unit 6. When however it is desired to pour liquid from the container, the container is detached from the base unit and thus from the power supply lead. It is therefore the base unit 12 rather than the container 1 which is seen to be connected to the mains; hence the name "cordless" for such containers.

As shown in more detail in Figures 1a and 2, the control unit 6 further includes a lateral extension 20 which mounts at the end thereof remote from the main body part of the control a second thermally-sensitive actuator 21 of the general type described in British Patent Specification No. 1,542,252. The actuator 21 is positioned below a vertical passage 22 which communicates with an upper part of the container via an opening 23. The actuator 21 is thus exposed to steam or vapour egressing from the container during boiling.

The actuator cooperates with an overcentre spring mechanism 123 carried by the lateral extension 20 of the control unit. Many different arrangements of such a spring mechanism are known in the art, and as shown in Figure 2 the mechanism incorporates an overcentre lever 24 mounted by means of knife edge pivots 25 and biased by means of an overcentre spring 26 into either of two stable conditions via an unstable dead centre condition.

In the first such condition shown in Figures 1 and 1a a set of switch contacts 30', 30" of the control unit, which are coupled to the end of the overcentre lever via a push rod 31, are closed whereby power may be supplied to the heater via the control unit. As shown in Figure 1a, the contacts include a movable contact 30' carried by a leaf spring connector 105 which directly engages a cold lead 106 of the heater, and a stationery contact 30" connected via a strip connector 107 to the top of one of the terminal pins 10.

On boiling a central tongue 32 of the actuator 21 moves downwardly as shown in Figure 2 and cooperates with the overcentre lever 24 so as to trip it to a second stable condition shown in Figure 2 in which the push rod 31 is moved upwardly so as to break the contacts 30', 30". In this condition the heater is isolated.

As shown in the drawings, a manually operable reset mechanism 40 for the overcentre spring mechanism 23 of the container is associated with the base unit 12. The reset mechanism comprises a push button 41 coupled to a pivotal actuating arm 42 by means of a slidable push rod 43 extending through apertured locating elements 44. The actuating arm 42 includes an upwardly facing recess 45 which receives a horizontal pin 46 carried by a downwardly projecting triangular plate 47 secured to the overcentre lever 24. Thus, by pushing the button 41 inwardly with respect to the base unit the user may reset the overspring mechanism from the "off" position shown in Figure 2 to the "on" position of Figure 1, inward movement of the push rod 43 causing pivotal movement of the actuating arm 42 and consequential movement of the lever 24 back to the first stable position. As will be seen in the drawings, the actuating arm 42 extends into the control-unit chamber 9 via an aperture 50 formed in the external base wall 8 of the container.

As also shown in the drawings the base unit further comprises an upwardly projecting cam member 51 in the form of laterally spaced cam elements 51', 51" (Figure 3) which define cam surfaces 52, the member 51 being inclined so that the surfaces 52 overhang recesses 53 defined therebelow. The elements 51', 51" of the cam member define a vertical recess therebetween which receives the downwardly projecting part 47 of the overcentre lever and the actuating arm 42 of the reset mechanism.

When the container is brought into initial engagement with the base unit as shown in Figure 3, the cam member extends through the aperture 50 formed in the external base wall 8 of the container into the control-unit chamber 9. If such initial engagement occurs with the overcentre spring mechanism in the first or "on" condition, the cam surface 52 engages each end of the horizontal pin 46 carried by the downwardly projecting part 47 of the overcentre lever in such a way that the overcentre spring mechanism is moved past its dead-centre condition and thus trips to the second or "off" condition as shown in Figure 4 before electrical contact is made between the terminal pins 10 and contact terminals 14. Thus the heater is always isolated from the terminal pins 10 before the pins are engaged with the contact terminals 14. Likewise, if the container is moved away from the base unit with the lever in its first condition, the pin 46 and the underside of cam surface 52 cooperate to trip the lever to the second condition before contact between pins 10 and terminals 14 is broken.

As shown in Figure 4 when the overcentre spring mechanism is in the second condition the central part of the horizontal pin 46 carried thereby is arranged for engagement with the recess 45 formed in the actuating arm 42. By virtue of the recesses 53 defined under the cam surfaces 52 the overcentre spring mechanism can be

moved to the first or "on" condition once the container and base unit are fully engaged, as shown in Figure 1. Thus, when full engagement has occurred, the ends of the horizontal pin 42 are free to move under the cam surfaces 52 formed on the cam member 51. As mentioned above the pivotal actuating arm 42 is received by the vertical recess defined between the cam elements 51', 51" and therefore does not foul on the cam member when moved to the "on" position as shown in Figure 1.

10 As shown in Figure 1, the base wall 5 is raised with respect to the external base wall 8 only across part of the lower region of the container so that a peripheral channel is defined which receives part of the element.

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CLAIMS:

- 5 1. An electric liquid heating container incorporating
an electric heater having an element and a head part
clamped in sealing relation adjacent an opening formed
in a base wall of the container to a thermally-sensitive
control unit underlying said base wall, the control unit
10 comprising downwardly projecting terminal pins which
form a terminal pin connector arranged for engagement
with a complementary socket connector mounted to a
separate base unit with which the lower part of the
container is adapted to be detachably engaged in use,
15 the control unit further including a first
thermally-sensitive actuating means mounted in good
thermal contact with a part of the heater head and
coupled to an electrical switch means operable to
disable the heater in the event of the element
20 overheating, and a second thermally- sensitive actuating
means exposed in use to steam or vapour egressing from
the container during boiling and coupled to an
electrical switch means via an overcentre spring
mechanism having an overcentre lever which is movable by
25 snap-action from a first stable position in which power
can be supplied to the heater and a second stable
position in which the heater is isolated, the control
unit being mounted in a chamber located below the base
wall of the container, the container further including
30 an upwardly extending passage which communicates the
part of the chamber in which the second thermally
sensitive actuating means is located with an upper
region of the container whereby the actuating means is
exposed to steam or vapour during boiling as aforesaid.
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2. An electric liquid heating container as claimed in
claim 1 wherein the base wall of the container is raised



with respect to a lower, external base wall thereof so that the chamber for housing the control unit is defined therebetween.

5 3. An electric liquid heating container as claimed in claim 2 wherein the said base wall is only raised with respect to the external base wall of the container across part of the lower region of the container so that a channel is defined around at least part of the
10 periphery of the lower region of the container in which a part of the heater element is located.

4. An electric liquid heating container as claimed in any of claims 1 to 3 in combination with a base unit
15 which incorporates a member which is arranged to cooperate with a part of the overcentre spring mechanism in such a way that, if the container is initially moved towards engagement with the base unit with the overcentre lever in said first position, the lever is
20 moved to the second position in which the heater is isolated before electrical connection is made between said complementary connectors of the container and base unit, the arrangement of said member and part being such that the lever can thereafter be moved back to the first
25 position to energise the heater when the container is fully engaged with the base unit.

5. An electric liquid heating container as claimed in claim 4 wherein the said part of the overcentre spring
30 mechanism comprises a generally horizontally extending arm carried by the lever, and the member of the base unit defines an inclined cam surface or surfaces which cooperate with the arm in such a way as to move the spring mechanism to a second condition (in which the
35 lever is in its second position) if the container is moved into initial engagement with or disengagement from the base unit with the lever in a first or "on"



condition (in which the lever is in its first position).

6. An electric liquid heating container as claimed in claim 5 wherein the movement of said arm is in a generally horizontal direction, a recess being defined beneath the cam surface or surfaces to permit movement of the arm, and thereby the overcentre spring mechanism, back into the first condition when the container and base unit are fully interengaged.

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7. An electric liquid heating container as claimed in claim 5 or 6 wherein the member of the base unit comprises two spaced apart cam elements defining a central vertical recess therebetween which receives a downwardly projecting part of the overcentre lever, the horizontal arm extending on both sides of such part for engagement with respective cam surfaces on the elements.

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8. An electric liquid heating container as claimed in any of claims 4 to 7 wherein the member of the base unit is arranged to project through an opening formed in the external base wall of the container into the chamber housing the overcentre mechanism.

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9. An electric liquid heating container as claimed in any preceding claim in combination with a base unit wherein a manually operable reset mechanism for the overcentre spring mechanism forms part of the base unit for the container, the base unit including a reset button or lever adapted to be mechanically coupled to the overcentre mechanism of the control when the container is engaged with the base unit.

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10. An electric liquid heating container as claimed in claim 9 wherein a releasable coupling is provided between the reset mechanism and the overcentre spring mechanism so that engagement therebetween is made when

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the container is placed on the base unit.

11. An electric liquid heating container as claimed in claim 10 wherein the reset mechanism incorporates an actuating arm arranged to project upwardly into the chamber of the container housing the overcentre mechanism via an opening provided in the external base wall of the container, the actuating arm being adapted for releasable engagement within the chamber with a part coupled to or carried by the overcentre lever.

12. An electric liquid heating container as claimed in claim 11 wherein such a part comprises the aforesaid generally horizontally extending arm carried by the lever, the upper end of the actuating arm including an upwardly facing recess arranged to receive the arm when the container and base unit are interengaged.

13. An electric liquid heating container as claimed in claims 7 and 12 wherein the actuating arm is arranged for pivotal movement in the vertical recess defined between said elements and thus engages a central part of the horizontal arm, beneath the downwardly projecting part of the lever.

14. An electric liquid heating container as claimed in any of claims 1 to 3 in combination with a base unit for the container, the base unit providing a receiving area for the lower part of the container and including an electrical socket connector adapted for engagement with the terminal pin connector of the container when the container is placed on the base unit wherein a manually operable reset mechanism for the overcentre mechanism and including a manually operable reset button or lever is mounted to the base unit and is coupled or adapted to be coupled to the overcentre lever at least when the container is placed on the base unit.



15. An electric liquid heating container substantially as hereinbefore described with reference to the accompanying drawings.

- 5 16. An electric liquid heating container in combination with a base unit, the combination being substantially as hereinbefore described with reference to the accompanying drawings.

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