United States Patent

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[54] **ELECTRIC IMMERSION HEATER**
7 Claims, 6 Drawing Figs.

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[51] **Int. Cl.** **H05b 3/06,**
H05b 3/08, H05b 3/02
[50] **Field of Search** 219/523,
322, 328, 336–337, 517, 437

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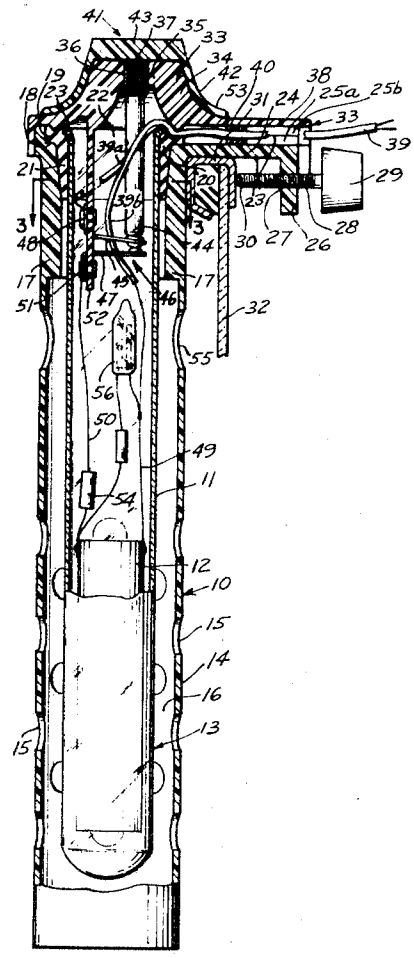
ABSTRACT: An electric immersion heater for use with home aquarium tanks. A glass tube containing at the bottom thereof an electric heating element is yieldably suspended within and in spaced relation to a heat-resisting apertured casing, the casing having a cover member with a depending bar extending into the tube and supporting the terminals of a thermostat. The casing and its said cover member have two complementary lateral extensions together forming a channelled passageway for electric conductors extending into the tube and connected to said terminals, said heating element being connected in series with said thermostat, there being a fuse in adjacent relation to and connected in series with said heating element. A knob member is rotatably mounted over said cover member and has a control rod in threaded engagement with the latter, the rod extending down into the tube and being operatively engageable with a contact arm of said thermostat, said knob being engageable with said cover member and thereby serving as a stop to prevent the control rod from excessively bending the engaged thermostat contact arm.



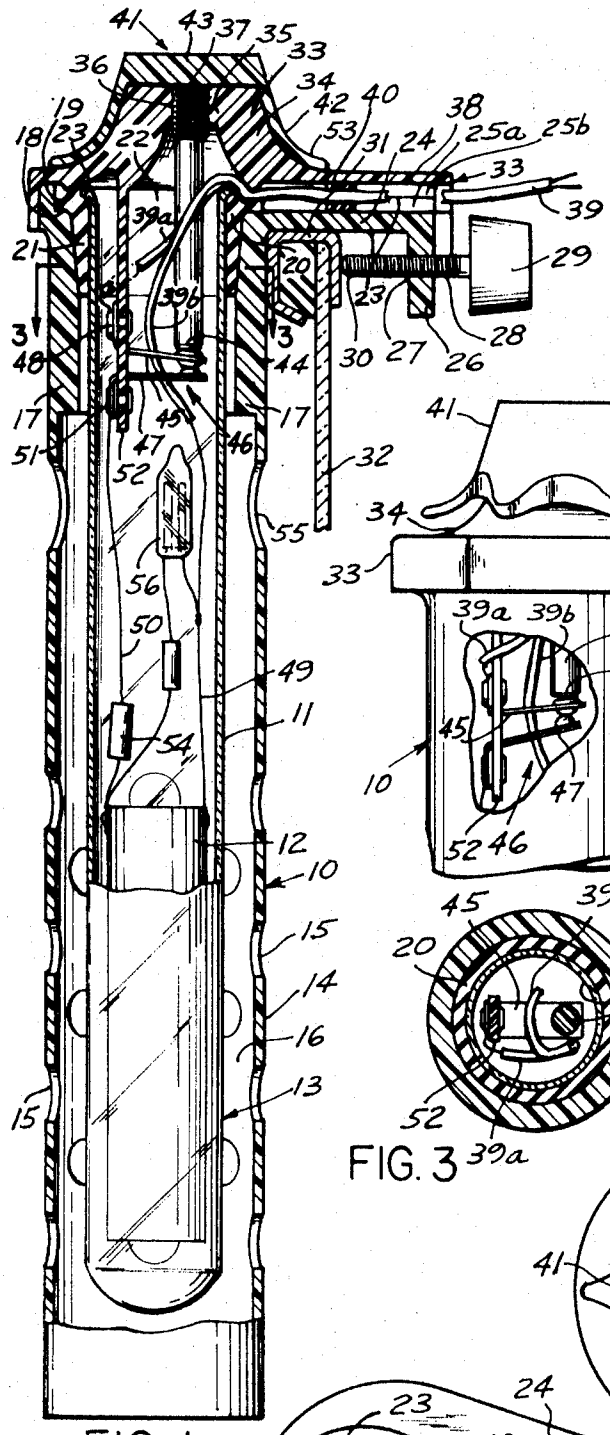


FIG. 1

FIG. 2

FIG. 3

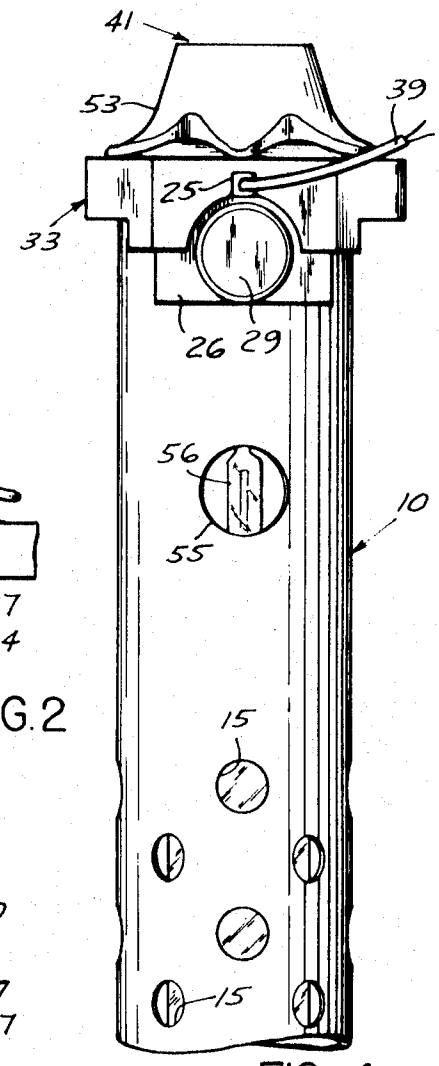


FIG. 4

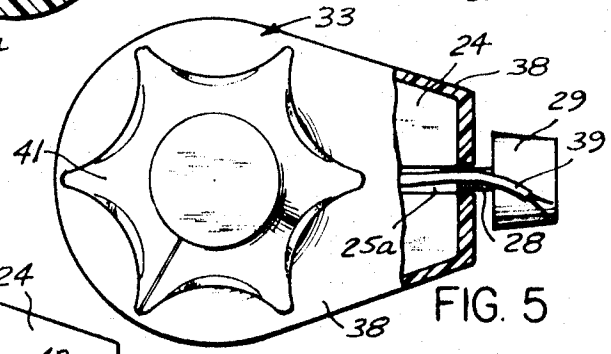


FIG. 5

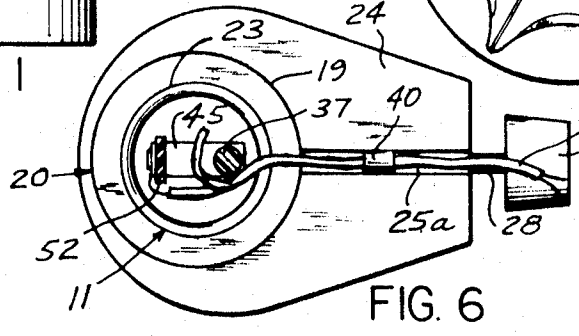


FIG. 6

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ELECTRIC IMMERSION HEATER

BACKGROUND OF THE INVENTION

1. The Field of the Invention

This invention relates to electric immersion heaters, and is especially directed to portable heaters of this class adapted for use with home aquarium tanks.

2. The Known Art

The known thermostatically controlled devices in this category, while capable of heating water and maintaining it at predetermined temperatures, do not contain certain safety features, or combinations of such features, deemed necessary for underwriters' approval when used with a home aquarium. This type of heater is almost always intended for manual handling—such as attaching the device to the wall of an aquarium tank and removing it when cleaning the tank or when it is desired to examine the device for one reason or another. During such operations the conventional glass tube containing the heating element is frequently subjected to shocks and impacts due to mishandling, with the consequent danger of breakage of the tube or displacement of the delicate parts of the enclosed heating element and thermostat. It is also a common occurrence for the device to be removed from the tank, while the circuit is still closed, and placed upon a table or other supporting surface. Since the device is no longer cooled by surrounding water, the temperature of the portion of the glass tube immediately adjacent the heating element may become sufficiently high to scorch the supporting surface or any adjacent infalmmable material, the device thus constituting a fire hazard. It also frequently happens with conventional immersion heaters that when the device is temporarily removed from the tank for a brief inspection or adjustment without turning off the current, the fuse in the line may blow after a very short interval in the air—before the device could be returned to the tank—a situation that is quite apt to arise where the line is subject to current fluctuations. Another disadvantage of conventional immersion heaters having thermostats that are intended to be hand adjusted is the ever present danger that during the adjusting manipulation the coactive thermostatic contact elements, or the bimetallic element thereof, may inadvertently be bent an excessive amount, thereby distorting the element or elements and destroying their operative effectiveness.

OBJECTS OF THE INVENTION

It is the objective of this invention to provide an immersion heater adapted especially for use with home aquariums that will function effectively and safely, and that will have none of the shortcomings above mentioned. More specifically, among the objects of this invention are the following: to provide means for protecting the heating element, its glass tube enclosure and the coactive elements therein against excessive shock and impact effects; to provide such protection and at the same time permit the heating member to be effectively immersed in and in engagement with the water being heated; to provide adequate sealing means for the tube, its contents and the electric wiring within the device; to provide a heat-resisting barrier around the tube, especially the portion thereof immediately adjacent the heating element, thereby to prevent scorching or overheating of a surface upon which the device is placed when it is taken out of the water; to provide a thermostat with a hand-adjusting means having stop means thereon to prevent any excessive bending or distortion of the thermostat elements; to provide lighting means to indicate whether the device is operatively electrically connected; to provide a fuse in such proximate relation to the heating element as to be operatively effective as soon as the tube air surrounding the heating element reaches a predetermined temperature; and to arrange said fuse and a thermostat in such predetermined spaced relation to the heating element and of such functional characteristics as to produce, with the thermostat closed, a predetermined safe minimum temperature spread between the tube air temperature when the device is operatively immersed and its temperature when the device is removed and held in the air during a predetermined period of time before the fuse blows.

SUMMARY OF THE INVENTION

In the preferred form of this invention, an elongated glass tube containing at the lower portion thereof a conventional electrical heating element is held suspended within an elongated casing of heat-resisting plastic material, the lateral apertured wall of the casing surrounding said tube and being in spaced relation thereto. The upper part of the casing contains an inner annular shoulder supporting a soft bushing of insulating material, the upper portion of the tube, which is open at the top, being in pressing circumferential engagement with said bushing, the top of the tube having a peripheral lip embedded in the bushing, whereby the tube is yieldably supported in its suspended position.

In sealing engagement with the top of the casing and the upper surface of the bushing is a cover member of heat and electrical insulating properties and having an upwardly extending central portion of substantially frustoconical configuration, the top horizontal wall of the cover member having a vertical axially disposed threaded apertured portion. Said cover member has a horizontally extending portion overlying and in engagement with a corresponding portion extending from the top of said casing, both of said extending portions forming a sealed passageway for electric conductors operatively connected to the tube's heating element and associated parts. The said cover member also has an integral inner bar depending downwardly therefrom into the tube, the bar supporting two spaced electric terminals operatively connected to the two coactively positioned contact-supporting arms of a thermostat, there being conductors connecting said thermostat and the electric heating element in series, and a lamp in parallel.

Rotatably positioned over the said frustoconical portion of said cover member is a correspondingly shaped knob; and extending downwardly and axially therefrom is a thermostat control rod extending through and being in threaded engagement with said threaded aperture portion of said cover member, the bottom end of said rod being in abutting engagement with the upper of said thermostat arms for controlling the frequency of the make and break action of the said arms in known manner. In order to prevent an excessive bending and permanent distortion of said arms, the said knob is so proportioned and positioned with respect to the top of said cover member and the bottom end of the control rod that the knob engages the top of the cover member when the said bottom end of the rod is at a predetermined level above that at which the said thermostat arms, or either of them, is excessively bent—the top of the cover member stopping any further downward movement of the control rod.

An extremely important feature of this invention is the use of a fuse positioned in proximate relation to and above the electric heating element. As will more clearly hereinafter appear, the spaced relation of the closely positioned fuse and remotely positioned thermostat with respect to the heating element, and their respective electrical and physical characteristics, are such as to provide a predetermined safe minimum temperature spread between the tube air temperature when the device is in water and its temperature when in air, so that when the device is in air with the current on, the danger of the fuse blowing before a predetermined time will be reduced to a minimum. The spacing of the outer casing wall from the glass tube is such that the ventilated space between the tube and casing, as well as the heat-resisting properties of the casing material, will obviate the danger of the portion of the casing immediately adjacent the heating element from becoming dangerously hot before the time set for the fuse to blow.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical longitudinal section of an embodiment of this invention, portions being shown in front elevation, the thermostat control rod being in its lowest position.

FIG. 2 is a fragmentary front elevation of the device of FIG. 1, a portion being broken away and showing the position of the contact arms of the thermostat with the control rod in a raised position.

FIG. 3 is a fragmentary section of FIG. 1 taken along line 3–3, with portions removed for clarity.

FIG. 4 is a fragmentary side elevation of FIG. 1.

FIG. 5 is a top view of FIG. 1, shown partly in section.

FIG. 6 is a top view of the device with cover and knob portions removed.

DESCRIPTION OF A PREFERRED EMBODIMENT

In the illustrated embodiment of the immersion heater constituting this invention, a tubular casing **10** of heat-resisting plastic material supports therein the tubular member **11**, shown as a glass tube, containing at the lower portion thereof the electric heating element **12** of conventional construction, said tube and heating element being collectively referred to herein as the heating member **13**. The lateral wall **14** of said casing **10** is in spaced relation to said tube **11** and is provided with a plurality of apertures **15**, the arrangement being such as to permit the water into which the device is operatively immersed to course through the apertures **15** and move (by convection) through the space **16** for effective engagement with the heating member **13**, as well as to permit air circulation within said space **16** when the device is taken out of the water, thereby to help insulate the wall **14** of the casing from the heating element **12**.

The upper portion of the casing **10** has a thickened annular wall portion **17** with a depressed annular shoulder **18** to receive the top flange **19** of the bushing **20** made of soft, resilient, water-impervious material, the generally cylindrical body portion **21** of said bushing being in yieldable pressing engagement with the adjacent inner surface of said thickened wall portion **17** and the adjacent outer surface of the glass tube **11**, the top open portion **22** of the tube having the peripheral lip **23** in pressing engagement with the top of said bushing's flange **19**, the upper portion of said flange being in pressing engagement with the cover member **33** to be hereinafter described.

The arrangement is such that said glass tube **11** is yieldably held suspended within said casing **10**, the entire tube below the casing's said thickened portion **17** being in spaced relation to the casing's wall **14**. The top of the casing is also provided with a lateral extension **24** having therein a channel **25***a* to accommodate therein electrical conductors for connection to a source of current supply, as will more clearly hereinafter appear. The said extension **24** has depending therefrom the wall section **26** having a threaded aperture **27** through which extends the threaded shank **28** of the clamping knob **29**, the terminal **30** being adapted for holding engagement with the top rim of an aquarium, such as the illustrated rim **31** of the aquarium wall **32**, whereby the casing **10** and associated parts are operatively supported, in known manner, within the interior of an aquarium.

Mounted over and in sealed relation to the said casing **10** is the said cover member **33**, made of heat-resisting and electrical insulating material, said member having an upwardly extending central portion **34** preferably, although not necessarily, of substantially frustoconical configuration. The top wall **35** of said cover member has an axial vertically disposed threaded apertured portion **36** in threaded engagement with the thermostat control rod **37** to be hereinafter described. Said cover member **33** has a lateral extension **38** proportioned to correspond with said extension **24** of the casing, extension **38** overlying said extension **24** and having a channel **25***b* overlying said channel **25***a*, thereby forming the channel **25**, through which the conductor wire **39** extends, the outer portion of said wire being adapted for connection to a wall outlet. In the preferred embodiment illustrated said channel **25** contains a seal **40** of suitable material in engagement with the surface of said wire **39** and the walls of the said channel to prevent water from entering the tube **11** into which the conductor leads **39***a* and **39***b* extend.

Rotatably positioned over the said frustoconical portion **34** of the cover member **33** is the knob **41** having a correspondingly shaped hollow frustoconical portion **42** from the top wall **43** of which depends the said thermostat control rod **37**. The bottom end **44** of said rod is in abutting engagement with the upper contact arm **45** of the thermostat generally designated **46**, the bimetallic contact arm **47** being in coacting relation to said arm **45** in known manner, said contact arms extending transversely within the upper portion of said tube **11**. The said lead **39***a* is connected to the terminal **48** of said contact arm **45**, the other lead **39***b* being electrically connected by conductor **49** to said heating element **12**, the latter being electrically connected by the conductor **50** to the terminal **51** of said bimetallic contact arm **47**. Both of said terminals **48** and **51** are affixed to the bar **52** which is integral with said cover member **33** and extends downwardly therefrom into said tube **11**, said contact arms **45** and **47** being supported by said bar **52**.

In the particular construction illustrated, the shape of the annular wall **53** of the knob **41** conforms to that of the said upwardly extending central portion of the cover member **33**, and is abuttable therewith when said bottom end **44** of the thermostat control rod **37** reaches a predetermined low limiting position upon an operative rotation of the knob **41** so that there could be no further downward movement of the rod. The said predetermined low level is that at which the rod will not excessively bend the contact arms **45** and **47**, or either of them, to positions at which they will become permanently distorted or incapable of effectively performing their intended functions. The said knob **41** accordingly serves not only to adjust the make-and-break action of said thermostat arms **45** and **47** for maintaining, in known manner, the water at the desired temperature, but also serves as a stop to prevent destroying the functional usefulness of the thermostat by careless operative manipulation of the control knob.

The said bar **52** is, as aforesaid, a part of the cover member **33** which is adjacent the top of the tube **11**, the heating element **12** being at the opposite end thereof—the arrangement being such that the thermostat **46** is remotely situated from the heating element. In relatively proximate relation to the heating element is the fuse **54** connected to the conductor **50** and in series with the thermostat **46**.

If the device is taken out of the water, with the current on and the thermostat switch closed, the casing **10**, especially the portion thereof immediately adjacent the heating element **12**, will be subjected to increasing heat effects due to the absence of water until the fuse blows; but due to the apertured wall **14** spaced from the tube **11**, this progressively increasing heating action is reduced through the ventilating and insulating action of the air within the space **16** surrounding the tube. With this heat-retarding effect, the fuse **54** is set to blow after a predetermined reasonably sufficient time for the device to be held in the air (for inspection, cleaning, or other purpose) prior to being returned to the water. If it is held in the air for a longer period, say longer than 3 minutes, the fuse, being close to the heating element, will blow immediately as the air in the tube adjacent the heating element reaches a predetermined temperature, say 170° F., at which the portion of the casing adjacent the heating element becomes too hot for safety. It is, however, also important that the spread between the temperature attained by the tube air in the region adjacent the thermostat with the device in water and the fuse-blowing temperature with the device withdrawn from the water be not too small, since under such a condition current fluctuations might cause an unwanted blowing of the fuse. With the fuse close to the heating element and the thermostat remote therefrom, with both fuse and thermostat, being operatively reactive to the temperature of the air within the tube, and with a ventilating space between the tube **11** and the casing **10**, it has been found that a reasonably safe spread can be obtained between said device-in-water and device-in-air temperatures.

In the illustrated device the casing **10** has an aperture **55** in the casing adjacent the lamp **56** connected in parallel to the heating element **12**, thereby to indicate whether the device is heating.

It will be observed that the fragile tube **11** is yieldably suspended within the casing **10** and maintained in spaced relation to the tube by the resilient bushing **20**. Any impact the device will suffer due to mishandling will accordingly be cushioned, with minimum danger of breakage of the tube or dislodgment of its delicate contents. Should the device be placed on a supporting surface with the current on, the heat-insulating air between the casing and the tube will obviate the danger of scorching the supporting surface or adjacent flammable material.

In the above description, the invention has been disclosed merely by way of example and in preferred manner; but obviously many variations and modifications may be made therein. It is to be understood, therefore, that the invention is not limited to any particular form or manner of practicing same.

We claim:

1. An electric immersion heater comprising a tubular heating member having a heating element therein, a casing of heat-resisting material surrounding and in spaced relation to said tubular member, resilient means between and in pressing engagement with the upper portions of said tubular member and casing for yieldably supporting said member within the casing, a cover member in sealing engagement with the top of said casing and having a downwardly depending bar extending into said tubular member, a thermostat having coactive contact arms supported by said bar and disposed within said tubular member, said casing and cover member having lateral extensions in coactive relation and together forming an internal passageway for electric conductors, a pair of electric conductors within said passageway, a knob in rotatable engagement with the top of said cover member and having a thermostat control rod extending downwardly through and in threaded engagement with said cover member, said control rod being in engagement with one of said contact arms for operatively adjusting the relative positions of said arms, said knob having a wall portion engageable with an underlying wall portion of said cover member at a predetermined low limiting position of said control rod, said heating element being electrically connected to said thermostat and said conductors, and a fuse in adjacent relation to said heating element and disposed between and connected in series with said heating element and said thermostat.

2. An electric immersion heater according to claim **1**, said bar having thereon two terminals electrically connected to said respective contact arms, said heating element being connected to one of said terminals and to one of said conductors, the other of said conductors being connected to the other of said terminals.

3. An electric immersion heater according to claim **1**, said resilient means comprising a flanged bushing of soft yieldable material impervious to water, the upper part of said casing having a thickened annular portion with a recessed annular shoulder supporting the flanged portion of said bushing, said cover member being in pressing and sealing engagement with the said flanged portion.

4. An electric immersion heater according to claim **1**, said casing having apertured portions in the wall thereof, an electric lamp within said tubular member and connected in parallel to said heating element, one of said apertured portions being in registry with said lamp for visual observation.

5. An electric immersion heater according to claim **1**, the said lateral extension of the casing having a depending wall portion, a holding knob member having a shank in threaded engagement with said depending wall portion and adapted for abutting engagement with the rim of an aquarium tank.

6. An electric immersion heater according to claim **1**, said cover member having an upwardly extending central portion containing a threaded apertured portion, said knob having a hollow portion defined by a wall portion of a configuration complementary to that of said central portion, said control rod extending down from the central axial portion of said knob and having a portion thereof in threaded engagement with said threaded apertured portion, said wall portion of said knob being engageable with said upwardly extending central portion of said cover member when said control rod is in its said low limiting position.

7. An electric immersion heater according to claim **6**, said upwardly extending portion of the cover member being of substantially frustoconical configuration, and said complementary wall portion of said knob being of corresponding substantially frustoconical configuration, whereby the correspondingly positioned frustoconical portions of said cover member and knob will be in abutting engagement when said control rod is in its said low limiting position.

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