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Elkins

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[45] **June 5, 1973**

[54] WATER-IMMERSIBLE ELECTRICAL HEATING DEVICE

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[52] **U.S. Cl.** **219/318,** 219/322, 219/328, 219/336, 219/338

[51] **Int. Cl.**.....**H05b 1/00**

[58] **Field of Search**.....219/316, 318, 281, 219/322, 335, 336, 337, 338, 523, 536, 538, 549

[56] **References Cited**

UNITED STATES PATENTS

3,476,915	11/1969	Rapsis	219/336 X
3,344,385	9/1967	Bartos et al.	219/528 X
2,511,902	6/1950	Cabrera	219/336 X
2,784,292	3/1957	Haloski	219/523 X
2,789,201	4/1957	Sherwin	219/523

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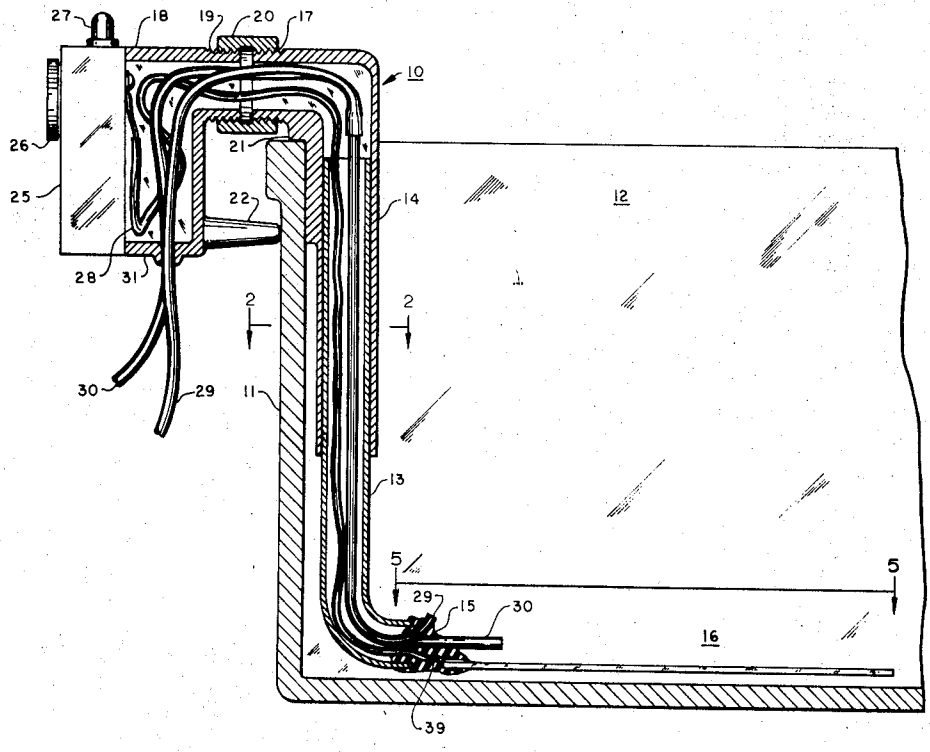
Attorney—Donovan J. De Witt

[57] **ABSTRACT**

An immersible electrical heating device for use in aquariums or other water-containing vessels, said device comprising a planar heating unit which is resiliently coupled to the lower end of a hollow support column carrying electrical leads to the heater unit along with water and/or air conduits which open to the water. The heating unit, which is flexible in character, comprises a semi-conductive core layer made up of a fabric imgregnated with a conductive resin, said layer carrying spaced bus elements arranged for connection to electrical leads and being bonded between electrically non-conductive face panels. The heating unit may, if desired, be enclosed within a perforate protective cage. The support column is adapted to hang from a wall of the vessel and thereby position the attached heating unit, which projects from the column at any desired angle, either along the bottom of the vessel or at some other appropriate location.

8 Claims, 10 Drawing Figures



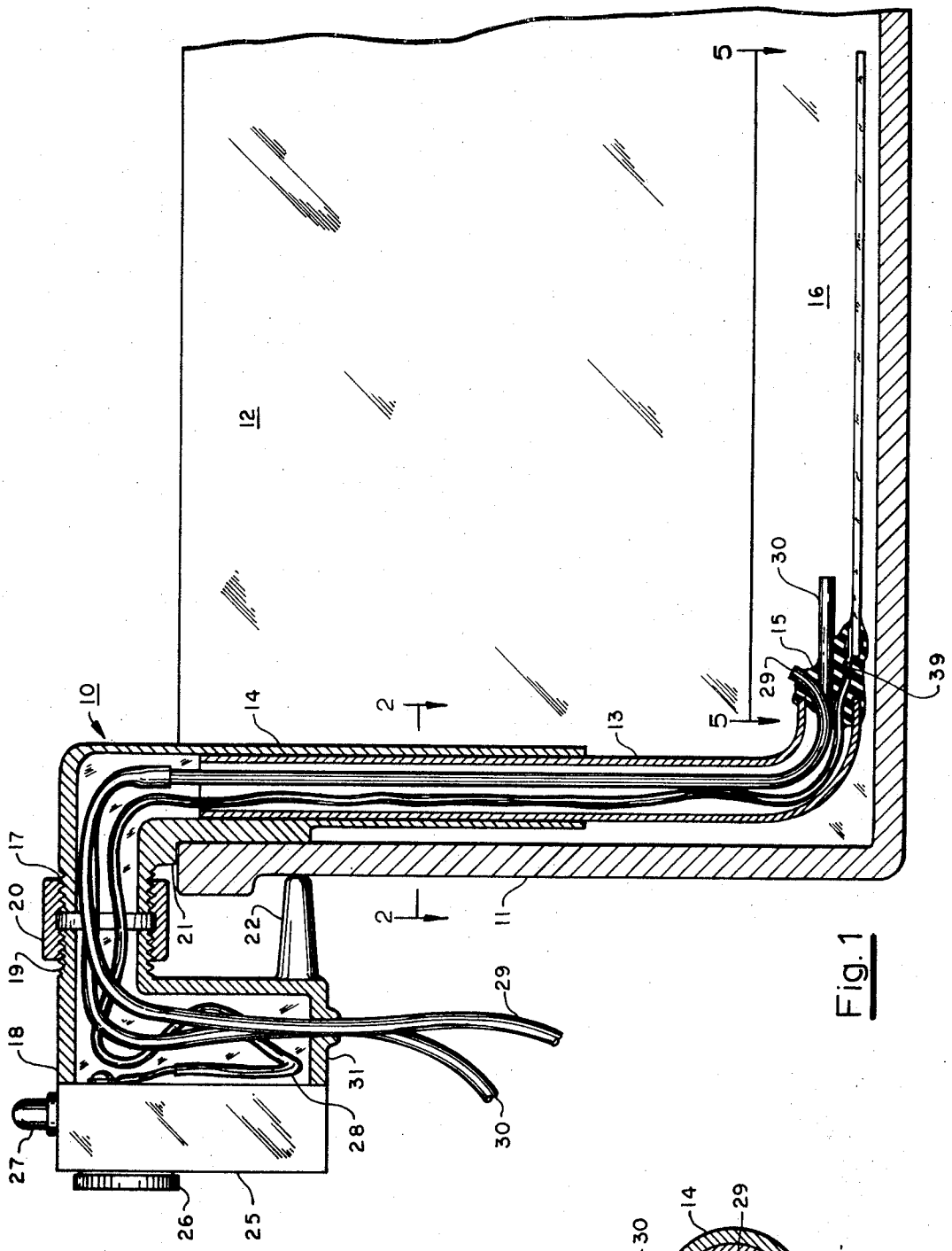

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Fig. 1

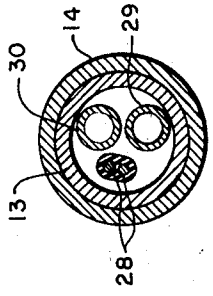
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Fig. 2

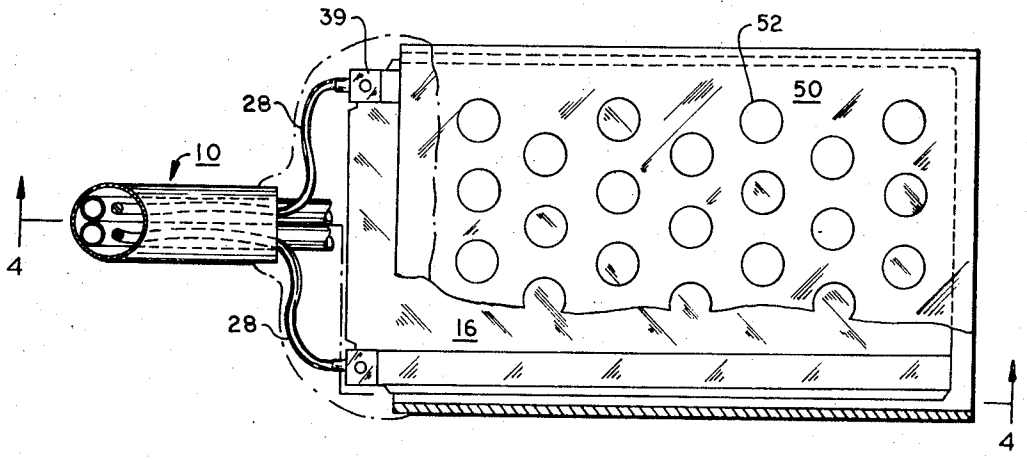


Fig. 3

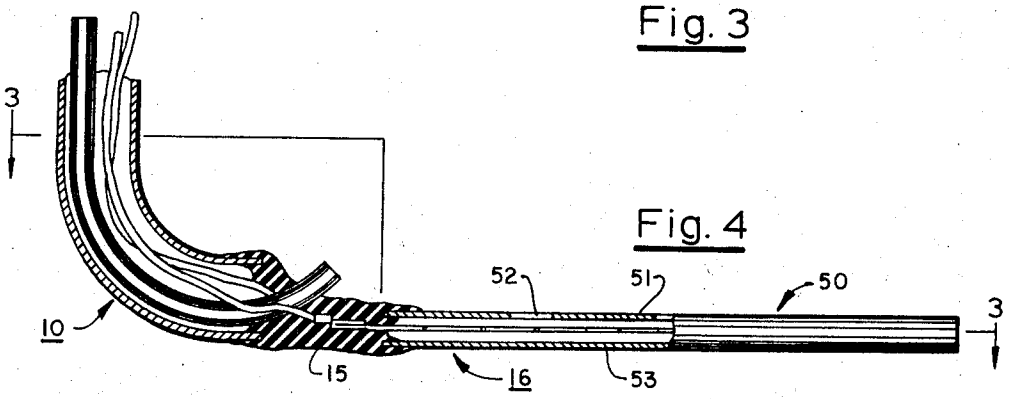


Fig. 4

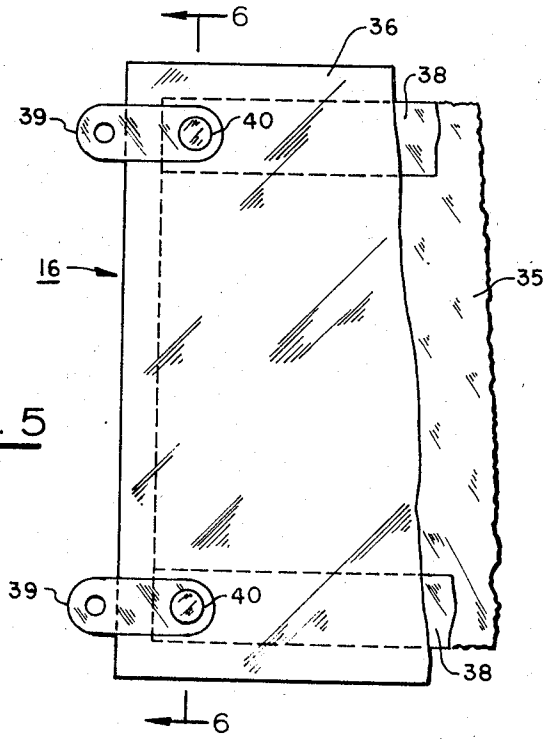


Fig. 5

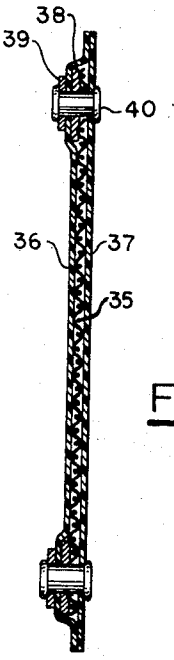


Fig. 6

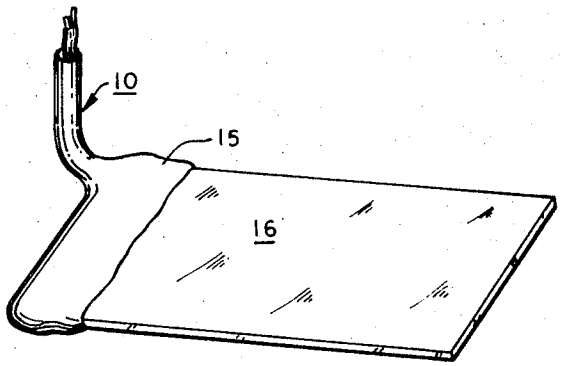


Fig. 7

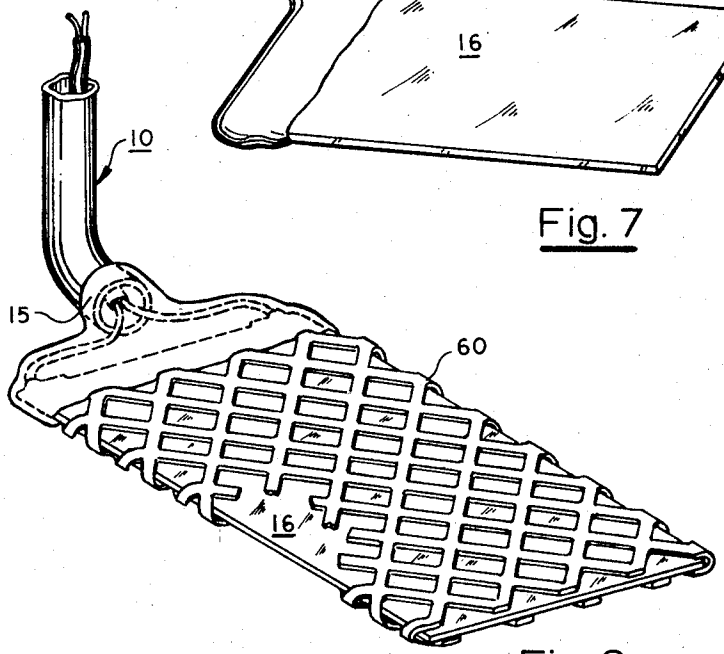


Fig. 8

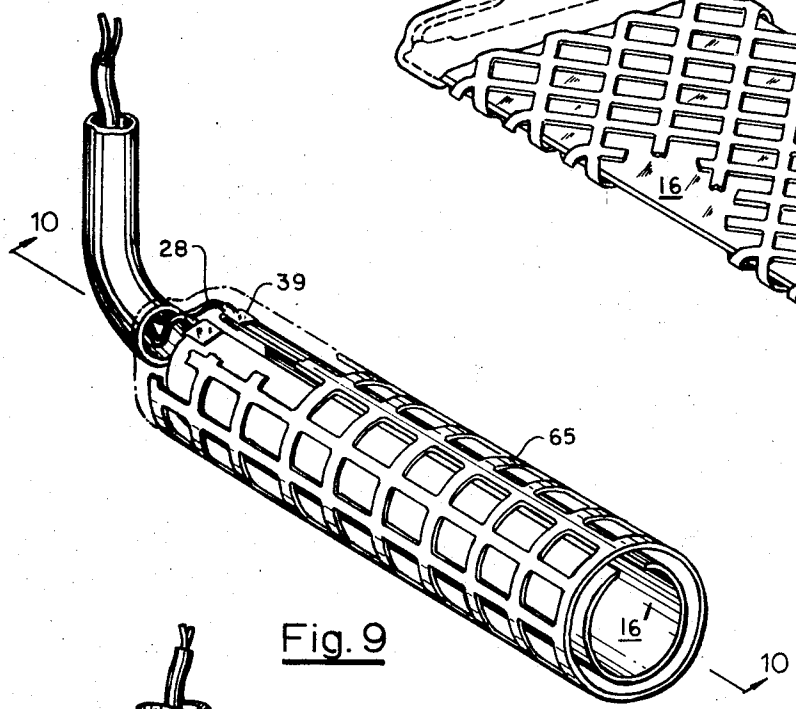
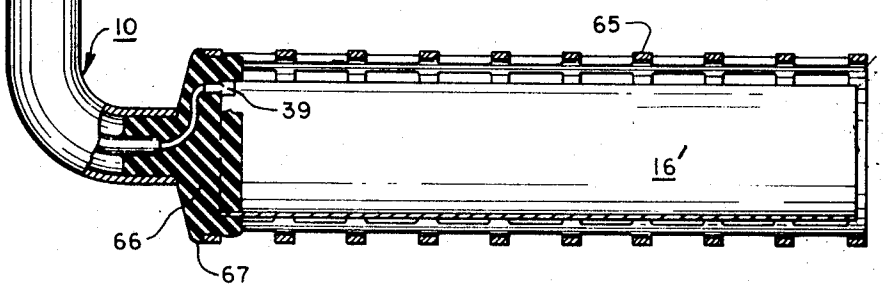


Fig. 9

Fig. 10



WATER-IMMERSIBLE ELECTRICAL HEATING DEVICE

SUMMARY OF THE INVENTION

This invention relates to a new and useful heating device for use in the water of an aquarium or the like. The device is made up of a flexible heating unit, adapted to give long, extended service under the water without cracking or delaminating, said unit being resiliently connected to the lower end of a generally rigid, hollow support column through which extend electrical leads which are connected to the heating unit, as well as any desired water or air conduits. When the device is in use in the water-containing vessel (which, for convenience, will hereinafter be referred to as an aquarium) the lower end of the support column, along with the heating unit connected thereto, is below the water which is thus in direct contact with the two faces of the heating unit. The air and water tubes carried within the column open from the lower end, for communion with the water in the aquarium, at positions adjacent the point of attachment of the heating unit to the column. The upper end of the column extends out of the water and over the top of the aquarium wall which normally supports the device, said end having associated means for securing the column against the supporting wall of the aquarium. Connection of the heating unit to the lower end of the column is made through a resilient bonding material such as silicone rubber or the like whereby the heating unit can be moved in any direction relative to the column without rupturing the bond. This material also acts to seal the column end.

In a preferred embodiment of the device, the lower end of the support column is curved at an angle of about 90° to permit the attached heating unit to lie flat upon the bottom of the aquarium or upon the sand or other material resting thereon. Similarly, such angular attachment permits the heating unit to lie against the back wall of the aquarium, if desired. In the latter case the plane of the heating unit will parallel that of the upright portion of the column, while in the bottom position the plane of the heater will be transverse to that of said column portion.

The upper end of the support column is preferably of inverted U shape so as to receive the upper margin of the supporting aquarium wall within the U. Further, this U-shaped portion can be formed of adjustably connected leg segments which collectively form a clamp which may be either tightened against the aquarium wall as the device is positioned within the aquarium, or loosened for its removal. Further, the central, normally upright section of the supporting column can be formed of telescoping sections whereby the lower end of the column, and with it the attached heating unit, may be lowered or raised, thereby adapting the device for use in aquarums of varying depth and size and also permitting the heating unit to be placed at any desired depth in a given body of water.

The heating unit referred to above is one of the planar, flexible type having a semi-conductive heating element forming an inner or core layer which, together with its bus elements, is enclosed within electrically insulating face panels which seal to one another about the periphery of the core layer, and to said layer as they overlie the same. The aforesaid bus elements, as fabricated of aluminum, copper or other conductive materials, are secured to the core layer in spaced, parallel relationship to one another and are connected with electrical leads which supply the current for passage through the core layer between the bus elements and thus generate the desired heat. Typical core materials of this semi-conductive type are fabricated of a fiberglass cloth which is impregnated with a carbon-loaded polyimide or other resin which is cured in place in the impregnated cloth. Materials of this type are described in U. S. Pat. No. 3,359,525 to Hubbuch, though other useful semi-conductive, yet flexible, materials are also taught in the art. As electrically insulating face panels for the heating unit there may be employed materials such as nylon, polyester, Nomex, Teflon or silicone rubber, for example. Further, more than one such overlying material, one atop the other, can be used, if desired. For example, a polyester panel can be overlayed over part or all of its surface by a coating of silicone rubber. Electrical terminals, insulated as required, are applied to the unit in such fashion as to make good contact with the bus strips and to be firmly anchored into the body of the core layer as required for good strength.

It is a feature of this invention that the hating unit be secured at one end thereof to the lower end of the hollow member employed as the supporting column. In effecting this mounting, the heating unit can be left flat and be joined to the column end by a flexible and resilient material such as silicone rubber or by other materials such as synthetic or natural rubbers or rubber latices, all of which are then cured in place. Alternatively, the heating unit can be partially or fully rolled and then secured to the column in this shape as one end of the roll is bound by the resilient bonding material. It is practical to seal the lower end of the column against entry of water in this operation, though presealed columns can also be employed which are then affixed to the heating unit in the desired manner.

Various protective or decorative enclosures of plastic or metal construction can be fitted over the heating unit, if desired. Their mounting can either be permanent (as one end thereof is bound into the material used to bond the heating unit to the column) or of a transient character such as when the device is merely slid into place over the heating unit. However, any such member employed should be perforate or otherwise shaped so as to allow of direct contact between the surfaces of the heating unit and the water of the aquarium, thereby insuring good circulation of the water over the heating surfaces when the heater is in the "on" position.

Conventional thermostat units, along with signal lights and the like may be mounted in the upper portion of the support column, said auxiliary devices receiving power as the latter is also supplied through suitable fittings to the electrical leads running down through the supporting column to the attached heating unit. Similarly, an air tube and water tubes running to and from an external filter unit can also be led into the upper portion of the column and then downwardly therethrough for discharge at any convenient location below the water. To keep water out of the column (and thus prevent deterioration of any insulation surrounding the electrical leads), the air and water tubes are preferably led at their discharge ends through the silicone rubber or other material employed to form the bond between the column and the heating unit. In this fashion, no water can leak past the tubes and into the column. Sim-

ilarly, the bonding material serves also to tightly enclose the electrical leads as they run from the column to their points of attachment to the terminals of the heating unit.

The term "silicone rubber," as employed herein, designates conventional materials of this character such, for example, as those prepared from a mixture of dimethyl silicone polymer, an inorganic filler, and a vulcanizing agent. The usual fillers are employed except for carbon black which interferes with the curing of the peroxide type of vulcanizing agent commonly used. The silicone rubbers are also referred to as silicone elastomers.

DESCRIPTION OF PREFERRED EMBODIMENTS

The objects and advantages of this invention will become apparent from the description which follows when read in conjunction with the accompanying drawings wherein:

FIG. 1 is a sectional view in elevation of a heating device of this invention in one embodiment thereof, the device being shown as clamped in place on a side wall of an aquarium and with the heating unit carried at the bottom of the column lying flat adjacent the bottom of the aquarium;

FIG. 2 is a sectional view, to an enlarged scale, taken along the line 2—2 of FIG. 1 and showing the electrical leads and a pair of water or air tubes running within the telescoping sections of the column;

FIG. 3 is a plan view, in partial section, of a heating device similar to that of FIG. 1, but with the resilient bonding material being shown in dotted outline and with the heating unit being enclosed within an essentially flat, perforate protective cage, said view being that taken along the line 3—3 of FIG. 4;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 3, but also showing the resilient bonding material in place;

FIG. 5 is a fragmentary plan view, taken along the line 5—5 of FIG. 1, in which the elements other than the heating unit have been stripped away;

FIG. 6 is a sectional view, taken along the line 6—6 in FIG. 5, showing the respective layers of the heating unit on a scale which, for purposes of illustration, exaggerates their thickness;

FIG. 7 is view in perspective of a heating device in an embodyment wherein the heating unit is attached to the supporting column in an offset position;

FIG. 8 is a perspective view of a heating device similar to that of FIG. 1, but with the heating unit being slidably encased with an expanded metal protective cage;

FIG. 9 is a perspective view of the heating device in an embodiment thereof wherein the heating unit is rolled and secured to the column in the rolled position, a perforate cage being shown as fitted about the heating unit; and

FIG. 10 is a sectional view, taken along the line 10—10 of FIG. 9, and showing the bond between the heating unit and the column as being a molded resilient plug over which the cage slidably engages.

Referring more particularly to FIGS. 1 and 2, there is shown a heating device indicated generally at 10 which is clamped in place on side wall 11 of an aquarium indicated at 12. The device 10 has a hollow, upright portion formed of telescoping sections 13 and 14. Mounted to the outwardly turned bottom end of this column through a resilient seal 15, which serves to prevent water from entering the column, is a planar, flexible heating unit generally indicated at 16, the plane of said unit extending parallel to the bottom of the aquarium.

The upper end of the supporting column 10 has the shape of an inverted U which is made up of the upper, outwardly turned portion of section 14 along with section 18, the adjacent ends of said sections being oppositely threaded at 17 and 19 and being engaged by a nut 20 so threaded that turning the nut in one direction acts to space the sections apart (thus permitting the device to be slid into position on wall 11), while turning the nut in the other direction acts to bring the sections together into the position shown in FIG. 1. The portion of section 14 which rests on the upper margin of aquarium wall 11 is provided with a shoulder 21, for better stability, while section 18 carries a boss 22 which engages the outer surface of wall 11 as the device is locked into place by nut 20, thereby securing the device against rocking motion about the top of wall 11.

Section 18 has a heavy wall section 25 which carries a thermostat control 26 and an indicator light 27, as well as a fitting through which current is supplied to the thermostat, light and leads 28 which, along with tubes 29 and 30, extend downwardly through the column 10. Said tubes, which typically carry air and/or water, feed into the column through a lower wall 31 of section 18. At their exit end, these tubes extend through seal 15 and there open to the water which is precluded from entering the column.

Referring to FIGS. 5 and 6, there are shown the elements which comprise the heating unit. Thus, the conductive core layer is shown at 35 as being encased by adherent, electrically nonconductive layers 36 and 37. Layer 36 overlies the bus elements 38 which are bonded to the layer 35 and run parallel to one another along opposide sides of the latter layer. The leads 28 are secured to terminals 39 which are held firmly in place against the bus elements 38 by means of connector posts 40. As seen in the several figures, said terminals and posts, along with the adjacent portions of leads 28, are well insulated by the sealing material 15, or otherwise.

FIGS. 3 and 4 show a modification of the device of the present invention wherein heating unit 16 is fitted with an outer guard member 50 of oval configuration which is secured in place by the sealing member 15. The upper wall 51 of member 50 is provided with apertures 52 to permit of good circulation of water about the member 16, while the bottom wall 53 is nonperforate.

FIG. 7 shows the heating unit mounted to the column in an offset position, an arrangement which permits the column to be positioned adjacent the back wall of the aquarium as it hangs from a side wall thereof. This view also brings out the fact that the material employed to form the function of seal 15 (e.g., silicone rubber) can spread out evenly over the entire surface, both upper and lower, of the heating unit.

In FIG. 8 is shown an embodiment of the invention wherein the heating unit 16 is fitted with an oval guard of expanded metal (or plastic) construction which slides into and out of position, as may be desired.

FIGS. 9 and 10 show an embodiment of the invention wherein the heating unit, here generally indicated at 16', is maintained by a seal 66 in a rolled position, the

unit being enclosed by a cylindrical, perforate guard member **65** which slides into place over seal **66** and against a shoulder portion **67** carried thereon. Here the seal is shown as one of molded construction.

While this invention has been described in conjunction with preferred embodiments thereof, it is obvious that modifications and changes thereof can be made therein by those skilled in the art without departing from the spirit of the invention, the scope of which is measured by the claims.

I claim:

1. An electrical heating device for use in water contained in a walled vessel, said device comprising a planar heating unit, a hollow support column, a resilient seal connecting said unit to the lower end of said column and serving to close said end against entry of water, and electrical leads running through the column and said seal for connection with the heating unit, the latter unit being flexible in character and comprising a semi-conductive core layer which carries spaced parallel bus elements connected to said leads and which is bonded between electrically non-conductive face panels, said column being adapted to be supported by a wall of said vessel and to pass downwardly into the water, thereby bringing the heating unit to the desired immersed position.

2. The device of claim **1** wherein the upper portion of the column has an inverted U shape adapted to fit over the top of the supporting vessel wall, said U-shaped portion being formed of adjustably connected leg segments which collectively form a clamp which may be tightened against said wall to maintain said column portion in a position fixed against movement.

3. The device of claim **2** wherein the lower end of the column is curved outwardly, away from any supporting wall, and wherein the heating unit carried by said end extends in a direction generally parallel to the bottom of the vessel.

4. The device of claim **3** wherein the heating unit is provided with a protective cage which permits water to circulate freely against the surface of the said unit.

5. The device of claim **3** wherein the resilient seal is fabricated of silicone rubber.

6. The device of claim **1** wherein at least one tube adapted to carry air or water extends downwardly through the column and opens to the water of the vessel through the resilient seal.

7. The device of claim **6** wherein the upper portion of the column carries a thermostat unit adapted to control the temperature of the water in the vessel at a predetermined level.

8. The device of claim **1** wherein the column portion adapted to pass downwardly into the water and to support the heating unit is made up of telescoping sections arranged for both longitudinal and rotational movement with respect to one another.

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