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[54] **OPTICAL FIBER DISPLAY**

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[52] **U.S. Cl.** ..... **240/2**, 119/5, 174/151, 339/119, 240/1 EL, 240/10

[51] **Int. Cl.** **F21v 33/00**

[58] **Field of Search** ..... 116/129 L; 240/2, 240/2 LC, 10 P, 1 EL, 10 T; 239/18, 19, 20; 119/5; 350/96 B; 339/59 L, 60, 94 L, 119 L; 174/151, 152, 153; 340/114, 280

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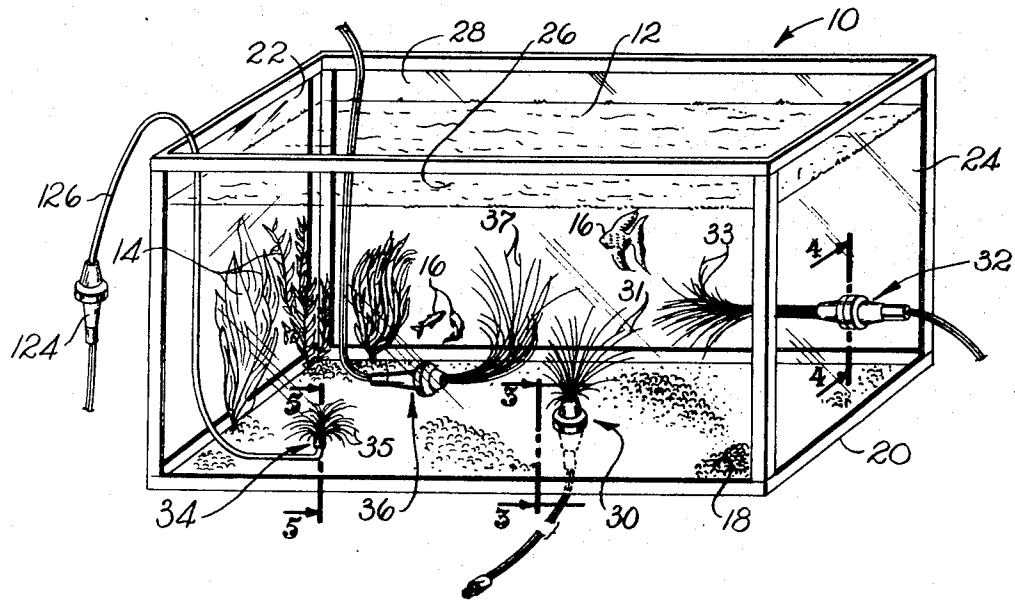
[57] **ABSTRACT**

An optical fiber display for use within a fish tank or the like for decorative or lighting purposes. A plurality of optical fibers are disposed below the liquid level of the tank and the light receiving ends of the fibers are secured in communication with a light source. The light source includes a light bulb and electrical connection for the bulb which is separated from the liquid. In particular embodiments the light-receiving fiber ends are carried on one side of a wall of the tank while the light bulb and electrical connection are carried on the other side of the wall.

11 Claims, 6 Drawing Figures



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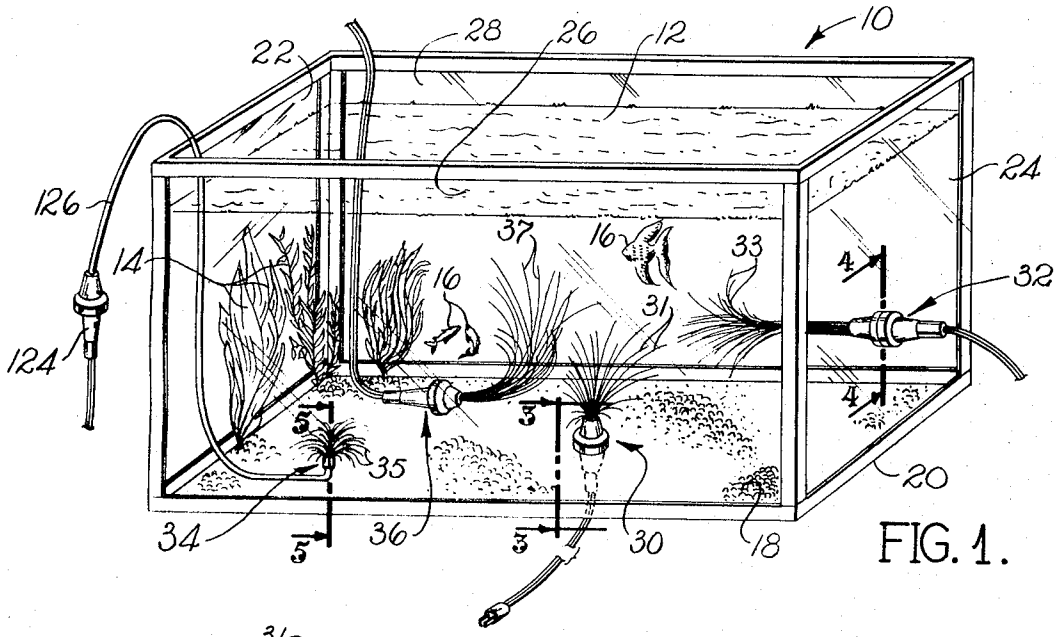

FIG. 1.

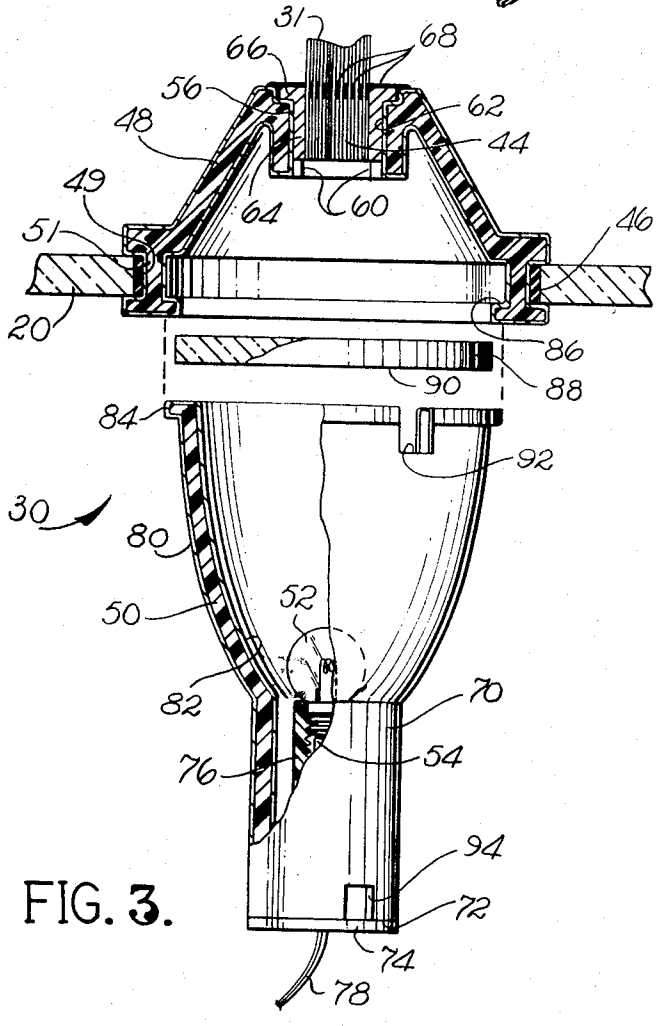

FIG. 3.

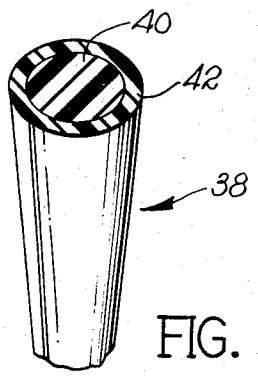

FIG. 2.

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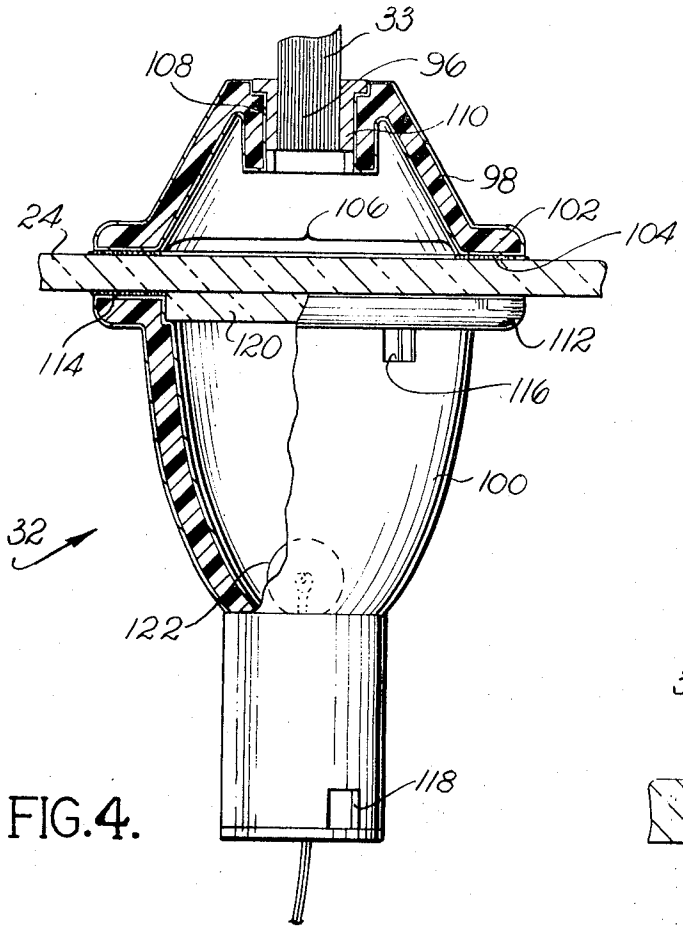

FIG. 4.

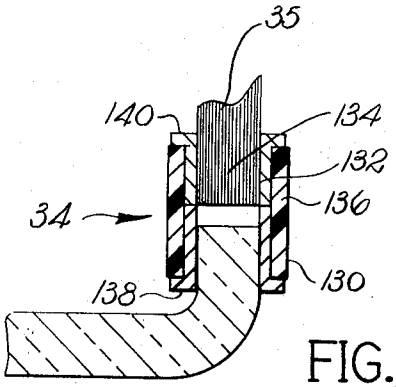

FIG. 5.

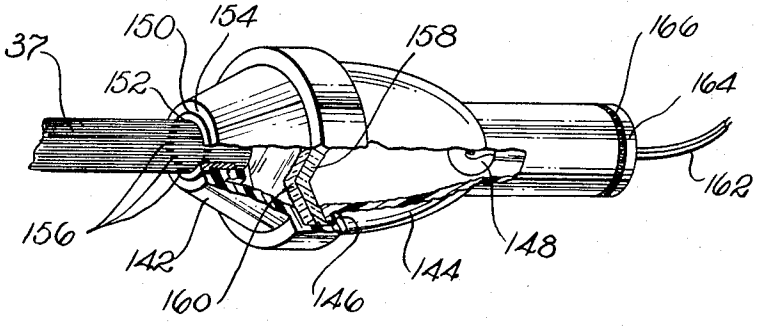

FIG. 6.

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OPTICAL FIBER DISPLAY

FIELD OF THE INVENTION

The field of art to which the invention pertains inlcude the fields of optics and radiant energy, particularly with respect to light conducting rods, such as optical fibers, and decorative lights.

BACKGROUND AND SUMMARY OF THE INVENTION

It is often desirable to provide light within a fish tank for decorative or illumination purposes. The present invention provides a decorative light display for a fish tank or the like which provides dramatic imagery effects which greatly enhance the decorative utility of the tank. In many of the embodiments herein a source of cold light is provided which can be utilized in a tank containing tropical fish or the like which may be sensitive to temperature changes. In particular, a plurality of optical fibers are disposed in a tank with their light emitting ends and light receiving ends below the desired level of liquid, and a light bulb and electrical connection are provided which are insulated from the liquid.

In specific embodiments, the optical fibers and the light bulb-electrical connection assembly are disposed on opposite sides of a wall of the tank. In one embodiment, the tank wall defines an opening and a light source is disposed through the opening. The light source has an anterior portion closing the opening and carrying the light receiving fiber ends on one side of the wall. A separate posterior portion of the light source carries the light bulb and carries the electrical connection on the other side of the wall. The posterior portion is formed to matingly engage the anterior portion. In another specific embodiment, anterior and posterior members are disposed on opposite sides of a transparent or transluscent portion of the tank wall so that each abuts the wall to define a light transfer area therebetween. The anterior member carries the light-receiving fiber ends and the posterior member carries the light bulb and electrical connection, light from the light bulb traveling through the tank wall to illuminate the fiber ends. In still another specific embodiment, the light bulb and electrical connection are disposed exteriorly of the tank and an auxiliary optical light conductor is utilized to transmit light from the bulb to the light receiving ends of the plurality of optical fibers. The auxiliary light conductor can comprise a single, larger fiber, or can also be a plurality of fibers, as desired. A sleeve is provided bundling the light receiving ends of the first mentioned plurality of fibers, and the bundled ends are coupled to the light emitting end of the auxiliary optical light conductor. In still another specific embodiment, the light bulb and electrical connection therefore are disposed within the tank enclosed with the light receiving ends of the optical fibers in a liquid-tight housing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a fish tank containing a variety of decorative light displays of this invention;

FIG. 2 is a perspective view of an optical fiber utilized in this invention;

FIG. 3 is a cross-sectional view of a particular illumination member utilized in this invention, taken on the line 3—3 of FIG. 1, in the direction of the arrows;

FIG. 4 is a cross-sectional view of an alternative illumination member utilized in this invention, taken on the line 4—4 of FIG. 1, in the direction of the arrows;

FIG. 5 is a cross-sectional view of another alternative illumination member utilized in this invention, taken on the line 5—5 of FIG. 1, in the direction of the arrows;

FIG. 6 is a perspective view of still another alternative illumination member utilized in this invention.

DETAILED DESCRIPTION

Referring to FIG. 1, there is shown a fish tank 10 containing water 12 within which there is disposed various marine growth 14 which may be either real or of various plastic material presently known, and fish 16. Disposed on the bottom of the tank is gravel 18 or other such material which simulates the bottom of an area within which marine life and fish might live. A bottom wall 20, side walls 22 and 24 and front and rear walls 26 and 28, respectively, define the bounds of the tank. A top wall may be provided, but is not shown in the present illustration. The wall 20, 22, 24, 26 and 28 can each be made of glass or other transparent or transluscent material, or may be of opaque material, provided that at least one wall is transparent or at least sufficiently transluscent to allow a view therethrough of the contents of the tank with appropriate lighting in the tank.

A plurality of illumination members are shown in the tank 10 to illustrate various embodiments of this invention. Thus, an illumination member 30 is shown protruding through the bottom wall 20 of the tank, and this member is illustrated in detail in FIG. 3. An illumination member 32 is shown on one of the side walls 24 and this member is illustrated in more detail in FIG. 4. Two other illumination devices 34 and 36 are shown lying on the bottom wall 20 inside the tank 10 and these devices are illustrated in more detail in FIGS. 5 and 6, respectively. Each of the illumination members 30, 32, 34, and 36 terminates in a spray 31, 33, 35 and 37, respectively, each spray being composed of a plurality of optical fibers having their light receiving ends bundled and flaring outwardly at their light emitting ends. Of course, one can utilize any one or a plurality of such devices to decorate a tank as desired.

Referring to FIG. 2, each optical fiber 38 comprises a central light conducting core 40 encased within a light reflecting jacket 42. The optical fiber 38 is constructed of materials well known to the art wherein the light conducting core 40 has a higher index of refraction than the jacket 42. For example, a core 40 can be formed of polystyrene having an index of refraction of 1.60 and the jacket 42 can be formed of a polymethylmethacrylate having an index of refraction of 1.49. Methods for forming such fibers are well known in the art. For use in the present invention, a balance must be struck between flexibility of the fibers and light emitting capability. The fibers must be sufficiently flexible to allow the formation of decorative spray shapes in a variety of forms, and yet the fibers must conduct sufficient light to be decoratively aesthetic and to assume a desired shape while being buoyed in the water. To obtain an aesthetically attractive display, one should utilize optical fibers having diameters of at least 7 mils.

Referring now to FIG. 3, the illumination member 30 illustrates one embodiment of this invention by which the light receiving ends 44 of the fiber spray 31 can be illuminated. The fish tank bottom wall 20 defines an

opening 46 through which the illumination member 30 is disposed. The illumination member 30 comprises an anterior portion 48 and a posterior portion 50 which, together, constitute a housing for the fiber ends 44 and for a light bulb 52 and electrical connection 54 therefore.

The anterior housing portion 48 is frustoconical in general shape and includes a cylindrical member 56 suspended from the forward end 58 thereof. A plurality of ribs 60 are formed radiating inwardly from the cylindrical member 56 to define a ribbed opening 62 in the forward end 58. The ribbed opening 62 is designed to receive the bundle end 44 of the fiber spray 31. The fiber ends are inserted into a metallic sleeve 64 and the sleeve is frictionally secured within the ribbed opening 62. An annular shoulder 66 on the forward part of the sleeve 64 limits the extent to which the bundled fiber ends are inserted within the ribbed opening 62 and accurately aligns the light receiving ends 44 of the fibers to face rearwardly of the anterior portion 48.

The base of the anterior housing portion 48 is formed externally with an annular groove 49 on which is disposed an O-ring 51 of soft material which can flex to effect seal with the wall 20 when the anterior member 48 is disposed in the opening 46. An adhesive, such as epoxy resin is disposed about the forward end 58 sealing the sleeve 64 to the forward end and closing up spaces between the sleeve shoulder 66 and forward end 58 and between the individual optical fibers, as indicated at 68, to provide a water-tight closure, preventing water 12 from the tank from leaking through the opening 46.

The posterior portion 50 of the housing terminates in a shank portion 70 having an open end 72 into which there is snap-fitted a cap 74. The cap 74 supports forwardly thereof a socket 76 carrying the electrical connection 54 for the light bulb 52. An electrical cord 78 is operatively associated with the socket 76 (by means not shown) and protrudes rearwardly from the cap 74. The cap 74 and socket 76 are designed so that when the cap 74 is snapped into position, the bulb 52 is positioned within the posterior portion 50 of the housing, but forwardly of the shank portion 70 thereof.

The posterior housing portion 50 of the housing is shaped elliptically, i.e., a longitudinal cross-section thereof is in the form of a section of ellipse. The entire housing is coated inside and out with a highly light-reflecting material 80. In this case, the entire housing structure is of aluminized molded plastic. Thus, there is provided an elliptically shaped reflective inner surface 82 in the posterior housing portion 50 to concentrate the light to a forward point. When assembled, this point corresponds to the position of the bundled ends of the optical fibers 44.

The forward end of the posterior housing portion 50 has an annular flange 84 thereon which fits within an annular groove 86 on the inner base surface of the anterior housing portion 48. The groove 86 is wide enough to accommodate not only the relatively narrow flange 84, but also a somewhat thicker disk 88. The disk 88 can be of clear glass or plastic and is operable to pass light while reflecting heat from its rear surface 90. Alternatively or additionally, the disk 88 can be of a color-absorbing material so as to transmit desired wave lengths of light for particular color effects; or a color filter may be disposed adjacent the bottom or top surface of the disk 88. The disk 88 is secured within the groove 86, pressed therein by the posterior housing flange 84.

A plurality of vent openings 92 are disposed around the flanged forward end of the posterior housing portion 50 to accommodate the rearward flow of heated air reflected by the disk 40. To further accommodate the flow of air, a plurality of vent openings 94 are formed in the rear end of the shank portion 70, adjacent the socket cap 74. This design facilitates the flow of air from the vents 94 in the shank portion 70 posteriorly of the light bulb 52 to the vents 92 immediately below the heat deflector 88, anteriorly of the light bulb 52.

The foregoing components cooperate to yeild an illumination member 30 which is particularly effective to transmit light to the optical fibers 31.

Referring now to FIG. 4, there is illustrated as another embodiment of this invention an illumination member 32 which can be utilized to illuminate the light receiving ends 96 of a plurality of optical fibers 33 without requiring an opening through the tank wall. The illumination member 32 also comprises an anterior portion 98 and a posterior portion 100 which are similar in construction to the anterior and posterior portions 48 and 50 of FIG. 3, except that the interface structure of each portion is modified for adherence to a wall 24 of the tank 10. The wall 24 is transparent, or at least sufficiently transluscent so that light for illumination of the optical fiber end 96 can be transmitted therethrough. In accordance with this embodiment, the anterior portion 98 is formed with an annular flange 102 which can be secured by adhesive 104 to the transparent tank wall 24. Other securing means can be utilized, for example, the flange 102 can be formed with suction rubber around its perimeter for adherence to the wall 24. In this manner, the base of the anterior portion 98 defines a light transfer area indicated at 106. In other respects, the anterior portion 98 is identical in construction to the anterior portion 48 of FIG. 3 and includes a ribbed cylindrical member 108 at the forward end thereof into which is secured the light receiving fiber ends 96 bundled in a metal sleeve 110. Adhesive material can be used to fill the spaces between the optical fibers and to seal the metal sleeve 110 to the anterior portion 98, but the adhesive can be omitted as in the illustration.

The posterior portion 100 is also formed in a manner similar to the posterior portion 50 of FIG. 3 except that the forward end thereof is provided with a relatively wide annular flange 112 by which the posterior member 100 can be secured, e.g., with adhesive 114, to the exterior surface of the tank wall 24. The posterior member 100 is provided with forward and rear vents 116 and 118, a heat reflecting disk 120, a light bulb 122 and electrical connections therefore, all in the manner of the posterior member 50 of FIG. 3.

In use, one need merely secure the anterior portion 98 of the illumination member 32 to the inner surface of a transparent or transluscent section of the wall 24 to define a light transfer area for the optical fibers 33. The posterior illumination member portion 100 can then be secured on the opposite side of the tank wall 24 so that its annular flange 112 is coterminous with the anterior member flange 102, whereby light from the bulb 122 is transmitted through the light transfer area 106 to impinge onto the optical fiber ends 96.

Referring now to both FIG. 1 and FIG. 5, there is illustrated another embodiment of this invention in which an illumination member 124 (FIG. 1) is disposed entirely exteriorly of the tank 10, but which communicates with optical fibers 35 within the tank by means of an additional optical light conductor 126. The illumination member 124 is similar in construction to the illumination member 30 of FIG. 3 except that it need not be provided with an annular groove 49, and may be of one piece. In this regard, one can utilize the illumination device described in detail in application Ser. No. 762,832, filed Sept, 26, 1968, by Joe P. Bruce and Robert S. Rosenast. The optical light conductor 126 is illustrated as a single flexible optical fiber, but one can utilize a plurality of optical fibers bundled together to form an elongated, flexible tube. The forward end 128 of the optical light conductor 126 can be secured in a metal sleeve 130 and disposed coaxially with the metal sleeve 132 bundling the ends 134 of the plurality of the optical fibers 35. The metal sleeves 131 and 132 are retained by a coupling sleeve 136, which slidably fits onto the ends of the metal sleeves 131 and 132, limited by retaining flanges 138 and 140, respectively. In such manner, light from the illumination member 124 is carried through the optical light conductor 126 to impinge on the bundled optical fiber ends 134. This construction is particularly useful in tank containing fish which are very sensitive to their environment, for example, tropical fish. With such fish, the temperature of the water must be very accurately maintained within narrow limits. The present construction conducts "cold" light into the fish tank, allowing decorative illumination without changing the temperature of the water.

Referring now to both FIG. 1 and FIG. 6, still another embodiment of the invention is illustrated. In this embodiment, the illumination member 36 is similar in construction to the illumination member 30 of FIG. 3, but is formed so as to be liquid-tight and is utilized by complete immersion beneath the water 12. The illumination member 36 is formed with anterior and posterior portions 142 and 144, respectively, which are secured together by means of adhesive 146 so as to form an integral, one piece, leak-proof housing when assembled. In this embodiment, vent holes are not provided, accordingly, a low voltage bulb 148, e.g., 6 volts, is utilized to minimize the amount of generated heat. Immersion in the water 12 cools the illumination member 36 housing so that a tolerable equilibrian level is maintained. The junction 150 between the metal sleeve 152 and forward end 154 of the anterior portion 142 is sealed by adhesive which also fills the spaces between the optical fibers 37 as indicated at 156. In this particular construction, a heat shield 158 is utilized between the anterior and posterior portions 142 and 144 and a color filter 160 is utilized in conjunction with the heat shield 158 to obtain a color as desired. An electrical cord 162 is fed through a socket cap 164, the opening therefore being sealed following insertion (not shown) and the socket cap 164 is sealed by adhesive 166 as shown to effect liquid-tight closure of the illumination member 136 housing.

I claim:

1. A decorative light display, comprising:
- a tank for holding a liquid and having walls defining its outer bounds;
- a plurality of optical fibers having light emitting ends and light receiving ends;
- a first housing within said tank below the desired level of said liquid enclosing and carrying said light receiving fiber ends;
- a light source for said optical fibers, including a light bulb and electrical connection therefor separated from said liquid;
- a second housing enclosing and carrying said light source;
- means for effecting light communication between said light bulb and said light receiving fiber ends.

2. The invention according to claim 1 in which a wall of said tank defines an opening, said first housing being disposed in said opening and said separating means comprises means for effecting a liquid-tight closure of said first housing with said wall.

3. The invention according to claim 2 in which said second housing is coupled to said first housing to effect said light communication and extends exteriorly of said tank, said second housing defining a vent opening exteriorly of said tank.

4. The invention according to claim 1 in which a wall portion is transparent or translucent and said first housing has a forward portion carrying said light receiving fiber ends and a rear portion, and including means for securing the rear portion of said first housing to said wall portion internally of said tank, and means for securing said second housing to said wall portion exteriorly of said tank with said light bulb in communication internally with said first housing to illuminate said light receiving fiber ends.

5. The invention according to claim 1 including means for disposing said second housing exteriorly of said tank, said means for effecting light communication including an optical light conductor comprising at least one connecting optical fiber having end faces between said light bulb and the light receiving ends of said first mentioned optical fibers, and first means for disposing one end face of said connecting optical fiber in said first housing adjacent said light receiving fiber ends and second means for disposing the opposite end face thereof in said second housing adjacent said light bulb to conduct light from said light bulb to said light receiving fiber ends.

6. The invention according to claim 5 in which said first housing comprises a sleeve bundling the light receiving ends of said first mentioned fibers and said opposite end face.

7. The invention according to claim 1 including means for effecting liquid-tight integral joinder of said first and second housings.

8. A decorative light display, comprising:
- a sheet-like member;
- a plurality of flexible optical fibers having light emitting ends and light receiving ends;
- means for bundling said light receiving fiber ends;
- a first housing enclosing and carrying said bundled light receiving fiber ends on one side of said sheet-like member and having a width dimension in the plane of said sheet-like member;
- a light source for said optical fibers, including a light bulb and electrical connection therefor;
- a second housing enclosing and carrying said light source on the opposite side of said sheet-like member and having a width dimension in the plane of said sheet-like member; and
- means for securing said housings on opposite sides of said sheet-like member and effecting light commu-

nication between said light bulb and said light-receiving fiber ends;

said sheet-like member having an extent substantially greater than the width dimensions of said housings and extending beyond the peripheries thereof.

9. The invention according to claim **8** in which said sheet-like member defines an opening, one of said housings is disposed in said opening and said securing means comprises means for effecting a closure of said one housing with said wall.

10. The invention according to claim **9** in which said housings are formed for mating engagement one to the other.

11. The invention according to claim **8** in which at least a transmission portion of said sheet-like member is transparent or translucent, and said first housing has a forward portion carrying said light receiving fiber ends and a rear portion, and including means for securing the rear portion of said first housing to said transmission portion on one side of said sheet-like member, and means for securing said second housing to said transmission portion on the other side of said sheet-like member with said light bulb in communication internally with said first housing to illuminate said light receiving fiber ends.

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