(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 617 394 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93309749.5**

(51) Int. Cl.[5]: **G09F 13/08**, G09F 13/14

(22) Date of filing: **06.12.93**

(30) Priority: **22.03.93 US 34083**

(43) Date of publication of application:
28.09.94 Bulletin 94/39

(84) Designated Contracting States:
BE DE FR GB NL

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(54) Modular illuminated advertising display.

(57) A sign that uses illumination to enhance a message on the sign comprises a housing (14) for carrying the message and a reflector (66, 68, 70) having a light reflective surface. The reflector (66, 68, 70) is mounted to the housing (14) so that the light from a source (22, 24, 26) projected at the reflector (66, 68, 70) is directed towards the message. The reflective surface of the reflector (66, 68, 70) has at least a portion with a parabolic cross-sectional configuration to focus a substantial amount of light from a source (22, 24, 26) onto the back of the message to be displayed. The housing (14) can be constructed to be connected to one or more like housings (14) to allow the size and shape of the overall sign to be selected by the end user.

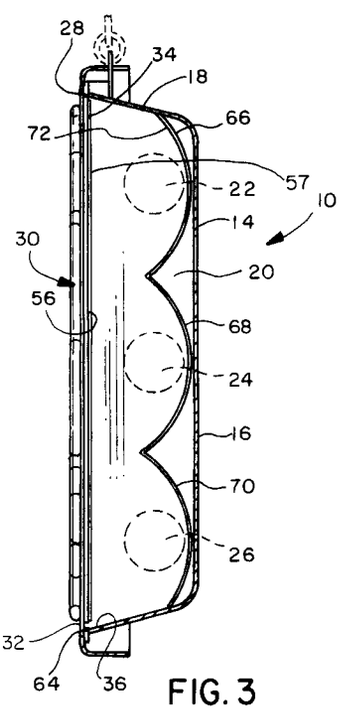

FIG. 3

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This invention relates to advertising displays and, more particularly, to an illuminated display that can be constructed a) with a fixed size and shape and b) from a plurality of modules that can be selectively joined to produce a size and shape as desired by the end user.

For over half a century, neon signs have been extensively used in advertising, particularly on store fronts and the like. Neon signs are desired for their intensity and their three dimensional look. Bright colors can be observed over a wide viewing angle.

Neon signs, however, have numerous drawbacks. First of all, the signs are constructed by bending glass tubing. Intricate bending steps are often required to produce a desired message. As a result, relatively highly skilled labor is required to manufacture such signs. Some shapes may be so demanding that cost becomes prohibitive.

Some shapes cannot be reproduced at all with neon, regardless of the skill of the fabricator. As a result, certain shapes, such as those used in well known logos, and the like, must be modified. For example, if there are width variations in lettering, this may not always be possible to reproduce in neon. This precludes uniformity in advertising and may detract appreciably from the look of a sign.

A further drawback with conventional neon signs is that each colored tube must be constructed with its own circuit. This often results in a maze of tubing which is unsightly when viewed at close range.

A further drawback with conventional neon tubes is that they are prone to breakage. The glass tubing must be sufficiently thin to facilitate its bending. Further, the tubes, upon being bent, may be stretched so as to become thinner and even more brittle. Accidental bumping of the tubes could cause rupture thereof that releases the confined gas and requires reconstruction of an entire circuit. Breakage is quite common during shipping and handling of signs with neon. In fact, some studies have shown that as much as 10% of shipped neon tubes sustain some damage.

A further drawback with neon signs is that they require transformers which are not only unsightly but prone to failure. It is very common to see certain circuits of neon signs flickering, which detracts from the appearance of the sign. It is also common for a failing transformer to produce an annoying humming noise which may be audible from a substantial distance away from the sign.

A further problem with neon signs is that they are normally custom made with there being no flexibility afforded the end user. If the end user desires to change a sign, as to increase size, an entirely new sign must be purchased.

Still further, neon does not lend itself to signage using back lighting. Conventional signs are normally either dedicated neon or back lighting signs.

The use of neon signs may also be limited by local safety regulations. Neon signs, to date, cannot be manufactured to meet U.L. specifications.

While the above problems have plagued the advertising industry for years, designers have contended with these problems for want of an alternative that produces a colorful, intense, three dimensional message comparable to the neon sign.

The present invention seeks to overcome the above problems in a novel and simple manner.

More particularly, the present invention is directed to a sign that uses illumination to enhance a message on the sign that is displayed. A housing for carrying the message is used together with a reflector having a light reflective surface. The reflector is mounted to the housing so that light from a source projected at the reflector is directed towards the message. The reflective surface has at least a portion with a parabolic cross-sectional configuration to focus a substantial amount of light from a source on the message to be displayed.

By connecting a light source to one of the reflector and housing in the vicinity of the focal point for the parabolically-shaped reflective surface, the width and intensity of the light from the source is increased. In essence, the parabolically-shaped reflective surface serves to enlarge the size of the light source.

The light source is, in one form, a fluorescent bulb and preferably at least a 20 watt fluorescent bulb to generate the desired intensity of light.

The light source is preferably tubular in configuration and has at least a portion that is non-straight. The parabolic portion of the reflective surface is preferably conforming in shape to the tubular light source. In one form, the light source is a bulb that defines a closed loop with the reflective surface having a matching configuration.

In one form, the reflector is made from molded plastic and has a light reflective coating defining the reflective surface. The coating may be applied by a vacuum coating process.

With the inventive structure, a relatively inexpensive sign can be constructed that is very visually appealing. The fluorescent tubes are relatively durable, as is the reflector, particularly when it is made of plastic. Thus, the possibility of breakage, during shipping, is substantially reduced over neon signs.

In one form, the message is defined on the sign by at least one panel with lenticular structure which produces a raised, illuminated message that is visible from the front of the device. By projecting the high intensity light through the lenticular struc-

ture, the light is redirected and effectively magnified to produce the appearance of neon without the disadvantages associated therewith.

At the same time, the high intensity forwardly projecting light produced through the inventive reflector virtually eliminates voids and makes the reflector of the present invention highly desirable to produce back lighting for more conventional type displays. Thus it is possible to integrate conventional back-lit messages with neon-simulating structure, according to the invention, into one sign. The illumination is sufficiently intense that the sign is useable with a darkened background, as on walls and ceilings, as well as in windows where there is no contrasting background, as is a common location for neon signs.

Truer graphic representations of existing logos can be achieved with the inventive structure. Width variations on lettering, sharp corners, etc. can be reproduced with the lenticular structure, as by molding the same to virtually any shape. Screened or litho graphics, heretofore too complicated and costly to produce in neon, can easily be incorporated into the inventive sign.

To further enhance the brightness of the light reflected by the parabolic surface, a raised rib can be provided, preferably centrally of the parabolic surface. That light, which would otherwise be reflected in such a manner that it would be blocked by the light source, is redirected against the parabolic surface at a location spaced from the rib to be directed at a message to be displayed.

To add flexibility to the sign, the invention further contemplates that the sign may be made in modular form. In one form, at least one of the housing and reflector is constructed to be connected to a sign of similar construction to increase the message display area.

To effect this interconnection, at least one of the housing and reflector on each of the first and second of the signs has cooperating clips which, in one form, are in the shape of dovetail connectors. By aligning the first and second signs in a preassembly position and relatively moving the first and second signs against each other, the clips are interconnected. The signs can be disassembled to reconfigure the overall appearance of the sign.

The individual modules are normally polygonally-shaped and can be square, rectangular, diamond-shaped, etc.

Virtually a limitless combination of sign sizes and shapes can be made with the basic modules. The ability to customize signs is a tremendous asset to franchisors and distributors. A basic unit can be made common to all franchisees/distributors with a portion of the sign customized to the individual entity and/or geographical location. The signs can also be changed periodically as demand dictates. At the same time, the module can be constructed so that the frame is unobtrusive and does not detract from the custom look of each sign.

Further enhancements to the sign are also contemplated by the invention. For example, animation can be incorporated into one or more of the modules.

Additionally, assembly and replacement of the light source can be accommodated by molding a receptacle into the reflector that receives and maintains the light source consistently in an operative relationship with the reflector. Typically, the light has a housing which is fitted in the reflector receptacle. A reflective tape can be provided on the housing to avoid any diminishing of light projection by reason of non-reflection by the housing.

The invention further contemplates a reflector for use in a sign to reflect light from a source so as to enhance a message on a sign, wherein the reflector has a reflective surface with at least a portion that has a parabolic configuration to focus light from a source in a direction to enhance the appearance of a message on a sign.

For a better understanding of the present invention and to show more clearly how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Fig. 1 is a front elevation view of an illuminated sign made according to the present invention;

Fig. 2 is an exploded perspective view of the sign of Fig. 1;

Fig. 3 is a cross-sectional view of the sign taken along line 3-3 of Fig. 1;

Fig. 4 is an exploded perspective view of an illumination source and light reflecting structure according to a modified form of the invention;

Fig. 5 is an exploded perspective view of a housing for containing the structure in Fig. 4;

Fig. 6 is a cross-sectional view of the assembled, modified sign according to the present invention;

Fig. 7 is an exploded, perspective view of a sign module according to the present invention;

Fig. 8 is a schematic representation of a plurality of the modules in Fig. 7 joined together to define an enlarged shape;

Fig. 9 is a plan view of a reflector on the inventive sign module;

Fig. 10 is a cross-sectional view of the reflector taken along line 10-10 of Fig. 9

Fig. 11 is a cross-sectional view of the reflector taken along line 11-11 of Fig. 9;

Fig. 12 is a side elevation view of the inventive module;

Fig. 13 is a plan view of the module;

Fig. 14 is a cross-sectional view of the module taken alone lines 14-14 of Fig. 13; and

Fig. 15 is a side elevation view of a spacer clip used within the module to maintain the reflector in a desired position within the module.

In Figs. 1-3, a preferred form of illuminated sign, according to the present invention, is shown at 10. The sign 10 has a message 12 viewable from the front thereof. The message 12 in Figs. 1 and 2 is shown strictly for purposes of illustration, as normally the message on the signs 10 will be custom made for each consumer.

The sign 10 consists of a rectangular housing 14 having a rear wall 16 and an integral, forwardly projecting peripheral wall 18. The walls 16, 18 cooperatively define a forwardly opening component receptacle/space 20 for, in this case, three conventional fluorescent tubes 22, 24, 26 which make up the light source for the sign 10.

At the open forward edge 28 of the housing 14, a message carrying wall at 30 is provided. The message carrying wall 30 is made up of a front panel 32 and a rear panel 34, each having substantially the same rectangular shape to fit closely within a conforming opening 36 at the front of the housing 14.

The rear panel 34 is preferably molded in one piece and includes a body 38 and raised, lenticular letters 40 projecting forwardly from a generally planar surface 42 on the body 38. The entire panel 34 is preferably molded from a clear material, such as acrylic or polycarbonate. The letters may be polished for clarity, however, with known molding techniques, this is generally unnecessary.

The raised letters 40 act to magnify light from the bulbs 22, 24, 26 and to effect dispersion thereof. With the panel 34 in the operative position of Figs. 1 and 3, the raised, lenticular letters 40 give the appearance of a three dimensional light source at the front of the housing 14, to give the impression of neon. That is, the letters 40 give the appearance that the source is within the letters 40 and projects radially outwardly therefrom through approximately 270°.

A preferred form for the letters 40 is shown in Fig. 6. In cross section, each letter 40 is shown to be defined by an outer surface 44 that is generally a solid U-shape, opening rearwardly. The outer surface 44 consists of a forward, convex surface segment 46 defined by a diameter D1 which blends into spaced, parallel, straight segments 48, 50, which are tangential to the surface segment 46.

In a preferred form, the diameter D1 is approximately 3/8" (9.5 mm) and the distance D2 between the apex 52 of the surface segment 46 and the forwardmost surface 54 on the message carrying wall 30 is approximately 3/8" (9.5 mm)

Returning to Figs. 1-3, in conjunction with Fig. 6, the rear surface 56 of the panel 34 is seen to be tinted where it coincides with the letters 40. The particular color used is a design consideration. The color can be applied by techniques well known to those skilled in the sign art. Light from the bulbs 22, 24, 26 will cause the forward projection of the selected color light through the front of the sign 10.

The remaining portion of the panel 34 is made opaque by applying a coating on the rear surface 56 thereof. The coating is preferably a white latex painted on the surface that will reflect light, for reasons discussed below. The coating need not actually be white, as other light reflective colors and treatments would give the same desired result.

The front panel 32 serves as an opaque mask for the front of the sign 10 and normally has a contrasting color to that of the letters 40 to highlight the letters 40. The panel 32 has cut-outs 58 therein for close reception of the raised letters 40. The cut-outs 58 may be preformed, die cut, laser cut, or otherwise formed by methods known to those skilled in the art. The panel 32 may be black or smoke colored material, brushed aluminum, or the like, that is capable of preventing light transmission therethrough.

The panel 32 has a flat rear surface 60 which facially abuts the planar surface 42 on the panel 34 with the panels 32, 34 operatively engaged as a subassembly which is snap-fit to the housing 14 as by conventional clips 62 in cooperating receptive openings 64 in the housing 14.

Light from the bulbs 22, 24, 26 projects through the translucent portion of the panel 34 to illuminate the letters 40. To enhance the amount of light transmission through the letters 40, reflectors 66, 68, 70, for cooperation with the bulbs 22, 24, 26, respectively, are provided. The reflectors 66, 68, 70 could be formed as a unit or by joining separate pieces. Exemplary reflector 66 is described in relationship to its cooperating bulb 22.

The reflector 66 defines a forwardly opening, U-shaped reflecting surface 72 which disperses light projected rearwardly from the bulb 22 forwardly through the translucent portions of the panel 34. This enhances the intensity of the light transmission at the front of the sign 10 and tends to eliminate light voids. The coating, which is preferably a white painted layer, on the rear surface 56 of the panel 34, intercepts light rays that do not pass through the letters 40 and directs these rays back to the reflector 66 to be dispersed in a forward direction.

A slightly modified form of sign, according to the present invention, is shown at 74 in Figs. 4-6. The sign 74 has a housing 76 defined by a rear panel 78, top and bottom panels 80, 82, respectively, and end panels 84, 86. The panels 78-86

cooperatively define a component space for the message carrying wall 30 and a two bulb light source at 88. The primary difference between the sign 74 and that 10 in Figs. 1-3, is in the arrangement of reflectors.

More specifically, the sign 74 has upper and lower inclined reflectors 90, 92 and angled end reflectors 94, 96. The reflectors 90, 92 each make an angle θ with the plane of the forwardmost surface 54 of the message carrying wall 30. The angle θ, in a preferred form, is approximately 50°. The end deflectors 94, 96 are also preferably inclined at a similar angle with respect to the surface 54. The reflectors are provided on the sign 74 primarily to intensify forward light projection and eliminate voids. The reflecting surfaces may be, for example, mirrored acrylic or polished metal.

Another form of the invention is shown in Figs. 7-15. In those figures, individual sign modules 210 are shown to allow the end user to custom build signage.

More particularly, each module 210 is constructed in a square shape. The shape of the module 210 is primarily a design consideration. The invention contemplates various different shapes, but preferably those that are polygonal.

Each module 210 consists of a housing 212 having an outer frame 214 that determines the shape of the module 210. Each module 210 has its own illumination means at 216 to project light through cooperating front and rear panels 218, 220, which define a message at 222 that is visible from the front 224 of the module 210.

The frame 214 has two oppositely facing wall pairs 226, 228 and 230, 232 which are joined to define an enclosed square space for the message-carrying panels 218, 220, as well as a space for the illumination means 216.

Clip means are provided on the peripheral wall 234 of the housing 212 in the form of female, dovetail connectors 236 and cooperating male dovetail connectors 238. The connectors 236, 238 are provided in pairs on each wall 226, 228, 230, 232. The connectors 236, 238 are located so that with the module 210 aligned with a like module 210, male connectors 238 are aligned with female connectors 236. The male connectors 238 are aligned at the front of the female connectors 236 in a preassembly position. By then pressing the module 210 with the male connectors 238 rearwardly, the male connectors 238 seat in the female connectors 236 and maintain the housings 212 on the two modules 210 in closely abutting, assembled relationship. Modules can be aligned and connected on the other walls 228, 230, 232 in like fashion.

In Fig. 8, nine individual modules 210 are shown connected to define a large square sign at 240. The shape of the sign produced from the modules 210 is merely a design choice, as is the orientation of the modules 210. For example, the module 210 could be rotated 90° so that they are displayed in a diamond shape.

The frame 214 can be made to have a minimal thickness so that the frame 214 does not significantly interrupt the message displayed by the combined modules 210. At the same time, since each module 210 is self contained, different types of panels 218, 220 can be employed on each housing 212 to produce a variety of different effects. For example, the sign 240 can be made up of modules 210, some of which use the illumination means 216 for back lighting, while others use the modules 210 to project light through panels 218, 220 to produce the neon-simulating illumination as previously described.

While there are many advantages to the modular construction, one desirable feature is that each sign 240 can be made generic by the manufacturer and customized by placing a message in one or more of the modules 210 that is appropriate to a particular entity. For example, a brewing company might have a basic design that is generic to all its distributors. The individual distributors can then customize the sign to put their own identity or identify geographical information or other information that is appropriate to the end user's place of display.

The invention also contemplates a highly effective illumination means 216 to produce an intense light with virtually no dead spots and which is useable for back lighting and neon simulation alike. More particularly, a reflector 242 is made, preferably as one piece in a molding process. The reflector 242 has a body 244 with a peripheral flange 246 which diverges slightly from front to rear to allow it to be pressed into and frictionally held within the back portion 248 of the frame 214.

With the reflector 242 and frame 214 in operative relationship, a light reflective surface 250 on the reflector 242 is situated to direct light from a source 252 forwardly against the message carrying panels 218, 220. The light reflective surface 250 is preferably defined by a silver coating that can be applied to the body 244 under vacuum by a process well known to those skilled in the art.

The body 244 is shaped so that the light reflective surface 250 has a parabolic shape. By situating the light source 252 so that light therefrom emanates at or adjacent to the focal point for the parabolic surface 250, a majority of the light from the source 252 is projected forwardly at the message carrying panels 218, 220. In this case, the light source 252 is a fluorescent bulb having a tubular body 254 shaped to define a closed loop 256. The parabolic reflecting surface 250 is shaped to match the configuration of the bulb body 254.

What this arrangement does is cause effective widening of the light source 252 to provide a uniform distribution of high intensity light without voids as might produce darkened zones on the panels 218, 220.

It is preferred that the light source 252 be a high intensity light, and preferably one that is rated at at least 20 watts. The bulb shown is one currently being made by the General Electric Company and sold as its model 2700K. This is a 28 watt 2050 lumens bulb. Other shapes could of course be used, including a straight shape, while still exploiting the focal advantage of the parabolic reflecting surface.

The light source 252 has a housing 258 which is used to receive power from a supply. The housing 258 is also used according to the invention to support the light source 252 on the reflector 242. More particularly, a receptacle 260 is formed directly in the reflector body 244 and allows the housing 258 to nest therein. With the housing 258 in the receptacle 260, the light source 252 is optimaily positioned with the body 254 thereon at the focal point of the parabolic reflecting surface 250.

A rear housing 262 contains a transformer 264 which is connected from a conventional power supply through a cord 266. Power from the transformer 264 is supplied to a connector 268 that is joinable to the light source 252 through a press fit connection. To assemble the power source 252, the user need only press the housing 258 into the receptacle 260. In addition to simplifying establishment of the electrical connection, the receptacle 260 consistently maintains the housing 258 in a position to optimally place the light source body 254 at the focal point for the reflecting surface 250.

To avoid a dead spot due to the housing 258, a tape 270 with a light reflective surface can be placed on the exposed surface of the housing 258.

To further maximize forward light projection, a central rib 272 is defined in the body 244 through approximately the central axis of the parabola defined by the reflective surface 250. Since the light source 252 is located at the center of the parabola defined by the reflective surface 250, the light source 252 would block the forward direction of light from the base of the parabola. The rib 272 is V-shaped so as to deflect light from the light source 252 away from the light source 252 to another area of the reflecting surface 250 to where it is projected forwardly without interruption by the light source 252.

To assemble the module 210, the components are successively assembled from front to rear through the rear of the housing 212. The front and rear panels 218, 220 are assembled so that the front surface 274 of the front panel 218 abuts to an inturned flange 276 on the frame 214. The front panel 218 has individual letters 278, or other design, die cut therein. The rear panel 220 has molded, lenticular projections 280 which fit within the cutouts 278 in the front panel 218. The front panels 218, 220 are made and function as described in detail previously herein.

Spacer clips 282 are mounted to the frame 214. The clips 282 have a forward edge 284 to abut to the flange 276 and a cantilevered finger 286 to captively hold the panels 218, 220 against each other and in an operative position within the frame 214. The clips 282 are preferably glued in place on the frame 214.

The back edge 288 of the clip 282 serves as an abutment to arrest forward movement of the reflector 242. Thus a consistent spacing between the reflecting surface 250 and panels 218, 220 is established.

The rear housing 262 is connected to the reflector 242, as by screws or an adhesive, so that the rear housing 262 and reflector 242 define a subassembly that slides into and out of the back portion 248 of the frame 214.

A high intensity illumination means thus results with virtually no dead spots within the module 210. The stacking of the individual modules 210 can be readily accomplished by a press fit operation performed by the end user. The modules 210 can be disassembled and reassembled in any desired configuration. The end user can readily access the light source 252 to effect changing thereof by merely pulling out the subassembly consisting of the reflector 242 and rear housing 262 and thereafter pulling out a spent light source 252 and simply press fitting in a replacement light source 252.

It can be seen that the inventive sign is easy and relatively inexpensive to construct, and durable and convenient to maintain. Virtually the only regular maintenance required is the periodic replacement of bulbs. The signs can be constructed according to the invention in virtually any size and shape.

The foregoing disclosure of specific embodiments is intended to be illustrative of the broad concepts comprehended by the invention.

Claims

1. A sign that uses illumination to enhance a message on the sign, said sign comprising:

a housing;

means on the housing for carrying a message to be displayed by the sign;

a reflector with a light reflective surface; and

means for mounting the reflector to the housing so that light from a source projected

at the reflector is directed towards the message carrying means,

said reflective surface having at least a portion with a parabolic cross-sectional configuration to focus a substantial amount of light from a source on the message carrying means.

2. The sign according to claim 1 wherein the parabolic surface has a focal point, a light source is provided, and means are provided for connecting the light source to at least one of the housing and reflector so that the light source projects light from adjacent the focal point of the reflective surface towards the reflective surface from where the light is directed at the message carrying means.

3. The sign according to claim 1 in combination with a light source and means are provided for connecting the light source to at least one of the housing and reflector, said light source comprising a fluorescent bulb.

4. The sign according to claim 3 wherein the fluorescent bulb is at least a 20 watt fluorescent bulb.

5. The sign according to claim 1 in combination with a light source and means are provided for connecting the light source to at least one of the housing and reflector, said light source having a tubular configuration.

6. The sign according to claim 5 wherein the light source has at least a portion with the tubular configuration that is non-straight.

7. The sign according to claim 6 wherein the parabolic surface has at least a portion that is non-straight corresponding to the non-straight portion of the light source.

8. The sign according to claim 5 wherein the light source comprises a bulb that is formed to define a closed loop.

9. The sign according to claim 1 wherein the reflector comprises a piece of molded plastic with a light reflective coating thereon to define the reflective surface.

10. The sign according to claim 9 wherein the reflective coating is applied to the plastic through the use of a vacuum.

11. The sign according to claim 1 wherein the parabolic surface has a center axis and there is a raised rib that interrupts the parabolic surface to redirect light, that would otherwise be reflected to be blocked by a light source, against the parabolic surface at a location spaced from the rib to be redirected at the message carrying means.

12. The sign according to claim 1 including first means on at least one of the housing and reflector for connecting the sign to a sign of similar construction to increase the area available to display a message.

13. The sign according to claim 12 wherein the first means comprises cooperating clips on at least one of the housing and reflector on each of a first and second of said signs.

14. The sign according to claim 13 wherein the clip means comprises cooperating dovetail connectors.

15. The sign according to claim 13 wherein the first means comprises means for connecting a first and second of said signs each to the other by aligning the first and second signs in a preassembly position and relatively moving the first and second signs against each other to engage the first means.

16. The sign according to claim 12 wherein the housing has a peripheral surface that is polygonally shaped and at least part of the first means is on the polygonally shaped surface.

17. The sign according to claim 12 wherein the housing has one of a square and rectangular shape.

18. The sign according to claim 1 in combination with a light source with means for mounting the light source to at least one of the housing and reflector and said reflector has a receptacle defined therein to support a portion of the light source to thereby align the light source in operative relationship with the reflector.

19. The sign according to claim 18 wherein the light source has a housing and a light reflective tape is adhered to the housing to reflect light from the light source toward the message carrying means.

20. The sign according to claim 1 wherein the message carrying means comprises at least one panel having at least a first portion that blocks projection of light and a second portion through which light can be transmitted to pro-

duce a message that can be viewed from a position in front of the sign.

21. In a reflector for use in a sign to reflect light from a source so as to enhance a message on a sign, the improvement wherein:

said reflector has a reflective surface with at least a portion that has a parabolic configuration to focus light from a source in a direction to enhance a message on a sign.

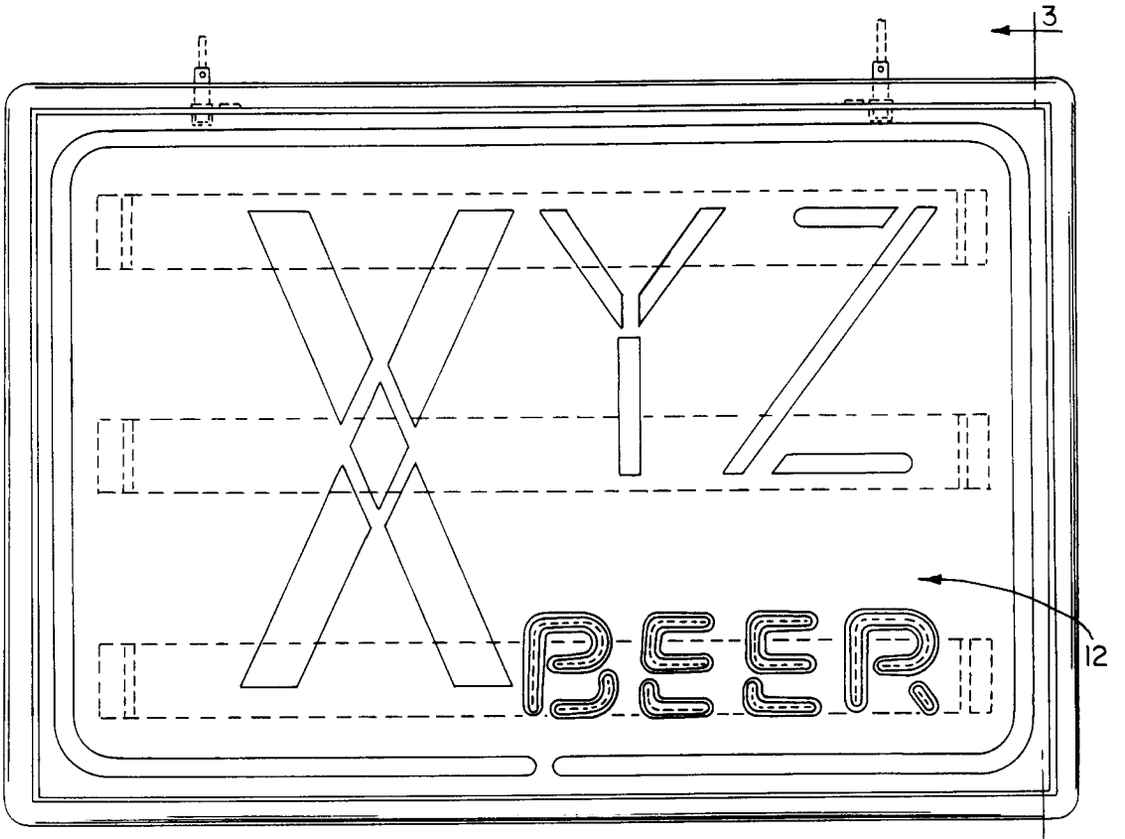
22. The improved reflector according to claim 21 wherein the reflector includes means for supporting a light source comprising a receptacle for receiving a portion of the light source to thereby situate the light source in a predetermined position relative to the reflective surface.

23. The improved reflector according to claim 22 wherein the light source has a tubular shape and the reflective surface has at least a portion that is matched to the tubular shape of the light source.

24. The improved reflector according to claim 20 wherein the reflector comprises a molded piece of plastic with a reflective cooling thereon to define the reflective surface.

25. The improved reflector according to claim 23 wherein the light source has a non-straight tubular portion.

26. The sign according to any one of claims 1 to 20, wherein the message on the sign is backlit by the light from the source.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XYZ
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FIG. 1

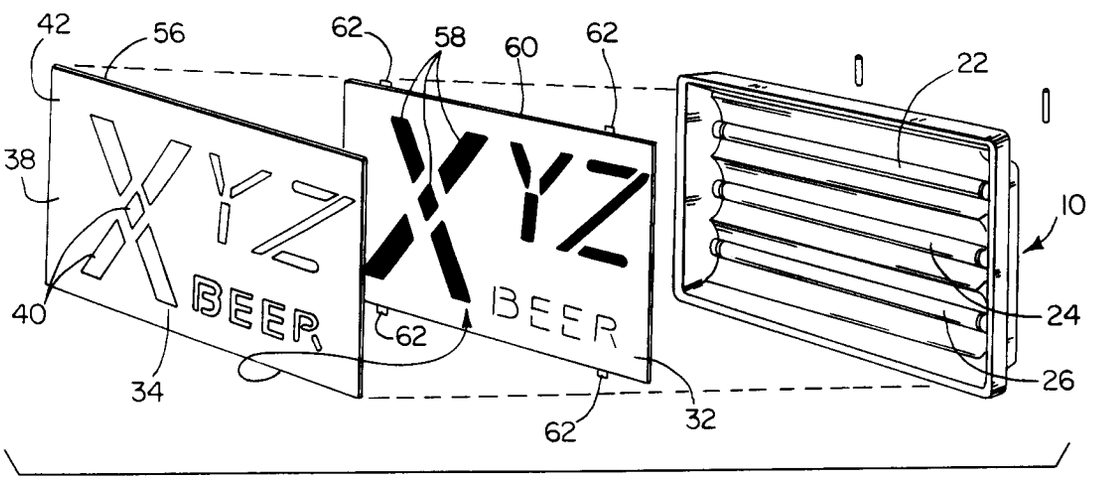
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FIG. 2

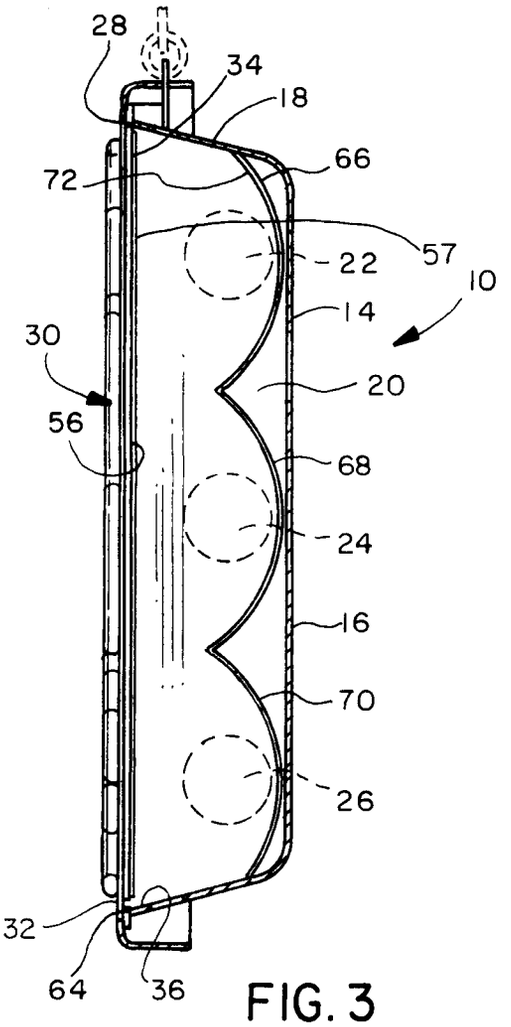
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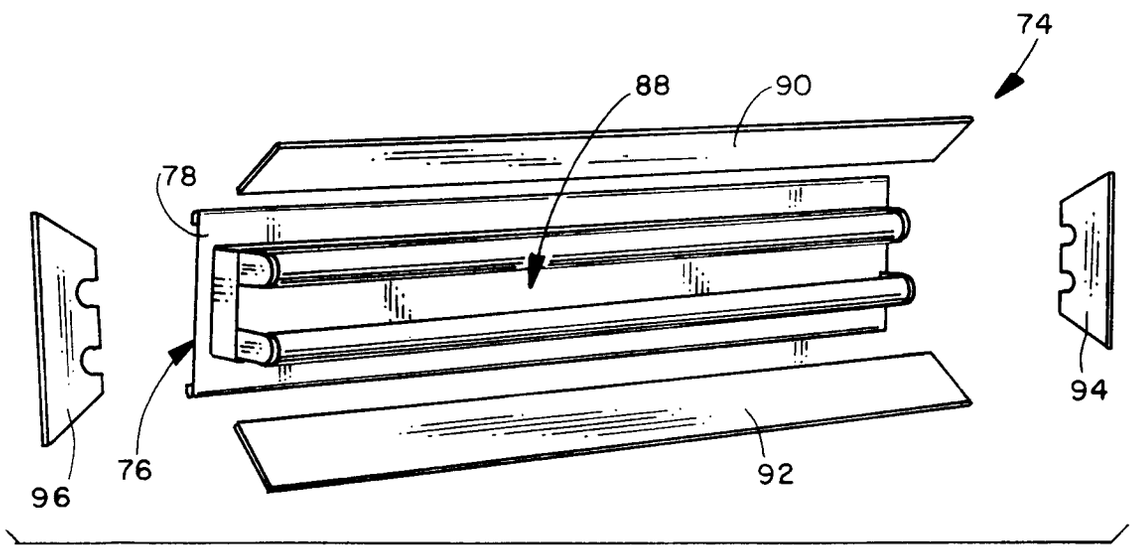
FIG. 3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96

FIG. 4

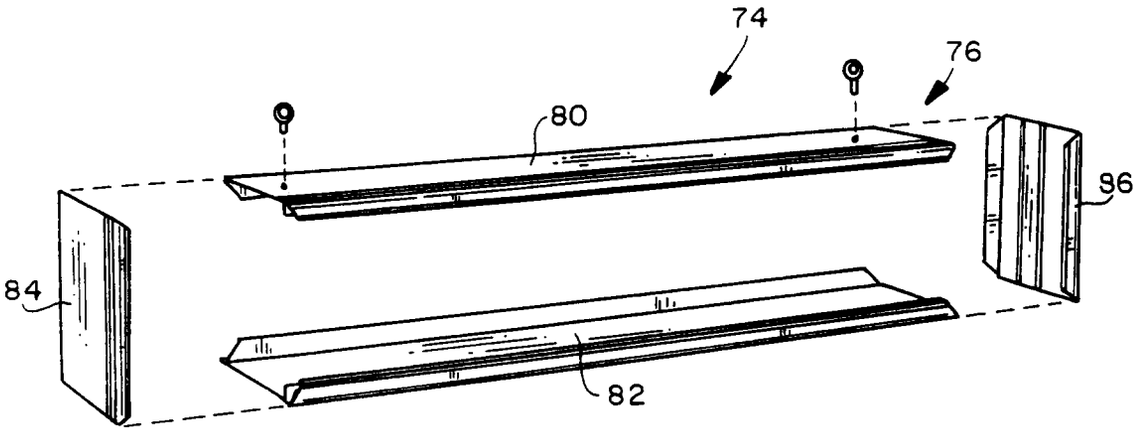
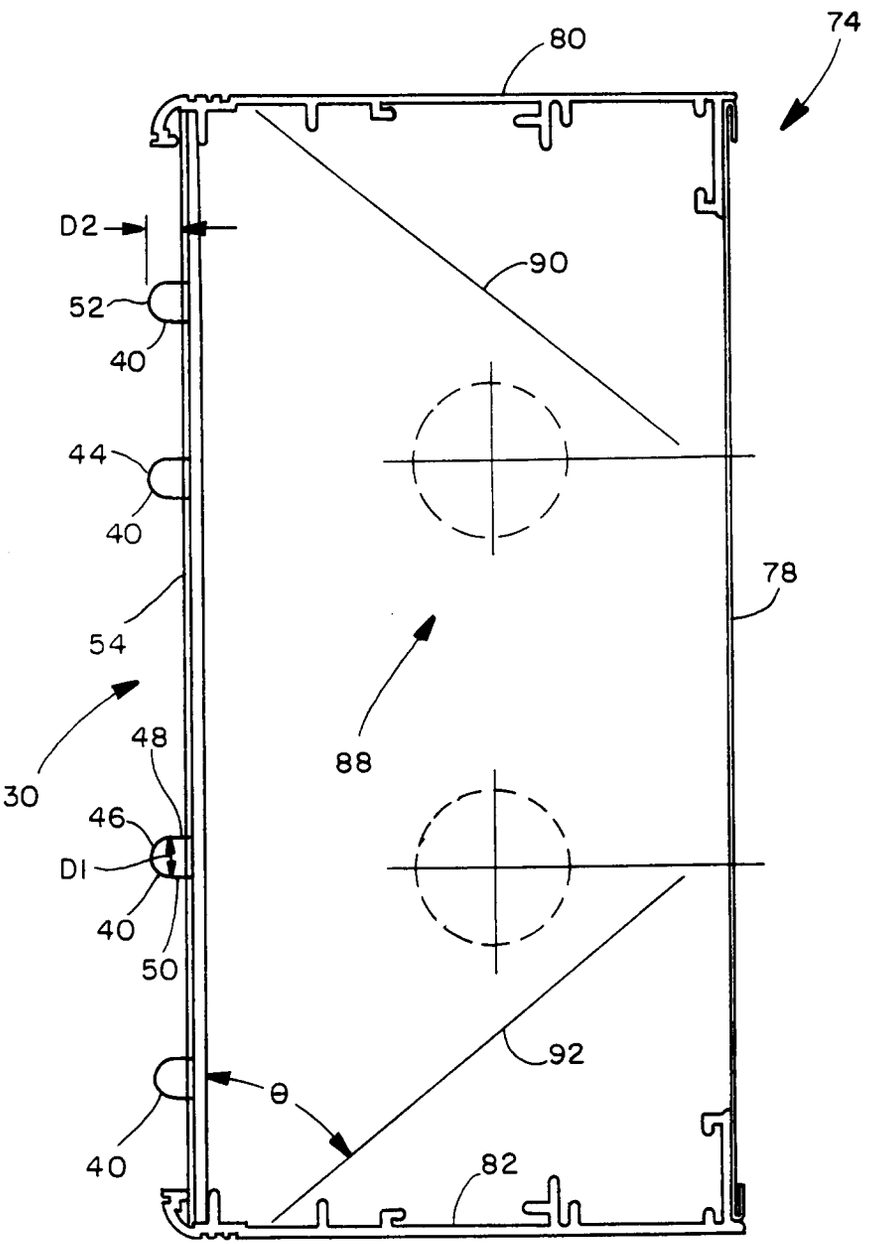

74
76
80
96
84
82

FIG. 5


74
80
D2
90
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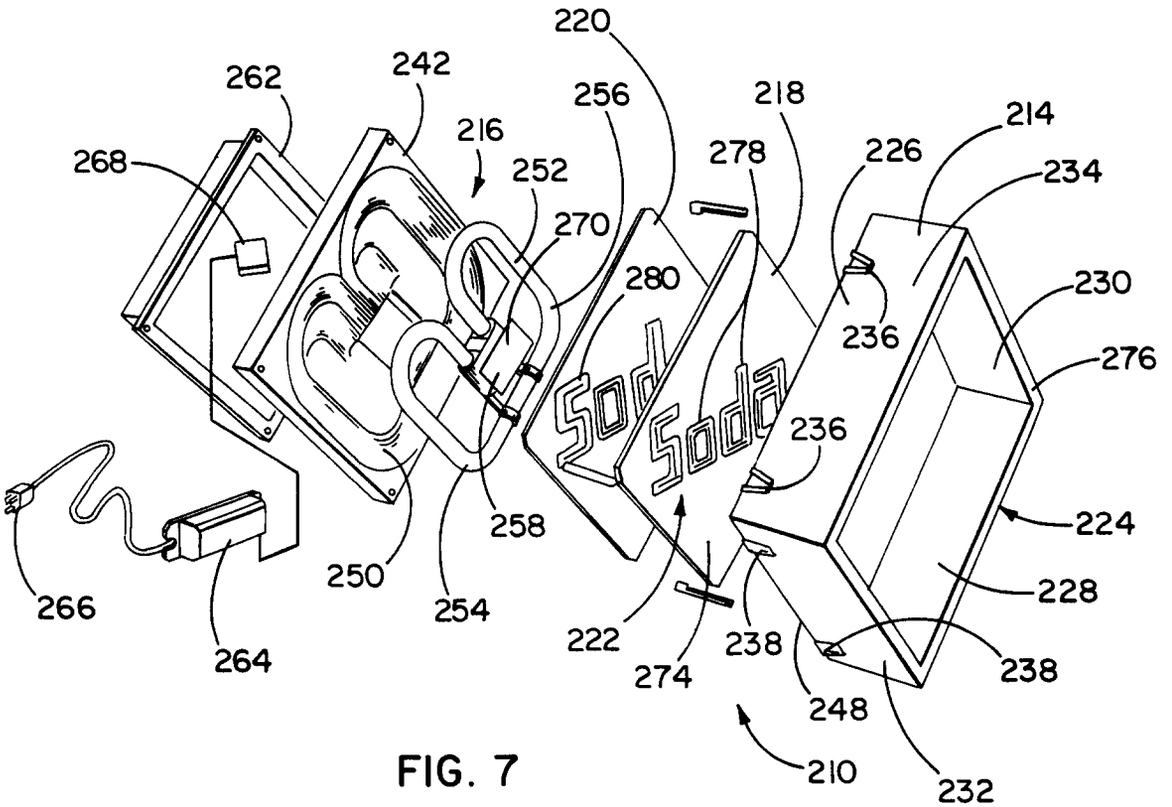
44
40
78
54
30
48
88
46
D1
40
50
92
θ
40
82

FIG. 6


220
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218
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216
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268
252
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280
230
236
276
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Soda
236
258
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254
222
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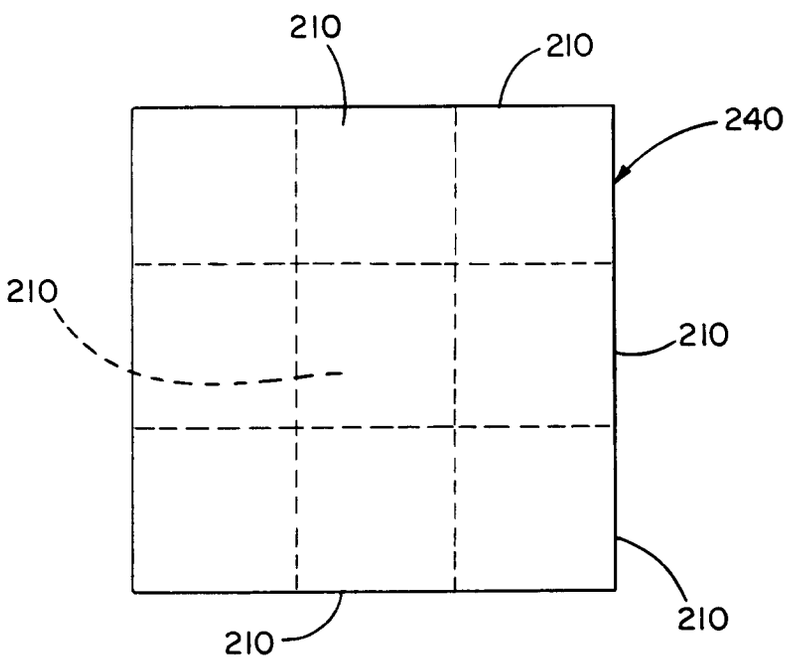
266
264
274
238
248
210
232

FIG. 7


210
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240
210
210
210
210

FIG. 8

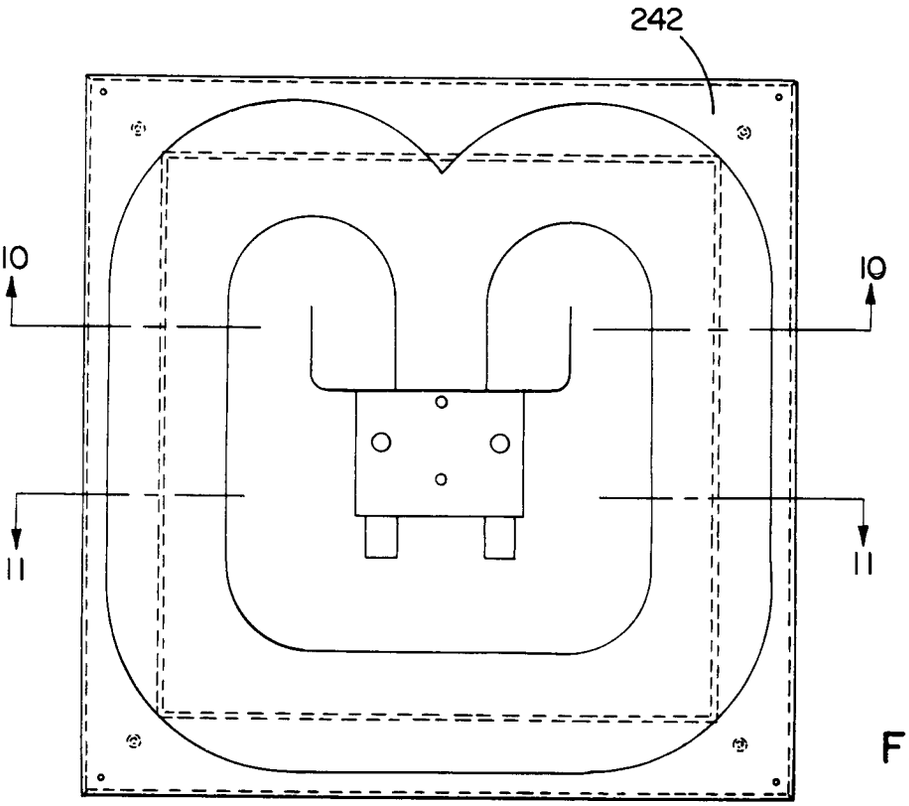


FIG. 9

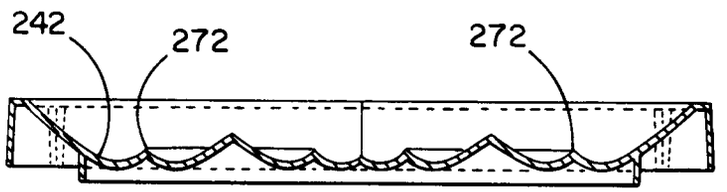


FIG. 10

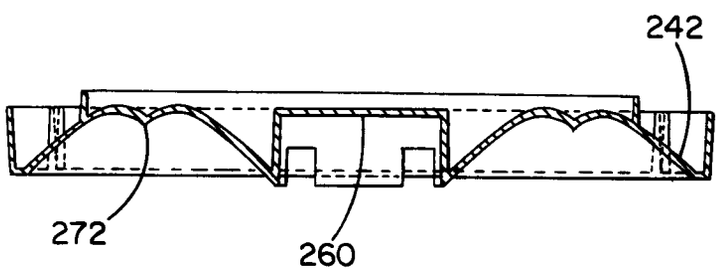
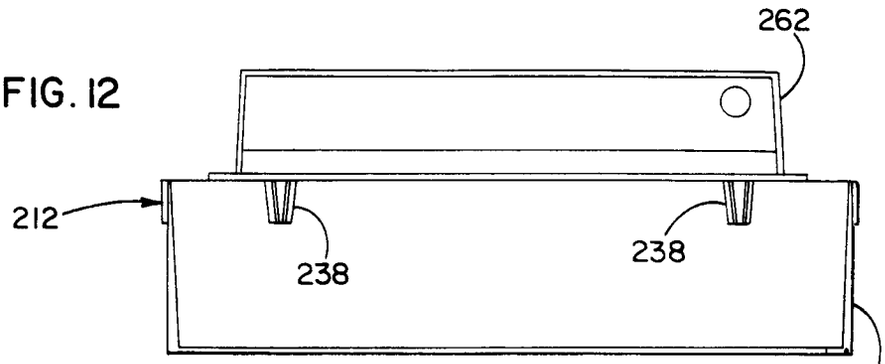


FIG. 11

FIG. 12



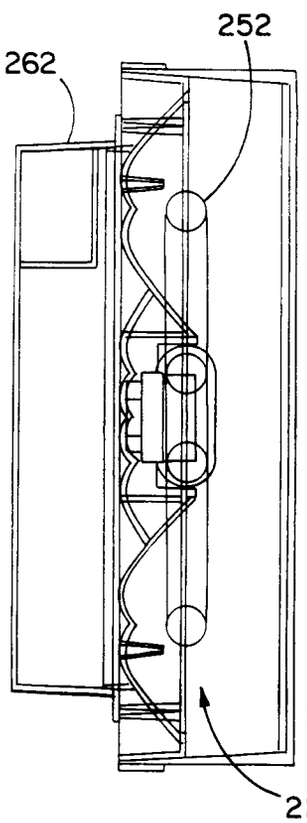


FIG. 14

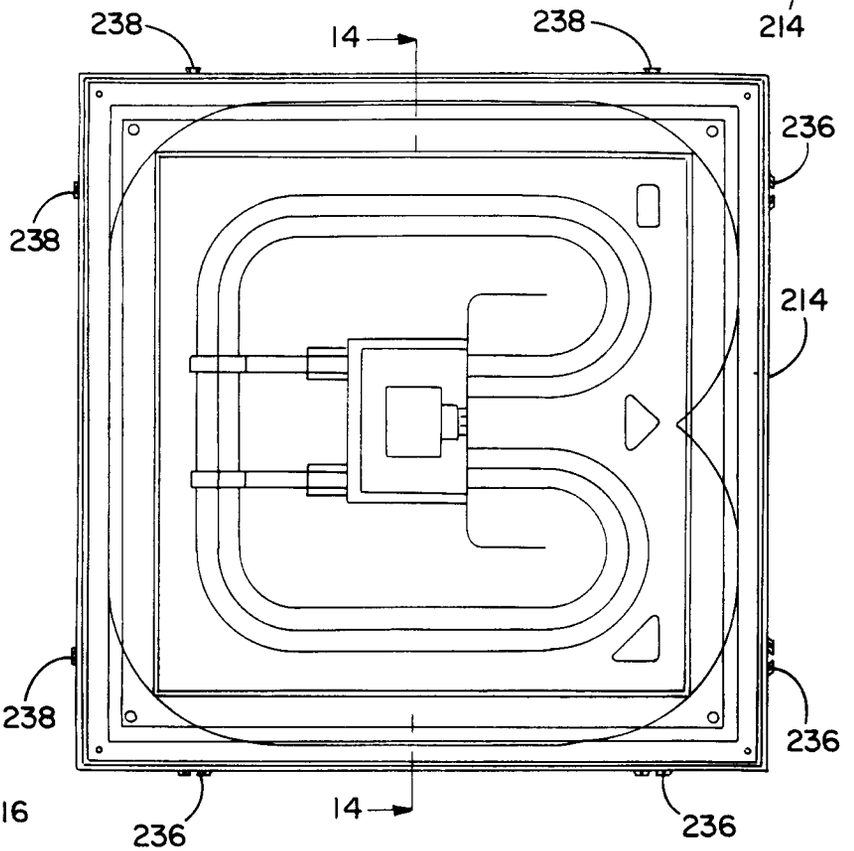


FIG. 13

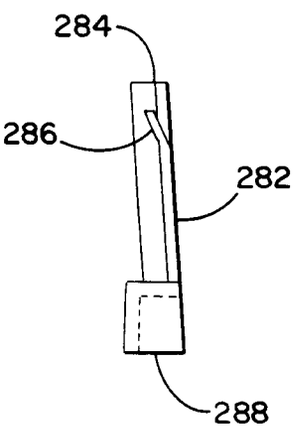


FIG. 15

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 9749

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X	US-A-4 373 283 (SWARTZ)	1,2,5, 18,20, 21,26	G09F13/08 G09F13/14
A	* column 2, line 8 - column 4, line 6; figures 1,3,4 *	9,11, 22-24	
X	DE-A-33 04 890 (DORN)	1,3-8, 20,26	
	* page 8, line 8 - page 11, line 9; figures *		
X	DE-A-37 21 302 (KRÖLLER GMBH & CO KG)	1,2,5, 21,26	
	* column 4, line 53 - column 6, line 3; figures *		
A	US-A-4 425 604 (IMAI ET AL.)	1-3,5, 11,21, 23,24,26	
	* column 3, line 57 - column 4, line 14; figure 2 *		TECHNICAL FIELDS SEARCHED (Int.Cl.5)
A	GB-A-2 212 647 (ARRIAZU)	1,12-15, 17	G09F F21V
	* page 6, line 3 - page 9, line 18; figures 1-7 *		

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	24 February 1994	Taylor, P

CATEGORY OF CITED DOCUMENTS

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