

July 18, 1961

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2,993,115

LIGHT DIFFUSER FOR FLUORESCENT LIGHTING FIXTURE

Filed Sept. 6, 1957

2 Sheets-Sheet 1

Fig. 1

Fig. 2

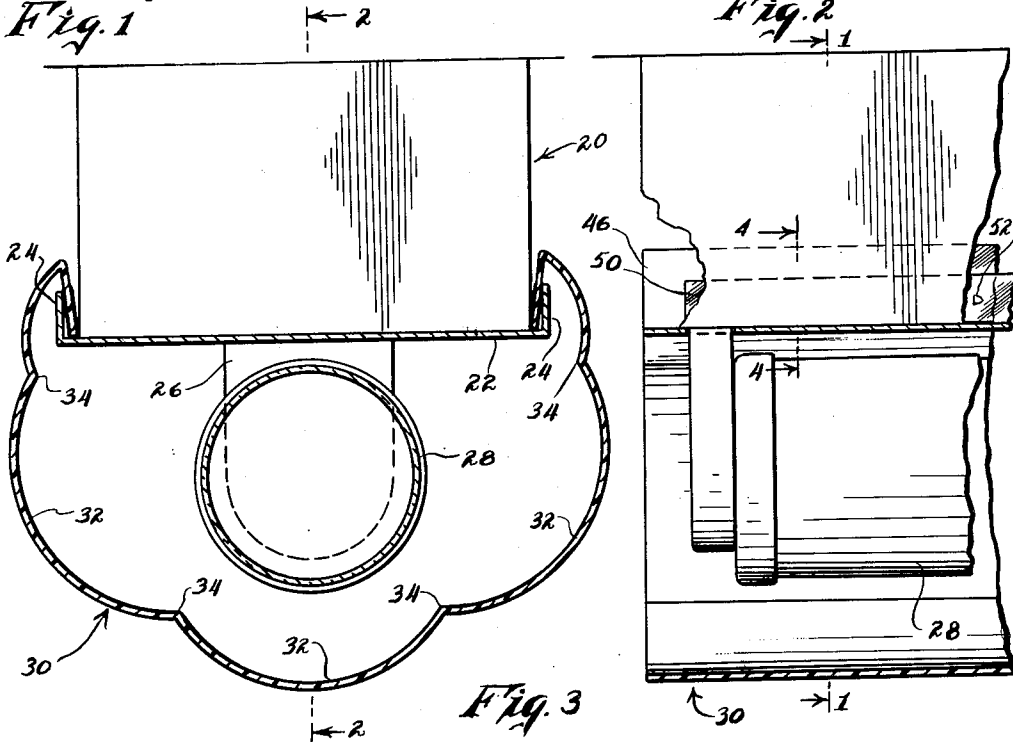


Fig. 3

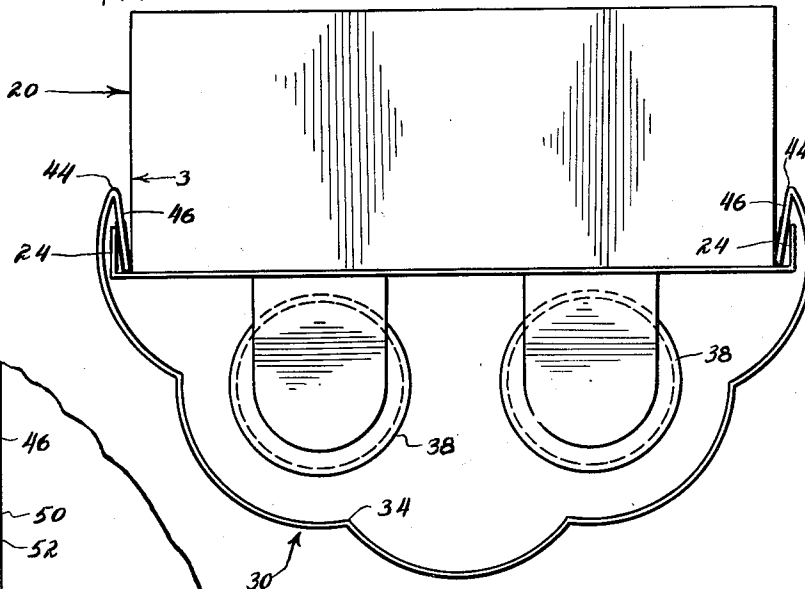
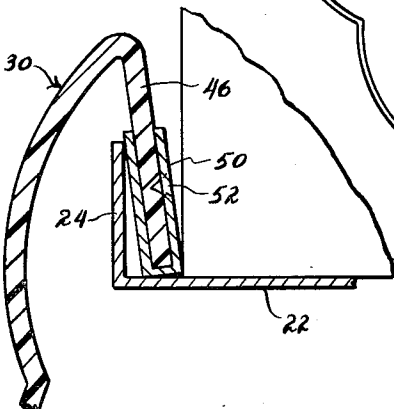


Fig. 4



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2 Sheets-Sheet 2

Fig. 5

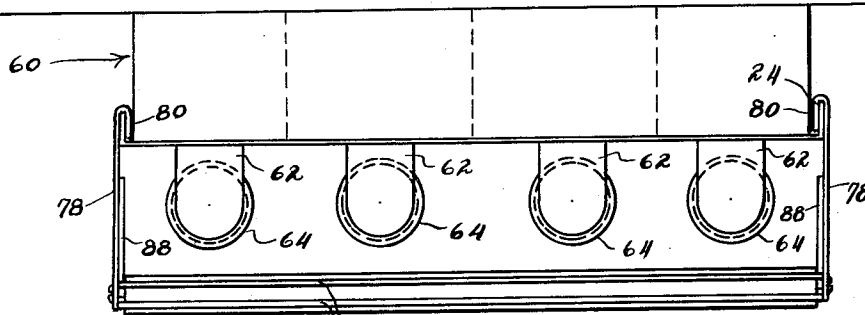


Fig. 6

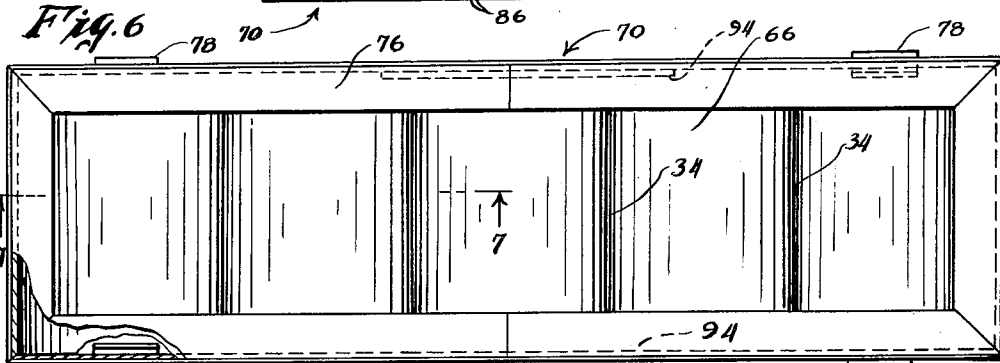


Fig. 7

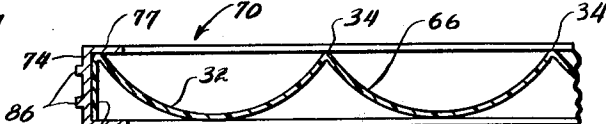
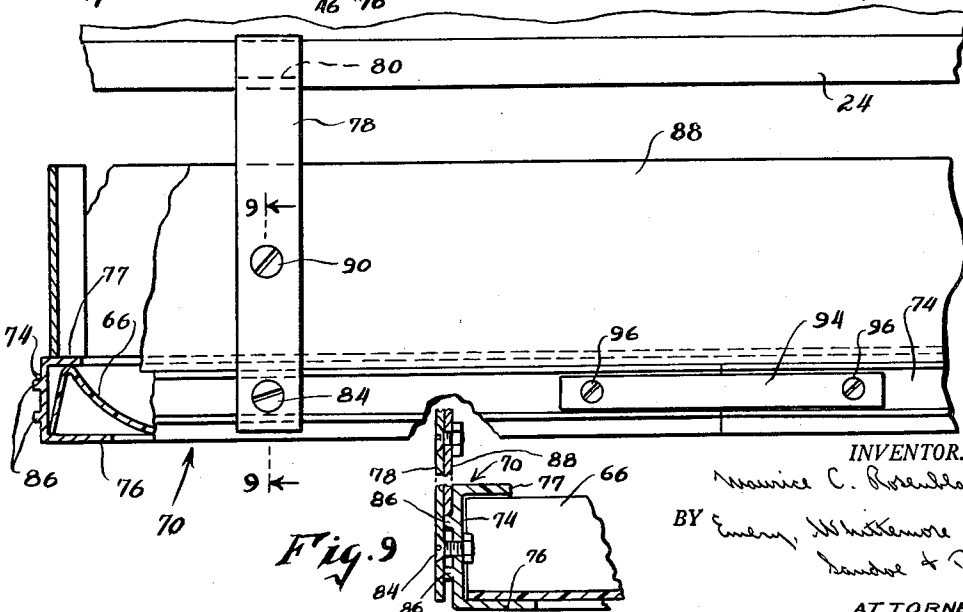


Fig. 8



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2,993,115 LIGHT DIFFUSER FOR FLUORESCENT LIGHTING FIXTURE

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3 Claims. (Cl. 240—51.11)

This invention relates to diffusers for fluorescent light fixtures.

It is an object of the invention to provide a light diffuser made of plastic sheet material and constructed in such a way that the diffuser is more economical to manufacture and to install. The invention also makes possible the removal of the diffuser, or the disconnecting of the diffuser at one side, for convenient replacement of fluorescent tubes.

The diffuser of this invention is made from a plastic sheet which has been creased or scored so that it assumes a desired contour when arched across a space between supports, or when crowded into a holding frame. The shape assumed by the plastic sheet, as the result of the creasing or score lines, improves the stiffness of the diffuser and makes it possible to use sheet material of lighter weight and lower cost than would otherwise be required.

Another important advantage of the invention is that the construction is one which can be manufactured without the use of hot forming or molding equipment. The creases or scores of this invention can be made with cold tools and cold sheet material, the only requirement being that the operation should be carried out in an atmosphere or under operating conditions which are not so cold as to make the sheet material brittle.

Another object of the invention is to provide a fluorescent light diffuser with supporting means that clip over the flanges of a conventional wire way or body of a conventional fluorescent light fixture.

Features of the invention relate to constructions by which standard lengths of the diffuser of this invention can be connected together in end-to-end relation for fluorescent light installations of any length.

Other objects, features and advantages of the invention will appear or be pointed out as the description proceeds.

In the drawing, forming a part hereof, in which like reference characters indicate corresponding parts in all the views:

FIGURE 1 is a sectional view through a fluorescent light fixture equipped with the diffuser of this invention, the wire way being shown in elevation and the other structure of the fixture being shown in section on the line 1—1 of FIGURE 2;

FIGURE 2 is a sectional view taken on the line 2—2 of FIGURE 1 but with the wire way or body of the fixture left in elevation;

FIGURE 3 is an end view showing the invention applied to a fluorescent light fixture of the type having two fluorescent tubes in parallel relation to one another;

FIGURE 4 is a greatly enlarged, fragmentary, sectional view taken on the line 4—4 of FIGURE 2;

FIGURE 5 is an end elevation of a modified form of the invention;

FIGURE 6 is a bottom plan view, partly broken away and in section, of the form of diffuser shown in FIGURE 5;

FIGURE 7 is an enlarged sectional view taken on the line 7—7 of FIGURE 6;

FIGURE 8 is a side elevation, partly broken away and in section, of the modification shown in FIGURES 5—7; and

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FIGURE 9 is an enlarged, fragmentary, sectional view taken on the line 9—9 of FIGURE 8.

The fluorescent light fixture shown in FIGURE 1 includes a wire way or fixture body 20 having a bottom wall 22 with upturned flanges 24 along its opposite sides. These flanges are slightly spaced from the outside surface of the wire way 20 in fixtures of conventional construction. Sockets 26 are attached to the bottom wall 22, and these sockets extend downwardly for supporting the opposite ends of a fluorescent tube 28. The construction thus far described is conventional.

The diffuser which is supported from these flanges is made from a sheet of translucent plastic, such as polyvinyl chloride. The plastic is scored or creased along parallel lines extending lengthwise or crosswise of the sheet. This creasing can be done with a roller or pressure blade or by any other application of force which stresses the sheet beyond its elastic limit so as to form a dihedral angle along each of the lines. Even though this angle is close to 180 degrees, or the sheet is substantially flattened again after the creasing, these lines cause the sheet to form with a scalloped contour when it is bent for connection with the wire way flanges, or other connecting means with which the sheet is combined when making a diffuser.

For modifications in which the sheet is to be bent about a longitudinal axis, it is necessary that the creasing leave the plastic with internal stresses that tend to reduce the dihedral angle along each of the crease lines. For modification of the invention in which the sheet is placed in a holder and assembled to give the plastic sheet a sawtooth contour, it is sufficient that the sheet be scored to a thinner section along parallel lines so that it will bend more easily at the locations of these lines.

The term "crease" as used herein designates a stressing of the plastic by which it tends to bend along the crease line to form a dihedral angle. The term "score" is used to designate the application of force which reduced the thickness of the sheet, and the line along which the reduction is made. The scoring tends to make the sheet bend more easily at the score line than elsewhere and to bend more easily in one direction than the other when the scoring is done from one side of the sheet, and the scoring sometimes sets up internal stresses which make the score line also a crease, but a crease does not necessarily reduce the thickness and a score does not necessarily set up internal stresses tending to eliminate the flatness of the original sheet. The expression "bend lines" is used herein as a generic expression to cover both crease and score lines.

The most important advantage in shaping the diffuser by providing bend lines which cause it to form itself to the desired contour when arched between flanges, or crowded into a channel frame, is the economy of manufacture as compared with earlier diffusers shaped by processes in which vacuum forming or other hot molding is used for giving the diffuser a permanent set. With this invention the creases and scores can be made progressively along the bend lines with simple equipment and without heat, the only requirement being that the operation be carried out in an atmosphere or other conditions in which the sheet is not so cold as to be brittle.

A diffuser 30 is supported from the bottom wall 22 of the fixture. This diffuser 30 is arched and the bending of the sheet causes it to form with arcuate sections 32 which meet with one another along creases 34.

The creases 34 are formed in the sheet material of the diffuser 30 along straight lines parallel to the longitudinal edges of the sheet; and the plastic sheet material is arched in a direction opposite to that toward which the creases face with the result that the sheet bends into the plurality of arcuate sections 32, the plastic material

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remaining stressed at the creases 34 which are bent outwardly by the upward curving of the diffuser.

The radiuses of the arcuate sections 32 depend upon the thickness and stiffness of the sheet of plastic, and also upon the force applied in making the creases 34. A harder creasing of the plastic sheet reduces the radius of curvature of the arcuate sections 32 which are formed by bending the sheet rearwardly away from the inside surfaces of the creases 34. In the preferred construction, illustrated in FIGURE 1, the plastic sheet is creased with sufficient force to give the center arcuate section 32 a radius of curvature that locates the axis of curvature substantially on the longitudinal axis of the fluorescent tube 38. The arcuate sections 32 on opposite sides of the center section are preferably curved so that their axes of curvature correspond to the longitudinal axes of the fluorescent tubes 38 (FIGURE 3) when the diffuser 30 is used with a fluorescent light fixture having two tubes.

Along both of its longitudinal edges, the plastic sheet of the diffuser 30 is provided with creases 44 turned in the opposite direction from the creases 34 so that the edge portions of the plastic sheet, designated by the reference character 46, extend downwardly into the clearance between the flanges 24 and the side wall of the wire way 20.

The cost of the diffuser 30 is less, and the amount of light transmitted is increased, by using thin sheets of plastic. Experience has shown that a polyvinyl chloride sheet having a thickness of 0.010 inch is sufficient, but sheets of greater or lesser thickness can be used. There are two features of the invention which make it practical to use such thin sheets. One is the curvature of the sections of the sheet about longitudinal axes with resulting stiffening of the sheet in the direction of its longitudinal extent. Another is that the longitudinal edges of the diffuser are supported along their entire length by the flanges 24.

In the preferred construction, the thin sheet of plastic, used for the diffuser 30, is further strengthened by having a metal binding 50 along each longitudinal edge portion 46. This binding 50 is best shown in FIGURE 4. In the preferred construction it consists of a sheet metal strip folded into a deep U-shaped section into which the lower part of the edge portion 46 is inserted and securely held by clamping the sides of the binding against the plastic sheet material. Friction is sufficient to secure the binding 50 to the plastic sheet of the diffuser 30, but if greater strength is desired, teeth 52 can be struck from the binding 50 at spaced locations along the length of the binding. The depth of each of the bindings 50 is preferably slightly greater than the height of the flanges 24 behind which the edge portion 46 is inserted when the diffuser 30 is assembled with the lighting fixture.

The diffuser 30 is made in standard lengths, for example two feet. Standard fluorescent lights are made in lengths of two, four, six and eight feet. When the diffuser of this invention is to be used with fluorescent fixtures of more than two feet in length, several lengths of diffuser are connected together. To insure continuity, the successive lengths of diffuser are overlapped. Better results are obtained if there is no overlapping of binding strips 50, the clearance between the flanges 24 of the sides of the wire way being insufficient, in the usual fixture, to permit overlapping of bound edges.

In the construction shown in FIGURE 2, the binding 50 terminates short of the end of the longitudinal edge portion 46 so that this part of the sheet beyond the binding 50 merely abuts the corresponding binding on the next diffuser sheet. The diffuser is preferably made with the binding 50 terminating back from the ends of the plastic at both ends of the binding. It is sufficient to have it terminate back from the end of the diffuser at only one end, however, but this has the disadvantage of requiring

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successive lengths of the diffuser to be always turned in a direction to leave the clearance at the same end. Such a requirement increases installation time to some extent.

Whenever it becomes necessary to replace a tube, one of the edges of the diffuser is lifted out of the space behind its retaining flange 24, and the diffuser is allowed to hang down from the flange on the other side. This leaves the diffuser in a safe place while tubes are being replaced; and after the tube is replaced, the free edge of the diffuser is lifted back into its former position behind the flange 24 to restore the diffuser to its working position.

FIGURE 5 shows another modification of the invention in which the fixture includes a wide wire way or body 60 with sockets 62 supporting a plurality of fluorescent tubes 64 in parallel relation to one another. Because of the width of this fixture shown in FIGURE 5, the fluted diffuser of FIGURES 1-4 is less suitable than the construction shown in FIGURES 5-9. A translucent plastic sheet 66 is formed with arcuate sections 32 and creases 34 in a manner similar to the method described in connection with FIGURES 1 and 3. However, the plastic sheet 66 is placed under the fluorescent tubes with the creases 34 extending transversely of the lengths of the tubes instead of parallel to them, as in FIGURES 1-4.

The sheet 66 is of substantially the same width as the wire way 60, and it is supported in a frame 70, preferably made of metal. The frame 70 is made of channel sections which provide a low side wall 74, best shown in FIGURES 7-9, and bottom and top walls 76 and 77, respectively. The plastic sheet 66 is supported by the bottom wall 76 and it is held down and restrained in its scalloped contour by the top wall 77.

At its opposite ends, the sheet 66 is turned downwardly along creases 34, and these downwardly turned ends contact with the walls 74 at the opposite ends of the frame 70.

In order to support the frame 70 and the sheet 66 from the wire way 60, there are clips 78, preferably metal, at spaced locations along the length of the frame 70, and preferably near opposite ends of the frame.

Each of the clips 78 has a hook 80 at its upper end for engaging behind the upturned flange 24 of the wire way 60. At its lower end, each clip 78 is connected to the frame 70 by a bolt 84, best shown in FIGURE 9.

The sections, of which the frame 70 is made, have ridges 86 along their outer surfaces. Above the frame 70, flat translucent, plastic sheets 88 are attached to the clips 78 in order to diffuse light which comes across the top of the frame 70. The lower portion of each of the plastic sheets 88 overlaps the upper part of the frame 70 and preferably extends downwardly to the top of the upper ridge 86. At some distance above the frame 70, the plastic sheet 88 is connected to the clip 78 by a bolt 90, this bolt being merely representative of fastening means for attaching the plastic sheet 88 to the clips 78 in order to prevent inward displacement of the upper ends of the plastic sheets 88.

The frame 70 is made in two sections which are shown in FIGURES 6 and 8 connected together by butt plates 94 attached to the side wall 74 by bolts 96 or other suitable fastening means. The reason for making this frame 70 in two parts is to permit the sheet material to be inserted easily into the side channels between the bottom and top walls 76 and 77, respectively.

It will be understood that for fixtures of greater length, the butt plates 94 can be disconnected from one or the other ends of the frame 70, and new channel sections can be inserted to extend the frame 70, the channel sections having butt plates at one end corresponding to the butt plate 94.

When the frame 70 is thus extended, successive plastic sheets 66 can join one another along down-turned edge

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portions 46, and the sheet at one end of the frame can be cut with scissors, if necessary, in order to obtain a total length of scalloped plastic sheet corresponding to the length of the frame. Ordinarily, the diffuser will be constructed of standard two-foot sections so that no cutting is necessary for any standard length of lighting fixture, such lengths being multiples of two feet.

The preferred embodiments of the invention have been illustrated and described, but various changes and modifications can be made and some features can be used in different combinations without departing from the invention as defined in the claims.

What is claimed is:

1. A diffuser panel for a fluorescent light fixture, which has a wire way and fluorescent tubes located below the wire way and between the opposite sides thereof, said diffuser panel including a confining frame having walls that bound a space on all sides, said walls including longitudinally extending channels with their open sides confronting one another on opposite sides of said space, a sheet of translucent plastic material located in the frame between the channels and with opposite edges of the sheet material between the top and bottom walls at opposite sides of the open side of the channel, the sheet of plastic material having weakened bend lines along which the material is bent sharply to form dihedral angles, with all of the dihedral angles facing away from the same side of the sheet, the bend lines extending transversely and all the way across the sheet from one side edge to the other, the walls of the frame including an end wall extending transversely of the length of the frame and generally parallel to the bend lines of the sheet and exerting pressure against the end of the sheet, and buckling the sheet into undulations that are limited by the top

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and bottom walls of the channels, the buckled sheet material between the dihedral angles being bent to curves having their centers of curvature on the side of the sheet opposite to that from which the dihedral angles face away, the total length of the sheet material being so correlated with the length of the space bounded by the confining frame, and with the height between opposite walls of the channel, so as to buckle the sheet for its full length, and detachable fastening means securing the end wall to the side walls of the frame.

2. The diffuser panel described in claim 1, and in which the panel is rectangular and has confining end walls at opposite ends of the frame.

3. The diffuser panel described in claim 2, and in which all of the walls are channel sections facing the space bounded by said frame.

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