

[54] **REFRIGERATED DISPLAY CASE**
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[73] Assignee: **Emhart Corporation**, Bloomfield, Conn.
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240/102 A; 40/130; 312/236, 116; D67/3;
316/17; 313/25, 27; 62/247, 252, 246, 251, 255

[56] **References Cited**

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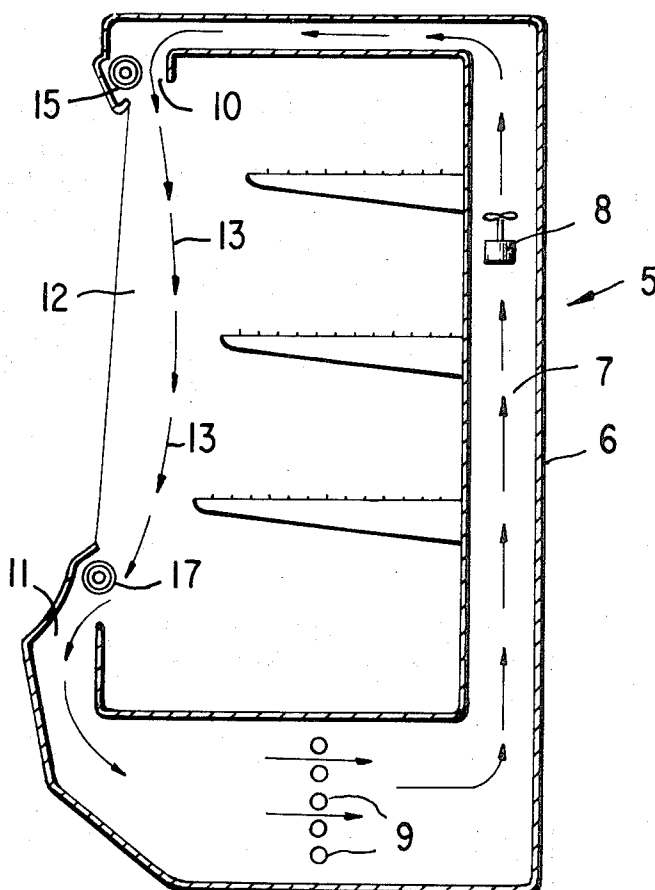
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[57] **ABSTRACT**

A refrigerated case and display lamp arrangement is provided which case may be alternately cooled and heated for defrosting purposes. An elongated tubular fluorescent lamp is mounted within the case and is provided with tubular jacket spaced coaxially thereabout. Elastomeric support members are disposed at either end of the lamp to hold the jacket in a particular spaced relationship with respect to the lamp. Axially extending grooves are formed in a radial face of each support member to receive the terminal edges of the tubular jacket. The outer surface of each supporting member is formed with a circumferentially extending recess for receiving a steel ring which biases axially extending surfaces of each supporting member into pressure engagement with both the tubular jacket and a glass portion of the fluorescent lamp.

A spacer member may be positioned about the fluorescent lamp approximately at the mid-span thereof for insuring a constant spaced relationship between the jacket and the lamp along the entire length thereof.

10 Claims, 4 Drawing Figures



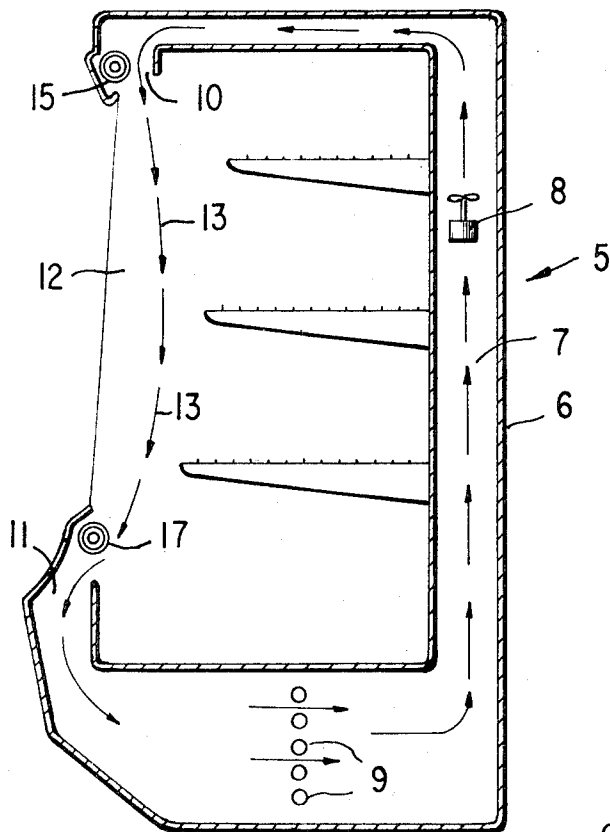


Fig. 1.

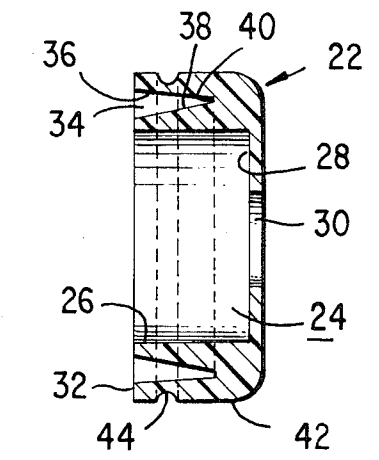


Fig. 3.

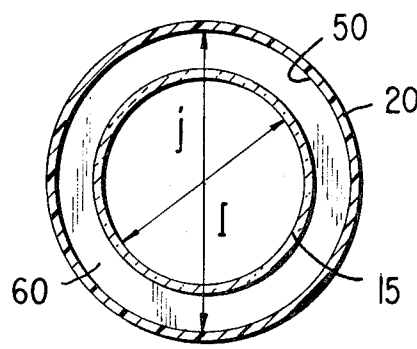


Fig. 4.

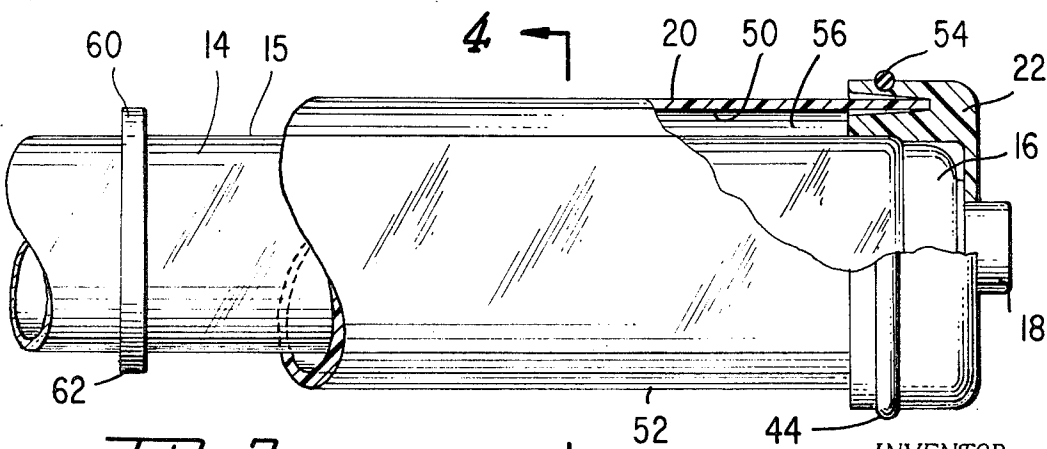


Fig. 2.

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REFRIGERATED DISPLAY CASE

BACKGROUND OF THE INVENTION

This invention relates to refrigerated cases and, more particularly, to such cases in combination with a fluorescent lamp assembly which overall combination provides a greater display light efficiency than heretofore possible.

The phosphor of a fluorescent lamp is energized by the 2537AX-radiation produced by a discharge through mercury vapor, and such radiation is a maximum at a mercury vapor pressure of about 6 microns corresponding to an envelope temperature of about 40° Centigrade. It has long been known that the light output of the common fluorescent lamp drops substantially when subjected to low temperature ambient conditions. This low efficiency is particularly noticeable when the cooled lamp assembly is further subjected to forced drafts generally referred to as "air curtains" within refrigerated food display cases and the like.

With the adverse effects of low temperature on fluorescent lamps in mind, the industry has placed light transmitting jackets, such as glass sleeves, around fluorescent lamps when the lamps are to be subjected to low temperatures. Due to the provision of such a jacketed assembly, the heat loss from such lamps has been reduced and satisfactory light output has been maintained at temperatures as low as zero degrees Centigrade, or freezing. Such jacketed fluorescent lamps are commercially available and are widely used.

The typical arrangement, such as those distributed by General Electric Company of New York, consist of a fluorescent lamp having an outside diameter of 1-½ inches and a glass jacket having an inside diameter of 1-¾ inches.

It had been generally thought, that such an arrangement was entirely satisfactory and that there were no substantial advantages to be gained by changing the diameter sizings of the shield with respect to the diameter of the fluorescent tube. U. S. Pat. No. 3,124,307 is evidence of this thought. Other relevant U. S. patents include U.S. Pat. Nos. 2,791,679; 3,358,167; 2,363,109 and Re 25,891.

It has been unexpectedly discovered, however, that the efficiency of a lamp assembly subjected to freezing air curtains may be increased by almost 500 percent by properly sizing a plastic jacket with respect to the fluorescent lamp and by hermetically sealing the annular space defined between the two.

Furthermore, it has been found that a fluorescent lamp may have a longer rated life when jacketed by a shield of such a properly sized diameter.

OBJECTS AND SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a refrigerated case lamp arrangement which provides a greater light output efficiency than heretofore known.

It is another object of the present invention to provide a sealed dead air space about a fluorescent lamp used in a refrigerated space.

It is still another object of the present invention to provide an improved sealing means for insuring the integrity of the dead air space when the lamp assembly is subjected to alternate heating and cooling conditions.

It is further object to the present invention to provide a jacket support arrangement which is inexpensive and easy to manufacture.

It is still a further object of the present invention to provide a jacketed fluorescent lamp assembly for use in refrigerated areas, having cold air curtains which assembly solves many of the problems confronting the industry.

At least some of the above mentioned objects are achieved by the provision a refrigerated space including an elongated tubular fluorescent lamp. An elongated transparent tubular shield may be coaxially supported about the lamp and sealed at the axial ends thereof to form a hermetically sealed, annular, dead air space. Elastomeric support members may be disposed at either end of the lamp for holding the shield in spaced relationship with respect to the lamp, and a biasing device is provided for forcibly urging the support members into resilient contact with the shield to provide an effective seal during expansion and contraction of the various members of the assembly due to thermal changes.

BRIEF DESCRIPTION OF THE DRAWINGS

While the invention is particularly pointed out and distinctly claimed in a concluding portion of the specification, a preferred embodiment is set forth in the following detailed description, which may be best understood when read in connection with accompanying drawings, in which:

FIG. 1 is a diagrammatic sectional view of a refrigerated case presenting a cold air curtain and the arrangement of the present invention;

FIG. 2 is a partial sectional view taken along the axis of a lamp arrangement according to the present invention;

FIG. 3 is an axial cross-sectional view of a sealing and support member included in the assembly of FIG. 2; and

FIG. 4 is a transverse sectional view of the assembly shown in FIG. 2, taken along line 4-4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, in which like numerals are used to indicate like parts throughout the various views thereof, FIG. 1 diagrammatically shows an overall assembly 5 according to the present invention.

A refrigerated case 6 is formed with ducting 7 having a blower 8 for forcing air through evaporators 9, out a top nozzle 10 and back through return air plenum 11 to repeat the circuit. As the cold air tracks across the front access area 12 in passing from nozzle 10 to return air plenum 11, the air current forms a cold air curtain illustrated by the arrows 13.

Typically, fluorescent display lamps 15 and 17 may be disposed in the flow of cold air as indicated in FIG. 1. It is due to the drastic cooling effect of this cold air flow that the lighting efficiency of a display lamp is greatly reduced.

FIG. 2 shows the lamp assembly included in the present invention including a tubular fluorescent lamp 15, which typically presents a diameter of 1-½ inches. The lamp 15 may comprise a glass portion 14, an axially extending metallic end cap portion 16 and a mounting and electrical contact housing portion 18.

A transparent tubular jacket 20 may be supported coaxially about the lamp 15 by elastomeric supporting members 22.

The elastomeric member 22 is shown in axial cross section in FIG. 2. The member 22 presents a generally cylindrical body having an axially extending recess 24 defined by a cylindrical internal wall 26 and a radially extending wall 28. An aperture 30 may be formed in the wall 28 for insertion of the contact housing portion 18 of the lamp 15.

One radially extending outer surface 32 of the support member 22 may be formed with an axially extending groove 34 defined by, converging, generally frustoconically extending walls 36 and 38 which are joined by a radially extending surface 40 to form the generally wedge-shaped annular groove 34. An outer cylindrical surface 42 may be formed with an annular recess 44 which may be generally semi-circular in cross-sectional configuration.

The body of the elastomeric support member 22 may be of any suitable synthetic rubber such as the compound described as neoprene compound 3628-11, manufactured by Pawling Company, of Pauling, N.Y. This compound has been found to be effectively resilient at temperatures as low as minus 40° F. and to vary only five points in durometer reading when subjected to a temperature of 210° F. for 70 hours. Of course, other materials, such as an ethylene propylene, could be used with satisfactory results.

It will be noted, that the diameter of the wall 26 defining the annular space 24 is sized to fit snugly on the glass portion 14 of the lamp 12. Furthermore, it will be seen that the frustoconical surfaces 36 and 38 are clamped forcibly against the interior surface 50 and the outer surface 52 of the transparent jacket 20 upon the placement of a continuous steel ring 54 within the recess 44. The force applied to the supporting member 22 by the ring 54 is aligned to force the frustoconical walls 36 and 38 against the inner and outer surfaces 50 and 52 of the transparent jacket and also to forcibly urge the inner wall surface 26 of the support member against the glass portion 14 of the fluorescent lamp 15. The placement of the ring 54 within the recess 44, as opposed to merely placing it on the surface 42, causes a more complete contact between the surfaces 36 and 38 with respect to surfaces 50 and 52.

Heretofore, in lamp assemblies wherein transparent jackets were coaxially supported about a tubular fluorescent lamp, the integrity of the dead air space 56 was often destroyed when the elastomeric material comprising the support member was subjected to alternate heating and cooling.

It has unexpectedly been found, that the air film immediately adjacent the inner surface 50 of the transparent jacket 20 presents a remarkable resistance to heat flow from the fluorescent lamp to the refrigerated ambient. When the supporting members of existing devices fail to maintain a hermetical seal about the space 56 during alternate heating and cooling periods, air currents are induced within the dead air space 56 which tend to rupture the air film adjacent the surface 50 of the jacket 20. This disruption of the air film, in turn, reduces the efficiency of that air film in resisting heat loss.

It is through the last mentioned arrangement that a dead air space 56 may be preserved about the fluorescent lamp 15 when subjected to vast temperature

changes and severely cold air curtains drafts. It had been thought that a thin dead air space of (e.g. one-tenth inch) would minimize disruptive air currents. However, it has been unexpectedly discovered that the air film may also be ruptured by the positioning of the inner wall 50 of the jacket 20 sufficiently close to the lamp 12 to induce thermal currents at the inner surface 50 which currents also tend to rupture the integrity of the air film.

It has been discovered that, by the critical sizing of the inside diameter of the jacket 20 with respect to the outside diameter of the glass portion 14 of the lamp 15, the integrity of the air film may be maintained. More specifically, it has been discovered that, when the inside diameter of the jacket 20 is of a magnitude in the range of 2-½ inches when the diameter of the glass portion 14 of the lamp 15 is 1-½ inches, the integrity of the air film is not disturbed and the lighting efficiency of the overall arrangement is remarkably improved over existing assemblies. This finding is contrary to current thought which teaches that a dead air space thickness of one-tenth inch is entirely satisfactory.

It should be stressed, however, that in order to maintain the effectiveness of the air film in retaining heat, both the proper dimensioning of the jacket and lamp and the proper sealing of the dead air space are critical in achieving the desired result of improved efficiency.

When a transparent plastic comprises the jacketing member 20, it has been found desirable to include a spacing member 60 which may generally consist of an elastomeric material formed as a ring having an internal diameter approximately equal to the outside diameter of the glass 14 of the lamp 12. If the plastic shield 20 should soften due to heat buildup within the space 56, any sagging along the length of the jacket 20 may be checked by the upper supporting surface 62 of the ring-like member 60. One or more of the rings 60 may be utilized to achieve the desired result. Suitable materials for the plastic jacket do include high impact strength acrylic and polycarbonate plastics.

Referring briefly to FIG. 4, the outside diameter of the lamp 15 is indicated by the letter *l* and the inside diameter of the jacket 20 is indicated by the letter *j*.

Due to the unusual heat flow resistivity presented by the air film immediately adjacent surface 50, it has been unexpectedly discovered that when the ratio of *j* : *l* is in the range of 4:3 to 5:3, that the light output efficiency of an overall assembly, having a lamp rating in the range of 500-2,000 milliamperes, (ma.), may be substantially improved. This critical placement of the diameters *j* and *l* is effective to eliminate thermal currents caused by heating at the surface 50 which currents disrupt the integrity of the heat resistant air film.

Due to the higher degree of heat conductivity exhibited by glass as opposed to plastic, a plastic jacket is more desirable than a glass jacket for heat retaining purposes.

It can thus be seen that a jacketed lamp assembly has been herein provided which markedly increases the efficiency of fluorescent lamp assemblies to be used in refrigerated spaces. Furthermore, it can be seen that a unique dimensional relationship has been herein provided with respect to a fluorescent lamp and a surrounding jacket which relationship preserves the integrity of a heat resistant air film immediately adjacent the inside surface of the surrounding jacket. This relationship is contrary to current teachings in the field.

An elastomeric support member is herein described which more effectively preserves the dead air space defined between the lamp and jacket than similar support members heretofore known. More particularly, the support member of the present invention preserves the hermetical seal during alternate cooling and heating periods of the assembly which cooling and heating may cover large temperature changes.

The overall arrangement according to the present invention lends itself to ease of manufacture and installation. The apparatus is inexpensive and easy to install. In fact, the apparatus of the present invention may be easily installed on existing equipment without any modification thereto.

Actual tests have shown that the efficiency of fluorescent lamps, disposed intimately with freezing air curtains and incorporating a plastic jacket mounted and sealed by the member 22 of the present invention, may be improved by as much as a completely unexpected, 500 percent. Therefore, the elements of the present invention are combined to present a classic case of synergism.

SCOPE OF THE INVENTION

While what has been shown in the preceding detailed description is a preferred embodiment of the present invention, it is, of course, understood that various modifications and changes may be made therein without departing from the invention. It is, therefore, intended to cover in the following claims all such modifications and changes as may fall within the true spirit and scope of the present invention.

What I claim is:

1. A refrigerated display case comprising:
 - a. Means for providing a cold air curtain;
 - b. Lighting means disposed within said air curtain for illuminating an interior of said display case; and
 - c. Said lighting means comprising,
 - An elongated tubular fluorescent lamp having a rating in the range of 500 to 2,000 ma.,
 - An elongated transparent tubular jacket supported coaxially about said lamp to define an annular dead air space,
 - Elastomeric support members disposed at either end of said lamp for holding said jacket in spaced relationship with respect to said lamp, and
 - Biasing means for forcibly urging axially extending surfaces of said support means into pressure contact with inner and outer surfaces of said jacket and an outer glass surface of said lamp to form

a hermetical seal for the annular dead air space

2. A refrigerated display case according to claim 1 wherein;

The ratio of the inside diameter Of said jacket with respect to the outside diameter of said lamp is in the range of 4:3 to 5:3.

3. A refrigerated display case according to claim 2 wherein;

Said elongated transparent tubular jacket consists of a plastic material.

4. A refrigerated display case according to claim 3 wherein said elastomeric support member comprises:

- a. A generally cylindrical body;
- b. A recess formed axially within said body for receiving an axial end of said lamp; and
- c. An annular groove formed in one radial face of said body for receiving an axial end of said tubular jacket.

5. A refrigerated display case according to claim 4 wherein;

Said Biasing means consists of a ring member.

6. A refrigerated display case according to claim 5 wherein;

An annular groove is formed in an outer cylindrical surface of each of said elastomeric support members for retaining said ring member.

7. A refrigerated display case according to claim 6 wherein said ring is of a generally continuous configuration and said annular groove for retaining said ring member is of a generally semi-circular cross-sectional configuration.

8. A refrigerated display case according to claim 6 wherein;

The axial length of said jacket is greater than the axial length of a glass portion of said lamp.

9. A refrigerated display case according to claim 6 wherein;

Said annular groove formed in one radial face of said cylindrical body of each said elastomeric support member is generally defined by two mutually converging frustoconical surfaces extending generally axially of said body.

10. A refrigerated display case according to claim 6 wherein;

A ring-like support member is disposed transversely about said lamp mid-span the terminal ends thereof to prevent sagging of said plastic jacket into contact with said lamp upon heating of said annular air space.

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