Sept. 20, 1966 AKIRA KAMEYAMA ETAL 3,274,420

ANNULAR FLOURESCENT LAMPS

Filed Sept. 27, 1961

Fig. 1

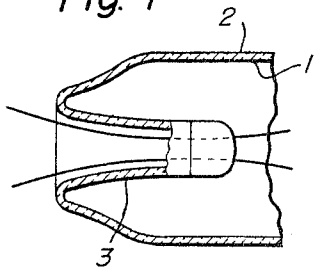


Fig. 2

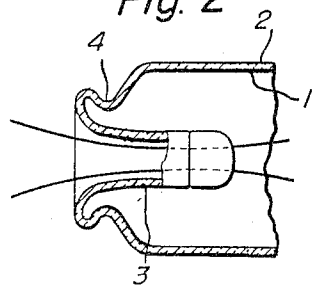


Fig. 3

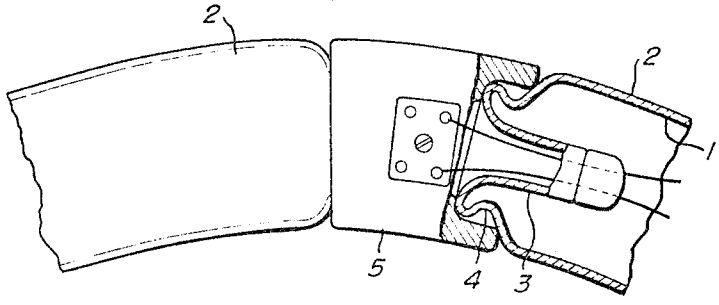


Fig. 4

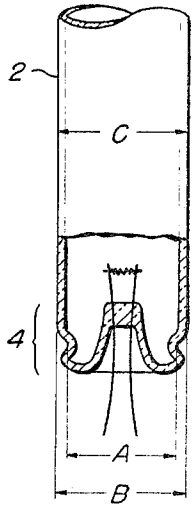


Fig. 5

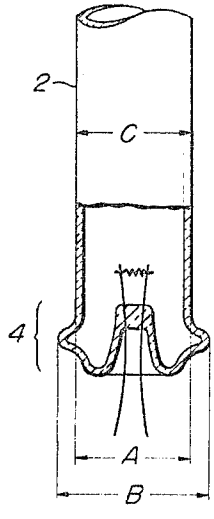
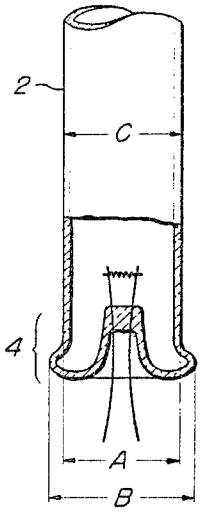


Fig. 6



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3,274,420

ANNULAR FLUORESCENT LAMPS

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2 Claims. (Cl. 313—109)

The present invention relates to annular or so-called "circline" fluorescent lamps and a method of manufacturing same.

The present invention has for its primary object to provide "circline" fluorescent lamps adapted to form a continuous and uniform light-emitting circle eliminating any gap or break therein as has been usual with the base portion of previous "circline" fluorescent lamps.

Another object of the present invention is to increase the total light flux of annular or "circline" fluorescent lamps.

A further object of the invention is to reduce the manufacturing cost of annular fluorescent lamps.

A still further object of the invention is to reduce the proportion of rejects occurring in the manufacture of annular or "circline" fluorescent lamps.

According to the present invention, there is provided a method of manufacturing annular fluorescent lamps comprising applying an appropriate mold to a straight glass tube at opposite ends of said tube, when stems are sealed therein, to obtain desired nodal formations at the opposite tube ends, said glass tube having a fluorescent layer previously coated on the inside thereof, and gripping said glass tube by said nodal end formations thereof for heating the glass tube to allow the latter to be bent into a circular form.

According also to the present invention, there is provided an annular fluorescent lamp manufactured by the above inventive method and having no metal rings fused to the glass lamp tube at opposite ends thereof.

The above and other objects, advantages and features of the present invention will be apparent from the following description when read with reference to the accompanying drawings in which:

FIG. 1 is a fragmentary longitudinal cross sectional view of one end portion of a fluorescent lamp bulb just before a mold is applied thereto in the manufacturing process according to the present invention;

FIG. 2 is a similar view of the same but just after the tube end has been shaped by the mold;

FIG. 3 is a fragmentarily longitudinal cross-sectional view of a fluorescent lamp with a base attached thereto after the tubular lamp bulb has been bent into a circular form; and

FIGS. 4, 5 and 6 are cross-sectional views of fluorescent lamp end formations obtainable by use of respective molds according to the invention.

Heretofore, in the manufacture of circline fluorescent lamps, stems having respective electrodes mounted thereon have been sealed in the opposite ends of a straight glass tube coated on the inside thereof with a layer of fluorescent material with metal rings of a diameter slightly smaller than that of the glass tube fused thereto in the respective sealing positions and then the entire glass tube heated to the softening point of the glass has been bent into a circular form by gripping the metal rings fused thereto.

Although the metal rings have been made of an alloy of nickel, cobalt, chrome or other expensive metal, they have been substantially of no use except in the tube bending operation. In addition, the fused joint between the glass and such metal ring have been undesirably liable to crack, though not very often.

Referring to the drawings, which illustrate the fluorescent lamp at different stages of the manufacturing process according to the present invention, stems 3, only one of which is shown, are sealed in opposite ends of a straight glass tube 2 having a fluorescent coating 1 on the inside thereof, as shown in FIG. 1. An appropriate mold, not shown, is then applied to the tube ends to form a nodal portion as indicated at 4 in FIG. 2 in the form of a circumferential ridge. Gripped by the opposite nodal portions, the glass tube is heated to soften, and bent so that the opposite tube ends are brought together to oppose each other and then cooled to solidify in that circular form.

The important factors in the prosecution of the inventive technique include the shape of the nodal ends and the temperature distribution along the glass tube during the bending operation. If the glass tube be heated to soften to such an extreme extent that it may readily be bent, it may sag under gravitation precluding tube formation into a correct circle and, further, the nodal tube ends may possibly be deformed so as to be released from the associated grips. On the other hand, if the glass be heated to soften only slightly, excessive effort and hence increased grip forces will be required for bending such glass tube. This may readily incur breakage of the nodal portions, particularly when the temperature thereof is excessively low and thus the glass is brittle.

Various nodal formations are illustrated in FIGS. 4, 5 and 6, in which the glass tube 2 having an outside diameter C is formed at either of the sealing ends with a nodal formation 4 having a minimum outer diameter A and a maximum outer diameter B, the difference between the two dimensions A and B being required to be from one millimeter to 16 mm. If the difference be less than one millimeter, an extremely large grip force would be necessary rendering such nodal formation impractical. Similarly, if the difference exceed 16 mm., wall portions of excessively small thickness would inevitably be formed also to render such nodal formation impractical. In the type of nodal formation shown in FIG. 4, dimension C is smaller than dimensions A and B, while in the types shown in FIGS. 5 and 6 dimensions A and C are substantially equal to each other and smaller than B.

In bending glass tubes shaped to dimensions as described above, the glass tubes are each heated preferably to the order of 600° C. at the nodal ends and to the order of 700° to 800° C. intermediate the ends for successful results. The tube is then evacuated and fitted with a one piece base made of light-transmitting resin and snapped on without employing any base cement to obtain a desired circline fluorescent lamp, with which it has been ascertained that a considerable light emission is obtainable through such single base. If any metal ring were employed as heretofore, it would interrupt the light emitted reducing the effective light emission to a negligibly small level.

It will be appreciated that, according to the present invention, in which the use of any metal ring is avoided, the cost of manufacture of circline fluorescent lamps is materially reduced, and any danger that cracks take place at the fused joint between the glass and ring is substantially completely eliminated. In addition, according to the present invention, the use of soda lime glass is allowed to further reduce the cost of lamps of the kind while decreasing the gas emission from the glass tube, as compared with conventional tubes having rings fused thereto.

What is claimed is:

1. An annular fluorescent lamp comprising a glass tube of circular form with the opposite ends disposed in

opposed relation; nodal gripping formations comprising a circumferential ridge on said tube at the opposite ends thereof; said tube having on its inside a fluorescent layer coated prior to the bending of the tube; and, a one piece light transmitting base means snapped onto the opposite tube ends.

2. An annular fluorescent lamp comprising a glass tube in substantially circular configuration with the ends thereof disposed in opposed relation; said ends substantially terminating in nodal gripping configurations comprising a circumferential ridge; and a one piece base member of translucent material snap assemblable onto the ends of the tube and snugly receiving the nodal formations by gripping the ridges thereof to complete the circular configuration of the lamp, whereby the lamp is substantially uniformly light emitting throughout the circular configuration.

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