Dec. 6, 1960 L. THORINGTON 2,963,612

ELECTRIC LAMP AND METHOD OF PRODUCING

Filed May 8, 1959

Fig. 1.

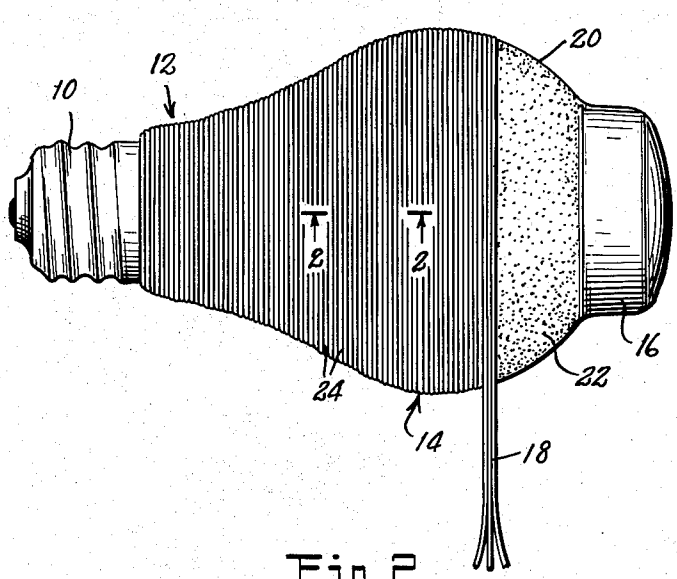


Fig. 2.

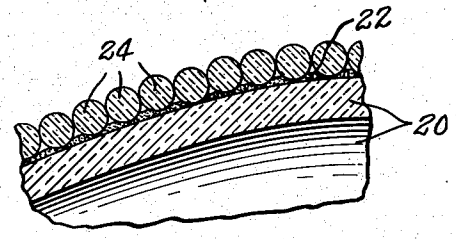
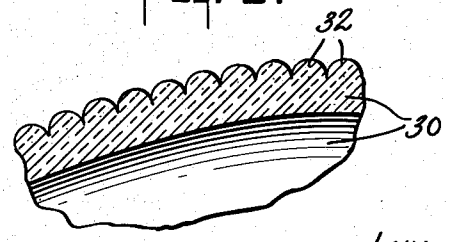


Fig. 3.



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ELECTRIC LAMP AND METHOD OF PRODUCING

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7 Claims. (Cl. 313—116)

This invention consists of improvements in electric light sources of the type employing a glass envelope and in methods of making them.

The subject matter of this invention is particularly adapted to improve several of the useful characteristics of incandescent lamps, but is not limited to application to such lamps, as will appear from the following disclosure.

An important object of this invention is to improve the mechanical and thermal shock resistance of the glass envelope of the lamp.

Another object of the invention is to impart decorative effects to incandescent lamps when operating.

Still another object of the invention is to modify the visual appearance of the incandescent filament.

A more specific object of the invention is to modify the surface of light transmitting incandescent lamp envelopes to attain the above objects of improved mechanical and thermal shock resistance, decorative effect and visible source modification.

A still more specific object of the invention is to provide an incandescent lamp bulb with a surface wrapping to produce these effects.

Another specific form of the invention involves the modification of the envelope surface for the same purpose.

Another object of the invention is to provide methods for producing the lamps which have the above characteristics.

Other and more detailed objects of the invention will be apparent from the following disclosure of the several embodiments thereof illustrated in the accompanying drawings.

This application is a continuation-in-part of my pending application Serial No. 802,049, filed March 26, 1959.

In the drawings,

Figure 1 is a typical elevational view of an incandescent lamp showing in part the improved structure of this invention and indicating a method of making it;

Figure 2 is a cross-sectional view taken on the line 2—2 of Figure 1; and

Figure 3 is a similar cross-sectional view of a modified form of lamp envelope.

The subject matter of this invention is adaptable to the envelope of various forms of light sources of which an incandescent lamp is a particularly useful example, whether made of glass, quartz, or any other material used in making light transmitting lamp envelopes.

A typical widely used form of incandescent lamp is diagrammatically illustrated in Fig. 1. As shown, in accordance with the usual practice, it includes a screw threaded base 10 and a glass envelope 20 comprised of an outwardly flaring neck portion 12, an intermediate spherical portion 14 and a terminal cylindrical dome portion 16. The internal construction of this lamp has not been illustrated because it is subject to wide variation in accordance with known practices in the art. It includes generally, although not shown, a re-entrant stem, a support of some kind, and a filament array mounted thereon. The envelope when the lamp is finished is hermetically sealed and is either highly evacuated or contains a gas filiing which was introduced after evacuation of the envelope.

In accordance with this invention there is applied to the surface of the envelope 20, a light transmitting reinforcing structure which provides the improvements refered to above. This reinforcement in case of the structure of Figs. 1 and 2 consists of a single layer wrapping of light transmitting yarn 18, which may be a monofilament or a multifilament. This yarn must be an efficient transmitter of light and may be preferably made of glass or quartz fiber, but which may be made of suitable plastic yarn such as nylon and dacron. The important characteristics of the yarn suitable for the purpose either in monofilament or multifilament form are that it must not be affected by temperatures encountered in the operation of the lamp either of the evacuated or gas filled type; must be an efficient transmitter of light and must be mechanically strong enough for the purposes intended. In the case of multifilament yarns it is preferred that they not be twisted or braided, but merely extend in parallel relation, as illustrated in Fig. 1. As will be apparent from the drawing, a multifilament yarn such as the three filament yarn shown will more quickly cover the surface of the bulb in a single layer, which is preferred, than would be the case when a monofilament yarn is used, thus reducing the wrapping time. The yarn is laid on in contacting convolutions 24 in the form of a single layer and the preferred embodiment of the wrapping begins at the base 10 and terminates at the juncture of the spherical and cylindrical portions 14 and 16.

In order that the yarn may be applied and permanently adhered to the surface of the envelope a suitable adhesive is desired. Many adhesives are available which are suitable for this purpose, having in mind that they are easy to apply, are efficient in light transmission, are stable in color characteristics, are tacky sufficiently long to permit winding of the bulb, and can be cured to final form easily. It is very important, of course, that they be temperature stable at the temperatures normally encountered in the operation of incandescent lamps and that they do not change from a clear water white condition to some other color which would reduce their light transmiting efficiency. There are available adhesives which are suitable in all respects with the exception that at the temperatures to be encountered in the operation of the lamp they gradually turn yellow or amber in color, greatly diminishing their light transmitting ability.

Among the adhesives which are suitable for this purpose is the commercially available epoxy resin known as Epoxide-201, which can be obtained from Union Carbide Chemical Company. The designation Epoxide-201 is a workable name for (3,4-epoxy-6-methylcyclohexylmethyl-3,4-epoxy-6-methylcyclohexanecarboxylate). Epoxide-201 is an epoxy resin which has chemical and physical properties suited to the purposes of this invention. Among the more important characteristics are its low viscosity prior to curing, its color stability, its temperature stability, and its inertness to reaction under ordinary conditions.

Epoxide-201 is commercially available as a low viscosity liquid and in the application of the yarn to the lamp bulb, in accordance with this invention, the bulb may either be dipped in the liquid to provide it with a thin coating of the adhesive, or the yarn may be run through the coating on its way to being wrapped on the bulb. In either event the Epoxide-201 acts as an adhesive to adhere the convolutions of yarn to the surface

of the glass bulb and to hold them in place against all normal forces of displacement upon curing and hardening of the adhesive by curing. The curing can be hastened by proper temperature control and by additions of hardening agents, all as is well known from the characteristics of Epoxide-201.

When the bulb is provided with a coating onto which the yarn is wrapped, there is formed a thin layer on the surface of the bulb which is indicated at **22** in Fig. 2, which remains tacky long enough to provide adequate time for wrapping the yarn around the bulb so as to bring it into engagement with the coating while tacky. When the coating has been cured the final product results, imparting to the bulb greatly increased resistance to mechanical and thermal shocks and an improved decorative appearance.

Another important useful characteristic of the wrapped bulb is due to the refraction of the light in passing through the light transmitting yarn which causes the incandescing filament as the source of light to have the appearance of being elongated throughout the axial length of the envelope. This visual elongation of the source of light greatly reduces the spot intensity which the incandescing filament would otherwise present to the eye by distributing the light from the relative point source throughout the length of the bulb. This change in appearance of illumination is also decorative. The above visual effects can in more common language be characterized as giving the light source the appearance of a flame.

Other adhesives are suited to the purposes of this invention. They include a formulation composed of Epoxide-201 and adipic acid in the molar ratio of 1.0 to 0.5. As those skilled in the art will know, other polycarboxylic acids can be used with Epoxide-201 for the purpose of increasing the toughness and heat resistance of the adhesive, and changing the curing time.

In furtherance of these objectives another formulation comprises Epoxide-201, maleic anhydride and 1,2,6-hexanetriol in the molar proportions of 1.0, 0.7 and 0.07.

These additional agents also aid in speeding the curing of the coating, which will, of course, go to the economics of the operation by reducing the manufacturing time.

A further suitable adhesive for the purposes of this invention is commercially available as "Teflon" adhesive sold by Gilbreth Company. Among the desirable characteristics of this adhesive is its water white color.

One can also use Epoxide Novolac Resin X–2638.3 sold by Dow Chemical Company. This is a liquid epoxy resin based on polyfunctional phenols of the novolac type, which represents the only information that Dow Chemical Company releases at the present time.

Curing as meant herein and as will be well understood by those skilled in the art in view of the nature of the chemical materials to be cured, is intended to include well known procedures covered by the following definition found in the American Society for Testing Materials Standards 1958, part 9, at page 578:

"Cure: To change the properties of a plastic or resin by chemical reaction which may for example be condensation, polymerization or vulcanization; usually accomplished by the action of either heat or catalysts alone or in combination, with or without pressure."

The general objects of this invention are also obtained by molding into the surface of the glass envelope a series of circumferential contiguous semicircular ribs which are integral with the body of the envelope. This is illustrated in Fig. 3, where a piece of the envelope **30** is shown provided with a series of semicircular ribs **32** molded on the outer surface, which extend around the bulb in planes at right angles to its longitudinal axis. The same results can be obtained if the ribs are molded on the inner surface of the bulb, and in some cases they can be molded on both surfaces.

As a further refinement and particularly where the wrapping yarn or filament has fuzzy projections, it may be desirable to again coat the bulb after it is wrapped and cure the coating to trap the fibers and further aid in cementing the convolutions to the bulb. The coating can be applied in any suitable manner, as for example by dipping and the same adhesives can be used as were employed in connection with the wrapping of the yarn.

The assembly of the three yarns **18**, as illustrated in Figs. 1 and 2 as being applied in a single layer side-by-side is not likely to occur in practice. The multifilament yarn **18** in actuality forms a group of extremely fine filaments assembled together in a bundle without twisting or braiding, which is not to mean that there will not be some twist in the bundle naturally. The filaments are assembled in the bundle substantially in parallel relationship, as illustrated in the drawings, but there may be a very low twist in the assembly. Likewise, the individual filaments may be intermixed in the bundle at different points therealong, so that the illustration in the drawing is in the sense an ideal situation as distinguished from the actual relationship of the filaments of the bundle, in a commercial yarn of this type.

The flame-like appearance of the light source when viewed through the wrapping or ribbing provided as herein disclosed, is related to the fineness of the filaments of the yarn or the ribs of the ribbing. The finer the filaments or ribs in cross-section, the more closely will the light source approximate the appearance of an elongated flame.

By way of further example, in accordance with this invention a bundle of glass fiber filaments corresponding to the bundle **18** of Fig. 1 was used having an overall diameter of 0.0097". The individual filaments of this bundle had a diameter of 0.00038". In other embodiments the bundle had an overall diameter of 0.003" composed of filaments of 0.0002". When a mono-filament yarn is used, as distinguished from the above multifilament yarns, a suitable dimension would be 0.005". The light refracting qualities of a monofilament yarn of this coarseness are not as good as desired, but are useful. However, if a multifilament yarn having an overall dimension of 0.05" but composed of much finer filaments is used, the result is still better. The coarser dimensions represent a practical upper limit to bundle and filament size while on the other hand the lower limit will be defined by the fineness of the multi- or monofilament yarns which are commercially available. The important point is that the finer the filaments and yarns the more flamelike will be the appearance of the incandescing filament.

These dimensional ranges are equally applicable to the ribbed type of lamp shown in Fig. 3. In this connection the smaller the center to center distance between the ribs the more flamelike in appearance will be the light source. The ribs can also be formed by molding the wall of the envelope so that in cross-section it is in corrugated form, with the ribs consisting of successively oppositely facing troughs.

From the above disclosure it will be apparent to those skilled in the art that some of the details of this invention are capable of variation within their skill and knowledge. It is also apparent that other adhesives and new adhesives having the required characteristics when they become available will be suitable for the purposes of this invention. It is desired, therefore, that the disclosure be taken in an exemplary sense and the scope of protection afforded hereby be determined by the claims.

What is claimed is:

1. An electric light source having a light transmitting envelope and means on the surface thereof in the form of contiguous light transmitting convolutions of a flexible light transmitting yarn which refract the light originating within the envelope, said yarn being flexible at ambient temperature.

2. In the light source of claim 1, said convolutions

lying in planes at right angles to the longitudinal axis of the envelope.

3. In the light source of claim 1, said convolutions comprising light transmitting vitreous yarn adhered to the surface of the envelope.

4. In the light source of claim 1, said convolutions comprising light transmitting synthetic yarn adhered to the surface of the envelope.

5. In the light source of claim 1, said convolutions comprising light transmitting nylon yarn adhered to the surface of the envelope.

6. In the light source of claim 1, said convolutions comprising light transmitting dacron yarn adhered to the surface of the envelope.

7. In the light source of claim 1, said light transmitting ribs comprising a wrapping of light transmitting filament and a light transmitting adhesive securing it to the surface of said envelope.

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