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F. A. HARRINGTON

2,934,792

METHOD OF FABRICATING INDICATOR LIGHT WITH MOLDED NYLON JACKET

Filed June 16, 1958

2 Sheets-Sheet 1

Fig. 11

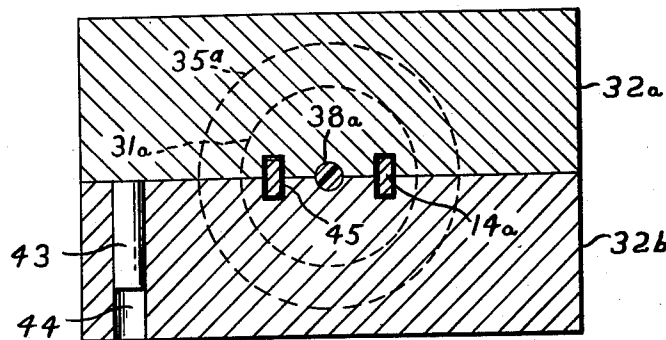
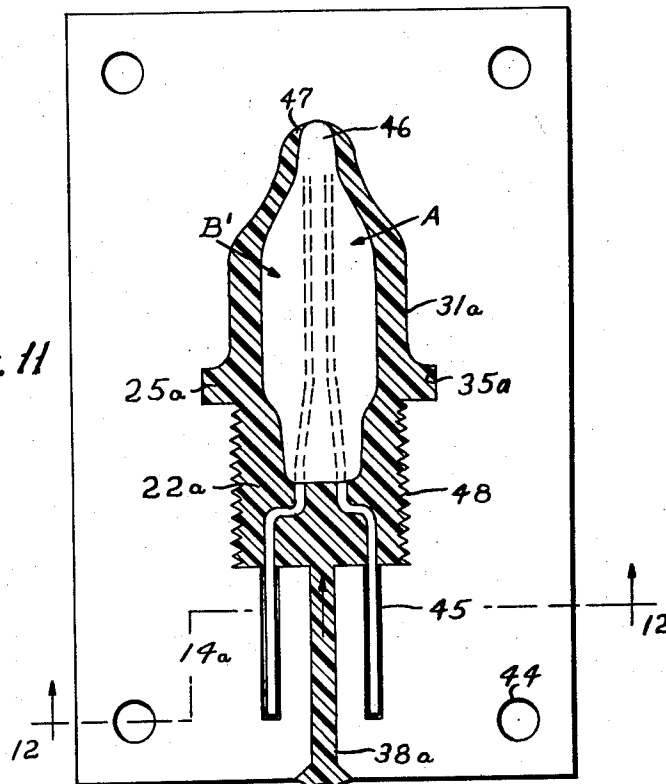


Fig. 12

INVENTOR.

FRANK A. HARRINGTON

BY

Lynn H. Latta

-ATTORNEY-

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F. A. HARRINGTON

2,934,792

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Fig. 2

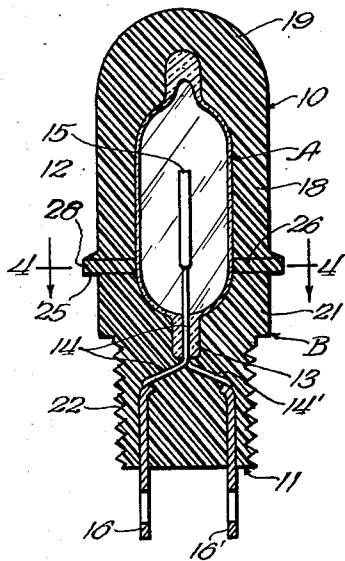


Fig. 1

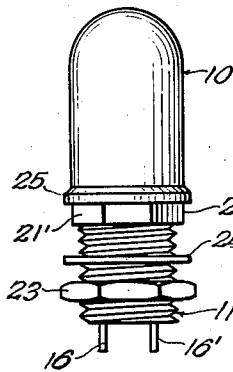


Fig. 5

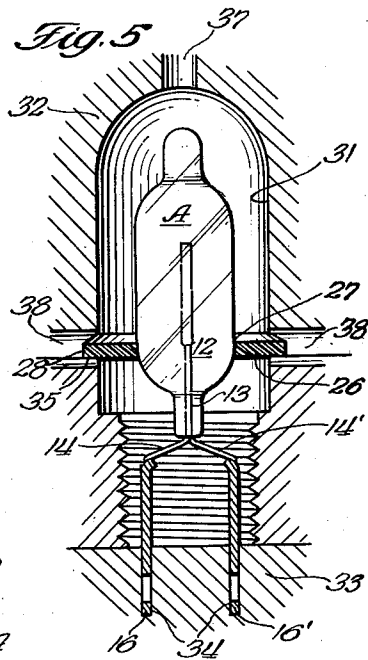


Fig. 3

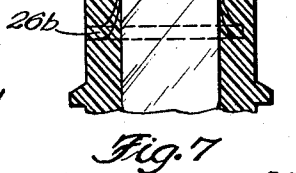
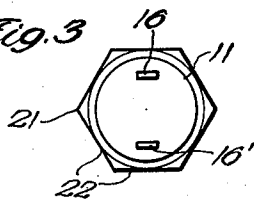


Fig. 7

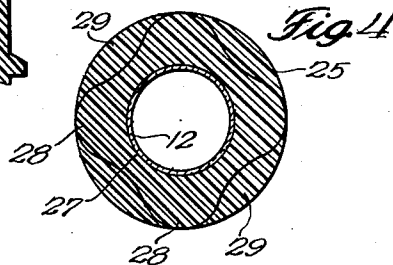


Fig. 4

Fig. 6

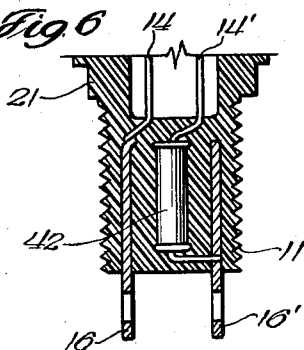


Fig. 8

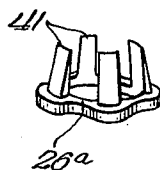


Fig. 9

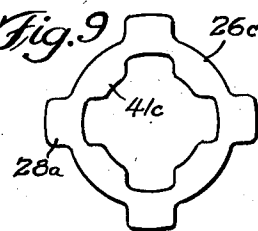
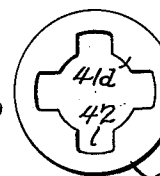


Fig. 10



INVENTOR
Frank A. Harrington
BY Lynn Latta
ATTORNEY

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**METHOD OF FABRICATING INDICATOR LIGHT
WITH MOLDED NYLON JACKET**

Frank A. Harrington, Brea, Calif., assignor to Marco Industries, Anaheim, Calif., a corporation of California

Application June 16, 1958, Serial No. 742,341

1 Claim. (Cl. 18—59)

This application is in part a continuation of my pending application Serial No. 379,012, filed September 8, 1953, for Indicator Light With Molded Nylon Jacket.

This invention relates to indicator lamps, such as are used for indicating to an operator or observer, the conditions of operation of remotely located portions of an electrical system or an electromechanical system. For example, the instrument panel of a large airplane carries not only the control actuators for many items of mechanism utilized in controlling the operation of the airplane, but also many indicator lamps for indicating the conditions of response and other conditions of operation of the various control units.

The lamp bulbs used for such indicator lamps are ordinarily quite small, but it is not customary to subject the eyes of the pilot or other operator to the direct rays of the lamp bulb. Rather, the usual practice is to mount the lamp bulb in a casing having at its exposed end a cap which carries a lens or window, usually of translucent material such as to dim the harsh glare of the direct rays of the lamp bulb, and quite often of a colored material (e.g. the color red) to increase the efficiency of the indicator lamp in arresting the attention of the observer.

Such lamps are used in large numbers and are frequently replaced as they outlive their useful life. Accordingly, it is of prime importance that they be of relatively inexpensive construction.

With the foregoing in mind, the primary object is to provide an indicator lamp of particularly inexpensive construction. In this respect, the invention contemplates a lamp comprising simply a small lamp bulb and a jacket including a light dimming or light transmitting hood surrounding the forward portion of the bulb and a base at the rear end of the casing for connection to an electric outlet, both molded integrally in a single unitary body of a synthetic resin plastic material, the jacket completely enclosing the lamp bulb, with the lamp bulb molded into the body. The synthetic resins in general, offer the best class of material from which to select one which can be satisfactorily molded and to which it is easy to impart the desired characteristic of translucency.

I am aware that others have previously proposed the molding of a lamp bulb into an integral jacket of plastic material completely enclosing the same. However, such lamps as previously proposed have not been satisfactory, due to a number of conditions including the difficulty of molding a suitable covering material around a lamp bulb at a temperature sufficiently low to avoid damaging the lamp bulb; and the difficulty of too rapid deterioration of the lamp bulb under the heat which is radiated by the lamp bulb when in use. Another problem is that of avoiding crushing the extremely thin envelope of a small lamp bulb under the pressure of injection molding procedure.

Among the available moldable plastic materials that can easily be rendered translucent, the possibility of molding the lamp jackets out of glass is obviously ruled

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out because, at the temperature at which molten glass can be satisfactorily injection molded, the thin envelope of the lamp bulb would be promptly melted and absorbed into the body of molten glass, with a consequent complete destruction of the lamp bulb as a functional unit. As to the group of synthetic resin plastics, thermosetting materials (such as the phenolic aldehydes) which would have adequate resistance to deterioration under temperatures and other conditions of usage, cannot be satisfactorily injection molded because they require too slow a molding cycle. To attempt to cast the lamp bulb into such materials is unsatisfactory for a number of reasons, one of which is that the process is too expensive.

Some of the thermoplastic resins, of satisfactory translucency characteristics, can be satisfactorily injection molded, but are not capable of withstanding the ambient temperatures of operation of indicator lamps. Others require too high a molding pressure, such as would crush the thin envelope of the lamp.

As to the foregoing problems, the invention has as its object to provide an indicator lamp which is inexpensive; which can be satisfactorily processed by injection molding; which is adequately resistant to the deteriorating effect of ambient operating temperatures, vibration, etc.; which is otherwise sufficiently durable; and to which can be imparted a satisfactory translucency and finish.

Another problem that has been met with in the attempts to injection mold a translucent jacket around a small lamp bulb, is the difficulty of obtaining a symmetrical coaxial relation between the lamp bulb and the external wall of the jacket in the final molded product. In injection molding processes, the plastic material is injected under substantial pressures. Such pressures tend to displace the lamp bulb to an eccentric position in the mold. Obviously, a lamp jacket which is too thin on one side and too thick on an opposite side would be unsatisfactory, particularly where the material is of such a translucency as to substantially dim down the intensity of the light rays. The dimming effect is obviously related to the thickness of the jacket wall, and such thickness must be uniform in order to obtain a jacket of circumferentially uniform dimming effect. Likewise, in those cases wherein a substantially transparent jacket might be desired, any substantial difference in thickness of the jacket wall around its circumference, would be definitely noticeable and therefore objectionable. It would be objectionable for the further reason that the thin envelope of the lamp bulb would not have the same uniform support around its circumference as in the case of a jacket of uniform wall thickness.

A further object of the invention therefore is to provide an indicator lamp embodying a lamp bulb molded into an integral packet of uniform wall thickness circumferentially, i.e. uniform radial thickness. Another object is to provide an improved method of molding such a jacketed lamp bulb.

Other objects will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a side view of an indicator embodying my invention;

Fig. 2 is an axial sectional view thereof;

Fig. 3 is an end view of the base of the lamp;

Fig. 4 is a transverse sectional view on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view of a portion of an injection molding apparatus, with the internal components of an indicator lamp of my invention installed therein, ready for the injection molding operation;

Fig. 6 is a fragmentary axial sectional view of a lamp embodying a modified form of the invention;

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Fig. 7 is a fragmentary axial sectional view of a lamp embodying a modified form of the spacer spider;

Fig. 8 is a perspective view of another modified form of the spacer spider;

Fig. 9 shows another modified form of the spider;

Fig. 10 shows another modified form of the spider;

Fig. 11 is a plan view of a mold utilizing a modified form of my improved molding method; and

Fig. 12 is a cross-sectional view taken on the line 12—12 of Fig. 11.

The invention as disclosed in Figs. 1-4

Referring now to the drawings in detail, the indicator lamp which is shown in Figs. 1-4 as an example of one form in which the invention may be embodied, comprises generally a lamp bulb A and an integral, molded jacket B, the latter including a light ray transmitting hood 10 and a base 11.

The lamp bulb A includes a thin envelope 12, which normally will be of glass, a stem portion 13 in which a pair of conductors 14, 14' are anchored and sealed; and a suitable light generating or emitting element 15 connected to and supported by the upper ends of one or both of the conductors 14, 14'. The particular lamp bulb shown is of the glow-discharge type (e.g. a neon tube) and the element 15 which is visible in Fig. 2, in this case constitutes one of the electrodes constituting a conductive connection to the gas filled atmosphere within the tube. In a filament type lamp bulb, it would of course be replaced by a filament. Connected to the respective conductors 14, 14' are a pair of terminals in the form of legs 16, 16' which are disposed in parallel relationship, properly spaced for insertion into the apertures of an electric outlet receptacle or for direct soldered connection to conductor wires.

The hood 10 of jacket B includes a tubular lateral wall portion 18 of uniform radial thickness surrounding the central body portion of envelope 12. In the particular lamp shown, this central body portion of the envelope 12 is cylindrical and the lateral wall portion 18 of the jacket is correspondingly cylindrical. The hood 10 also includes a closed end portion 19 which, for best appearance and dispersal of light rays, may be spherical or spheroidal.

Base 11 of the jacket B includes a waist portion 21 which may be polygonal in transverse section, so as to provide flat wrenching faces 21' for engagement by a wrench to hold the lamp while it is being secured into a mounting panel or the like. The base 11 also includes an externally threaded end portion 22 upon which is threaded a nut 23 for clamping a washer 24 against the rear face of a mounting panel.

Conductors 14, 14' and terminal legs 16, 16' are molded into the threaded end portion 22, in a symmetrical relation to the longitudinal axis of the lamp, and the end portions of legs 16, 16' project from base 11, for insertion into an electrical connector socket or for soldered connection to conductor wires.

Intermediate the base 11 and hood 10, jacket B has a waist flange 25 within which is molded a spider 26 of Nylon material. Spider 26 (Fig. 4) has a central circular aperture 27 which receives the cylindrical body portion of lamp bulb envelope 12 adjacent the lower extremity thereof, the edge of the spider surrounding the aperture being snugly engaged against the wall of envelope 12. Spider 26 is of star form, having a plurality of radiating arms 28 which project into waist flange 25. Circumferentially spaced notches or gaps between the arms 28 are filled by web portions 29 of jacket B which bridge between the base 11 and hood 10, integrally joining them.

The molding process of Fig. 5

The primary function of spider 26 is to secure the envelope 12 in a coaxial position within a mold cavity 31

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(Fig. 5) during the molding process. Fig. 5 illustrates a mold comprising a sectional female die 32 having the cavity 31 therein, and a closure section 33 having therein deep, narrow recesses 34 to snugly receive the legs 16, 16'. Mold cavity 31 includes an annular waist recess 35 in which the fingers 28 of spider 26 are received.

The plastic material is injected into the mold through a central port 37 at the crown of the mold cavity and through a plurality of lateral ports 38 disposed equidistantly around the circumference of the cavity. From the upper portion of the cavity, wherein hood 10 is molded, it flows freely through the gaps between the fingers 28 of the spider 26, into the base portion of the cavity, to form the base 11.

In a preferred form, spider 26a (Fig. 8) includes circumferentially spaced fingers 41 projecting generally axially from its inner margin at the upper side thereof, and slightly converging so as to engage the lamp bulb with light, yielding pressure; thus securely grasping the bulb without any likelihood of crushing the envelope 12.

Modified form—Fig. 7

Fig. 7 illustrates another modified form of spider that may be utilized. In this form, a circumferentially continuous frusto-conical collar, of feather-edge radial section (extremely thin and tapered) projects axially from the inner margin of spider 26b. The material of the spider 26b is sufficiently resilient to stretch around the lamp bulb, gripping it securely.

Fig. 7 also illustrates a construction wherein the spider 26b is identical with the jacket, both as to material and color, thus being integrated with the jacket to such an extent as to avoid either blocking or deflecting the light rays to any different degree than the body of the jacket.

Modified molding method—Fig. 11

Fig. 11 illustrates a simplified and improved molding method which employs a mold comprising mating die blocks 32a, 32b conjointly defining a mold cavity 31a and having respective locating pins 43 and bores 44 for accurately matching the die blocks to one another. Instead of the lateral injection ports 38 of Fig. 5, the apparatus has a single injection port 38a, coaxial with the major axis of mold cavity 31a and communicating with the end of the cavity in which the base of the lamp is shaped.

Bulb A is positioned in the mold cavity by engagement of its terminal legs 14a in slots 45 formed sectionally in the mold blocks 32a, 32b; and by engagement of its tapered nose 46 in a conical end recess 47 of cavity 31a, which is symmetrically contoured about the major axis of the mold cavity.

Cavity 31a has, intermediate its ends, an annular waist recess 35a for shaping the waist flange 25a of the lamp jacket; and an internally threaded base-forming recess 48 for shaping the threaded cylindrical base 22a of the lamp.

In the improved process of molding utilizing the mold of Figs. 11 and 12, a bulb A is inserted in the lower mold block 32b, terminal legs 14a being fitted over block 32b, the mold is clamped shut, and plastic nylon resin material is injected under pressure through injection port 38a. As the flowing resin meets the rear end of bulb A, it forces the bulb A forwardly until its nose 46 bottoms in recess 47, thereby accurately centering the bulb A in the mold cavity at its forward end. The terminal legs 14a, sliding snugly in slots 45, maintains the rear end of bulb A centered on the major axis of the mold cavity. As the flowing resin advances toward the forward end of the mold cavity, it parts and flows equally around all sides of bulb A.

Thus the jacket B' which is molded around bulb A, is symmetrically disposed around the bulb in coaxial relation and of uniform wall thickness throughout its circumference.

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I have discovered that the nylon molding material has the combination of characteristics which makes it entirely suitable for solving the several problems noted hereinabove. It has a relatively low molding pressure (e.g. in the neighborhood of 1500 pounds p.s.i., which is considerably below a pressure that could be damaging to the relatively fragile envelope of the lamp bulbs utilized by the invention). This is in contrast to the average molding pressures of commonly used injection molding plastic materials, which range in the neighborhood of 15,000 p.s.i., a pressure entirely too great to be withstood by the fragile glass envelope of the lamp bulb. Also, the nylon material is relatively stable in the presence of ambient operating temperatures for most conditions of usage of indicator lamps of the type under consideration. Such operating temperatures commonly range in the neighborhood of 350° F. and the known thermoplastic materials which could be successfully injection molded about the thin glass envelope of the lamp bulb, will not satisfactorily hold up under such operating temperatures, but will rapidly deteriorate.

I claim:

A method of fabricating an indicator lamp including a lamp bulb, a molded jacket enclosing the same, and a pair of terminal legs projecting from the rear end thereof and electrically connected to said lamp bulb, including the fol-

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lowing steps: providing a sectional mold having a mold cavity corresponding to the external contours of the jacket to be molded and having a pair of spaced slots to receive the said terminal legs so as to provide one point of support for said lamp bulb; inserting said bulb into said mold with said terminal legs received in said slots to position the rear end of the bulb in concentric relation to the mold; piloting the forward end of the bulb in the forward end of the mold cavity; injecting polyamide molding resin into the rear end of the mold along the major axis of the mold and around said bulb to fill the mold cavity; utilizing the pressure of the resin against the rear end of said bulb, as it enters the mold, to press the forward end of the bulb against the forward end of the mold cavity with a centering action to establish concentricity of the forward end of the bulb on the major axis of the mold; and causing the resin to solidify to form a concentric jacket about the bulb.

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