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2,906,905

FLUORESCENT LAMP

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Fig. 1.

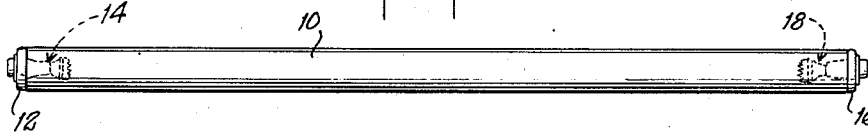


Fig. 2.

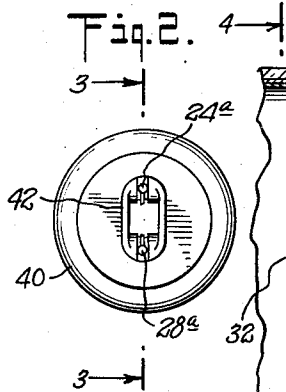


Fig. 3.

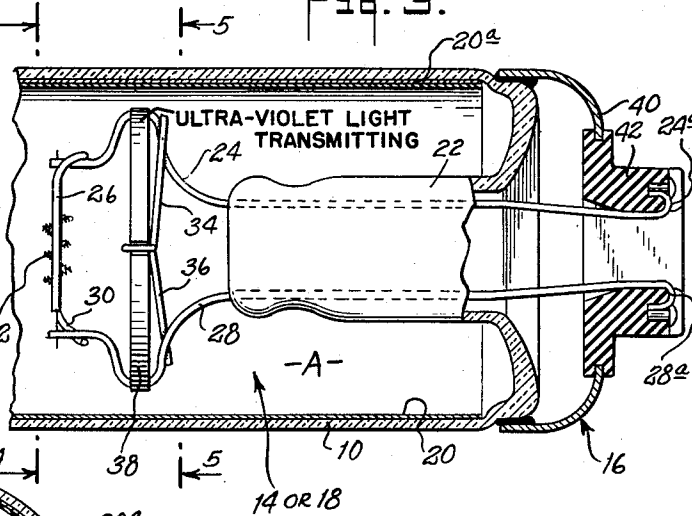


Fig. 4.

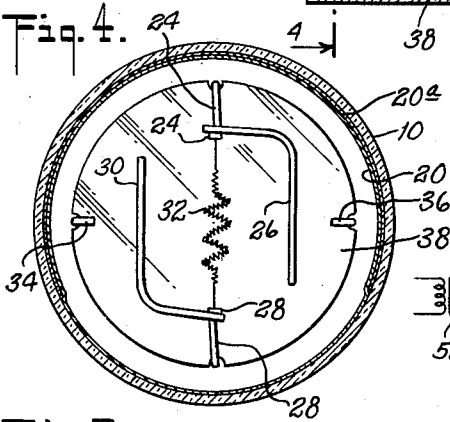


Fig. 5.

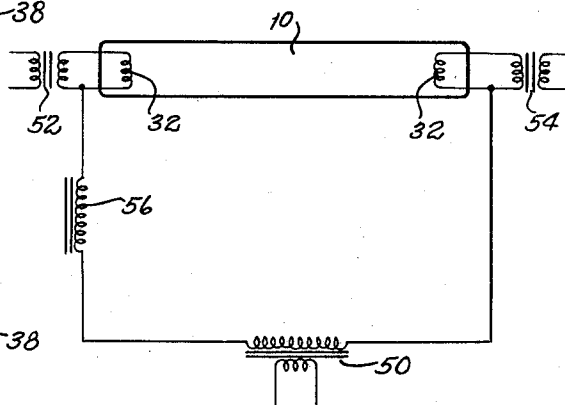
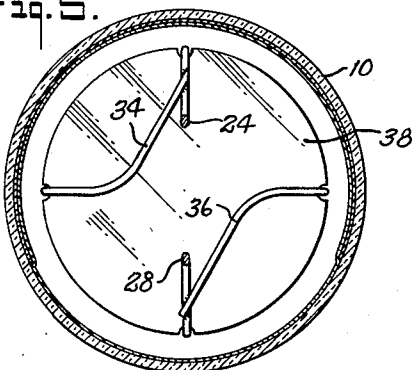


Fig. 6.



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FLUORESCENT LAMP

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5 Claims. (Cl. 313—109)

This invention relates to fluorescent lamps.

More specifically, it is concerned with fluorescent lamps of high light output.

One object of this invention is to provide a novel structure for controlling the pressure within a high light output fluorescent lamp to insure proper operation thereof.

Still more specifically it is an object of this invention to provide a novel construction by means of which a pair of pressure controlled chambers are provided in the fluorescent lamp containing an atmosphere of mercury and neon to insure maximum generation and utilization of ultra-violet light radiation by means of which its fluorescent coating is energized.

More generally this invention relates to improvements in a high lumen output fluorescent lamp of the rapid start type.

Other and more detailed objects of this invention will be apparent from the following description of the embodiment thereof illustrated in the attached drawings.

In the drawings,

Figure 1 is a general plan view of a fluorescent lamp in accordance with this invention;

Figure 2 is an end view thereof;

Figure 3 is an enlarged cross-sectional view of one end of the lamp taken on the line 3—3 of Figure 2;

Figures 4 and 5 are cross-sectional views taken on the respective lines 4—4 and 5—5 of Figure 3; and

Figure 6 is a diagrammatic and schematic illustration of the lamp and its basic circuit.

This invention has for its object to provide an improved form of fluorescent lamp operating at a relatively high current density as compared with the usual fluorescent lamp now in use. More specifically, the lamp of this invention is designed to operate with an arc current of about 1.25 amperes and to produce approximately two and one-half times as much light as the comparable fluorescent lamp operating at a lower arc current density. To put it another way, the lamp of this invention, using the standard four foot tubulation envelope of 1½ inch diameter is rated as a 100 watt lamp as compared with the conventional four foot lamp which is rated as a 40 watt lamp, both being of the rapid start type.

Referring to the drawings, the lamp is illustrated as comprising a sealed light transmitting envelope 10 in which the air has been evacuated and replaced to provide an atmosphere consisting of a mixture of mercury vapor and neon at a pressure under normal ambient conditions of about two millimeters of mercury. The lamp is provided at its ends with a double contact recessed base 12 and 16, such as commonly used with rapid start fluorescent lamps. At each end of the lamp, as shown in Figure 1 diagrammatically at 14 and 18, there is provided the usual re-entrant stem and press supporting the electrodes which alternatively serve as cathodes, as is well known in the art.

The interior of the envelope is coated with a coating of a phosphor or mixtures thereof, depending upon the desired output spectrum for the lamp, which is applied in

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accordance with well known practices. For a purpose which will be described in more detail later, there may be provided, as illustrated, an underlying coating 20^a of titanium dioxide. As illustrated in Figures 4 and 5, the coating 20^a covers only an upper portion of the tubular envelope 10. In the case illustrated, it extends through an arc of about 230 degrees, leaving an uncoated lower arcuate section throughout the length of the lamp of 130 degrees.

If desired, the circumferential extent of the coating 20^a may be 180 degrees, leaving the lower half of the tube uncoated, although other extents of the coating may be provided. The titanium dioxide coating can be applied in a number of well known ways and should be relatively thin, it being possible to make this layer even thinner, so long as it is substantially opaque, than the fluorescent layer. It will be seen then, as illustrated in the drawings, that while the phosphor coating 20 covers the entire interior surface of the envelope 10, the underlying titanium dioxide layer 20^a is of less circumferential extent.

The function of this coating is to provide both a visible and ultra-violet light reflector, directing the visible light downwardly, assuming the lamp is supported in the relative spatial position illustrated in the figures. The coating 20^a also reflects the ultra-violet light tending to excite the overlying phosphor layer from the rear so that this layer is in effect excited from both sides, intensifying its activation to luminesce.

The envelope 10 is provided at each end with a re-entrant stem 22 terminating at its inner end in the usual press in which the support wires 24 and 28 are mounted. Mounted at each end of the tube is a metal cap 40 which has secured centrally thereof an insulating sleeve 42 into which the ends 24^a and 28^a of the lead wires which are connected to the wire supports 24 and 28 are secured, to provide the contact of the lamp in accordance with the well known type of double contact recessed base used on rapid start fluorescent lamps.

Intermediate the cantilever ends of the support wires 24 and 28 are integral U-shaped formations which provide a seat for the disc 38 which will be referred to later. The terminal ends of the support wires 24 and 28 serve as mountings for the electrode or cathode 32, which is preferably of the triple-coiled, or coiled type, and provided with the usual coating of high thermionic electron emissive material, of which many are well known in the art. The ends of each electrode are mechanically and electrically connected to the support wires, as by welding, clamping or the like.

It will be helpful to state here that the construction shown in Figure 3 is provided at each end of the envelope. Welded near the ends of the support wires 24 and 28 are a pair of wire extensions 26 and 30, respectively, which lie parallel to and substantially in the plane of the electrode 32 but spaced laterally thereof, as clearly shown in Figure 4. These extensions provide what are sometimes termed anode horns or probes, and are used for that purpose.

Also welded to the wire supports 24 and 28 at points on the other side of the disc 38 are a pair of support wires 34 and 36 having reversely bent ends to engage notches in the ends of the disc 38 similar to the notched engagement of that disc with the U-shaped humps formed in the support wires. This insures four point suspension for the disc 38.

The discs 38 are made of any suitable ultra-violet light transmitting material, which is also preferably a transmitter of visible light and a reflector of infrared rays. For example, this disc can be made of silica glass, one form of which is commercially available under the trademark "Vycor," a product of Corning Glass Works. It may also be made of fused quartz.

As is clear from Figure 4, the diameter of the disc 38 is somewhat less than the internal diameter of the envelope 10, thereby to form between it and the end wall of the envelope a relatively small constricted chamber A, which functions as will be explained to maintain the mercury pressure within the lamp substantially constant. The smaller diameter of the disc establishes communication between the central discs at the opposite ends of the envelope and the relatively smaller chambers A at the extreme end.

The A chambers are relatively the coolest parts of the lamp when it is operating, resulting in the main from the fact that these discs interfere with the normal convection currents within the lamp and substantially prevent their movement in the A chambers formed by them. The result is that the vaporized mercury present when the lamp is operating tends to move into the A chambers, which being the coolest parts of the lamp, cause them to condense. The direct result is that the vapor pressure in the main chamber of the lamp remains at a relatively fixed predetermined value, depending upon the design of the lamp.

The relative coolness in the A chambers is further insured by the fact that the discs act as partial reflectors of the relatively warm infrared rays generated in the main chamber. These discs also transmit the visible and ultra-violet light to the chambers A, with the result that the phosphor coating surrounding these chambers is energized to luminesce. The transmission of the visible light from the main chamber into the A chambers further contributes to minimize the usual darkness at the ends where the cooling chamber is located.

These various features of improvement are further augmented by the use of neon gas in mixture with the mercury vapor gas as distinguished from argon which is sometimes used for this purpose.

As previously explained, this lamp operates at relatively high current densities, giving a strikingly high lumen output per foot of lamp length.

Figure 6 is included for the purpose of providing a complete disclosure. The circuit is somewhat similar to that used with the usual rapid start lamp. As shown in the figure, the electrodes 32 are conductively connected to the secondaries of a pair of low voltage transformers 52 and 54, which are permanently connected thereto and provide a pre-heat voltage of 3.5 to 3.9 volts. The primaries of these transformers are energized from the usual house light circuit and in any event are energized from the same circuit as is the primary of the main transformer 50, the secondary of which is connected across the electrodes through a current limiting reactor or electro-magnetic ballasting device 56. As is well

known in the rapid start lamp, the electrodes 32 are energized during normal operation of the lamp, keeping them warm, and thereby distinguishing them from the regular pre-heat lamp that uses starters. In a rapid start lamp the filaments are always being heated during lamp operation. In the regular pre-heat lamp the coils are heated only for a few seconds prior to striking the arc lighting the lamp and, once the lamp arc strikes, the pre-heating stops and is used again only when the lamp is restarted. The continuous heating utilized in the present invention has the advantage of providing easier starting under difficult starting conditions such as low line voltage and lower temperature, allows the lamp to be operated in dimming and flashing types of circuits, provides normal and steady lamp operation and lengthens the life of the lamp.

From the above description the nature and scope of this invention will become apparent, and therefore, it will be seen that the subject matter of this invention is not strictly limited to the exact details of the examples herein described. It is preferable, therefore, that the scope of protection afforded be that defined by the claims.

What is claimed is:

1. A fluorescent lamp comprising a sealed tubular glass envelope containing an atmosphere of mercury vapor and neon at about two millimeters of pressure and a fluorescent coating extending to the ends thereof, a pair of spaced electrodes in said envelope and a pair of ultra-violet light transmitting discs supported within and spaced between the respective ends of said envelope and said electrodes to form a pair of pressure control chambers at those ends, said chambers being in communication with the central chamber lying between said discs.

2. In the combination of claim 1, said discs being composed of silica glass.

3. In the combination of claim 1, said discs being composed of quartz.

4. In the combination of claim 1, said electrodes being electron emissive and having wire supports and said discs being mounted on said supports.

5. In the combination of claim 1, said discs being of less diameter than the internal diameter of said envelope to provide said communication.

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