Aug. 11, 1959 M. E. MACKSOUD 2,899,583

LIGHT SOURCE

Filed March 29, 1956 3 Sheets-Sheet 1

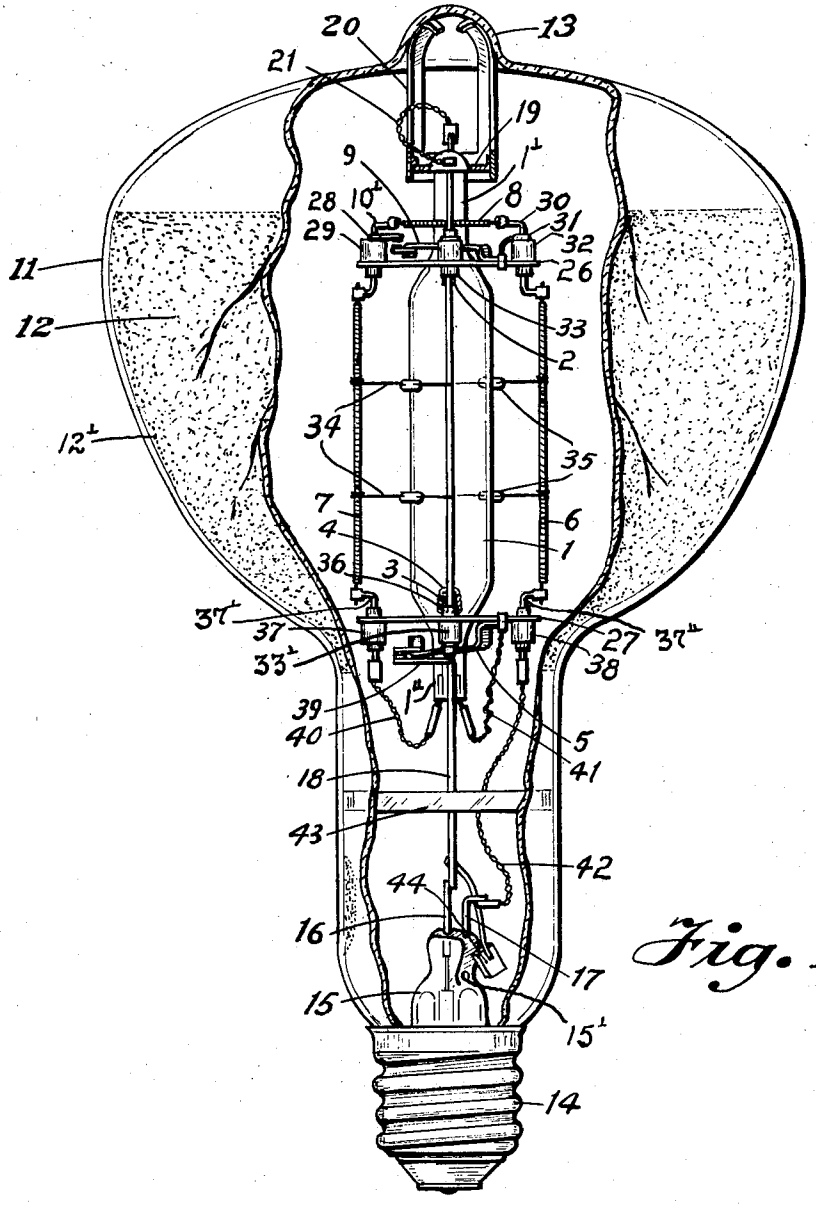


Fig. 1

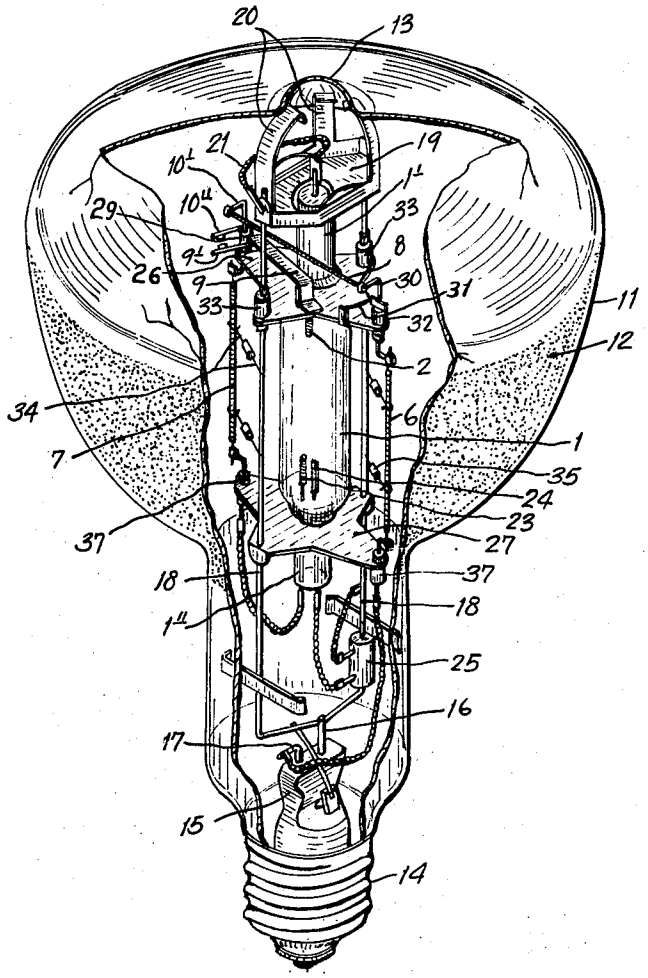
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Fig. 2



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Fig. 3

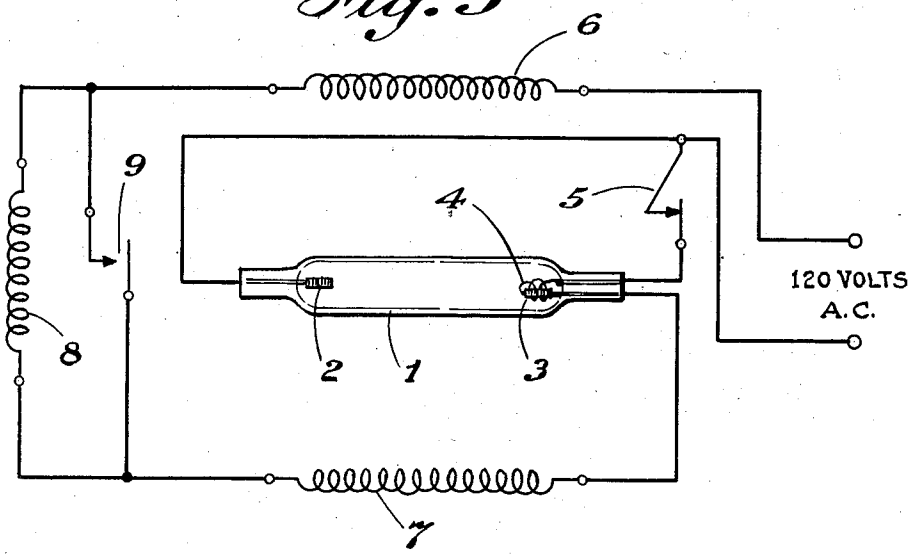
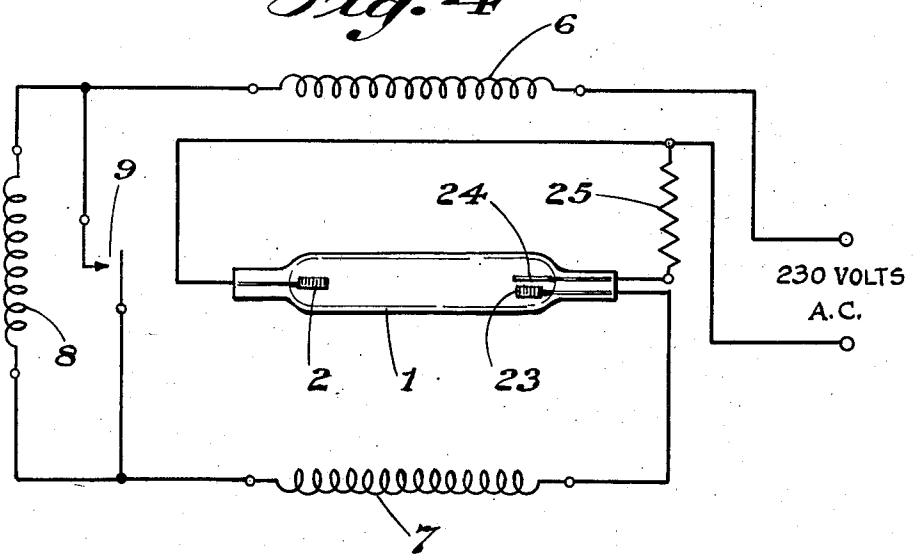


Fig. 4



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United States Patent Office

2,899,583

Patented Aug. 11, 1959

2,899,583

LIGHT SOURCE

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Application March 29, 1956, Serial No. 574,905

1 Claim. (Cl. 313—109)

This invention relates to electrically energized light sources.

A general object of this invention is to provide a new structural form for electrical light sources consisting of three light producing elements, (1) a mercury arc discharge lamp; (2) an incandescent filament; and (3) a fluorescent coating.

A more specific object of this invention is to provide a novel form of assembly of three such light sources to produce a useful lighting unit which can be mounted in the usual screw socket and requires no accessories either to initiate its operation or to maintain it in proper operation.

Still another object of the invention is to provide an incandescent filament associated with a mercury arc discharge lamp so as to provide a current limiting device therefor.

As an additional object the lamp of this invention includes automatic control whereby a portion of the ballasting incandescent filament is removed from circuit after the lamp has reached stable operation and whereby adequate ballasting can be provided during the start up without overload thereof, and whereby after stable operation is reached the excess ballast is removed from circuit, resulting in a high lumen efficiency of the incandescent ballast filament in normal operation.

A more specific object of the invention is, therefore, to provide in such a light source a ballasting device which has a longer life.

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

In the drawings,

Figure 1 is an elevational view of an electric light source in accordance with this invention with a portion of the outer envelope broken away constructed for 120 volt operation;

Figure 2 is a perspective view of a modified form of electric light source in accordance with this invention, showing a portion of the outer envelope broken away constructed for 230 volt operation;

Figure 3 is a diagrammatic and schematic circuit illustration for the lamp of Figure 1; and

Figure 4 is a similar illustration for the lamp of Figure 2.

A complete disclosure of all of the objects of this invention can best be given progressively in connection with a detailed description of the material illustrated in the accompanying drawings.

With special reference to Figure 1, a lamp designed for 110 to 120 volt A.C. operation is illustrated. It consists of an outer envelope 11 of glass which of course is sealed, evacuated and provided with the usual gaseous atmospheres employed in modern electric lamp construction. This envelope has affixed thereto at one end, in accordance with usual practice, a screw base of the standard size for regular lamp socket use. A portion of the enlarged end of the envelope 11 is provided with a fluorescent coating 12 of suitable phosphors or mixtures thereof to give a desired light spectrum, and particularly one which is complementary to the spectrum of the mercury vapor light source and the incandescent filament of the entire assembly. The art well understands the nature of such coatings and how they are to be applied. If desired a mirror reflecting coating can be applied either to the outer or inner surface of the enlarged portion of the envelope 11 to provide a reflector type of lamp, which reflecting surface is usually coextensive with the fluorescent coating.

A novel feature in accordance with this invention is the proposal to apply to the inner surface of the envelope 11 which will underlie the fluorescent coating 12 a monotomic layer 12' of magnesium oxide over which the fluorescent coating is deposited. The purpose of this layer of magnesium oxide is to effect light producing excitation of the fluorescent coating on the side adjacent the glass wall as well as on its inner exposed surface. The crystals of magnesium oxide are excited by the ultra violet light radiations from the mercury arc discharge lamp 1 within the envelope and they in turn excite the adjacent crystals of the fluorescent coating 12. In addition the magnesium oxide coating acts as a reflector of ultra violet light, whereby to more efficiently excite the fluorescent coating on the side adjacent the closed wall of the bulb. Thus the coating is excited by direct ultra violet radiations from the source 1 on its inner surface and by secondary excitation by reason of the presence of magnesium oxide coating on the other side. This results in a higher lumen efficiency for the coating 12.

The envelope 11 has the usual re-entrant stem tube 15 provided with a tubular tube, not shown, which opens into the interior of the envelope 11 through the aperture 15' on the stem tube.

Mounted in the press of the stem tube is a pair of metal wire supports 16 and 17 which pass through the press in the usual manner and by means of connecting leads are connected to the shell and center contact of the screw base 14.

Secured to the support wire 16, as by welding, is a U-shaped wire support 18 which appears in edge elevation in Figure 1, but is like the same element shown in side elevation in Figure 2. Welded to the two legs of the wire support 18 are a pair of metal flexible positioning straps 43 which engage the walls of the neck of the envelope 11 to center the support. Welded to one of the legs of the support 18 is a getter package 44 which may specifically be of any suitable construction, but which in this case is so positioned as to overlie the exhaust aperture 15' of the tubular tube. The purpose of this positioning of the elements is to prevent the movement of vapors through the aperture 15 in either direction from impinging upon some portions of the fluorescent coating 12 by breaking down the rush of gases in this manner. Mechanical destruction of some portion of the coating is prevented during manufacturing, processing of the lamp.

Mounted on the legs of the support 18 in spaced relation are a pair of support plates 26 and 27. These plates are mounted on the support 18 by means of pairs of insulating bushings attached to the plates respectively. Only one of the bushings for each pair is shown in Figure 1, namely bushing 33 for the upper plate and bushing 33' for the lower plate. The other bushing of each pair is directly in back of that shown but their relative arrangement is the same as that illustrated for the bushings 33 and 33' of Figure 2. The plates are provided with central apertures through which the terminal ends 1' and 1'' of the mercury vapor discharge lamp 1 extend. These ends of the discharge lamp are of reduced diameter forming shoulders which are engaged by the support plates, thereby longitudinally positioning the lamp 1.

The envelope of the discharge lamp 1 is of quartz and the reduced ends form presses through which the leads for the cathodes of the lamp extend in sealed relation. The cathodes 2 and 3 of the discharge lamp may be of any suitable form, and one of them may be provided with a cooperating electrode 4. However, any suitable form of electron emissive cathode may be used for the electrodes 2 and 3.

Mounted in diametrically opposed relation on the support plate 27 are a pair of insulating supports 37 and 38 in which are mounted a pair of supporting wires 37′ and 37″. The supporting wire 37′ is connected by a flexible lead 40 to the cathode 3. The auxiliary electrode 4 is connected by a flexible lead 41 to the support plate 27. A fixed contact 39 for a thermostatic switch is welded to the wire support 18. The heat sensitive contact 5 of the thermostatic switch is welded to the support plate 27.

One end of each of a pair of incandescent filament sections 7 and 6 is respectively connected to the wire support leads 37′ and 37″. The other ends of these incandescent filament sections are secured to wire supporting leads 10′ and 30 which are also mounted in insulating supports 29 and 32 mounted on the metal plate 26. The insulating supporting bushings 37, 38, 29, 32, 33 and 33′ are made of any suitable refractory insulating material. The support wires 10′ and 30 are connected to the opposite ends of a second incandescent filament section 8. Incandescent filament sections 6, 7 and 8 can be of any metal suitable for the purpose and have any physical form such as a coiled or coiled-coiled construction.

In order to brace and prevent sagging of the filament sections 6 and 7 several supports are provided from them to the support frame 18 by means of wires 34 and insulating beads 35 which may be of glass or other suitable material.

A second thermostatic switch consisting of a fixed contact 28 welded to the wire support 10′ and a flexing arm 9 welded to the plate 27 is provided. The flexing arm 9 is connected by a lead 31 to the support wire 30. In résumé it will be seen that the incandescent filament sections 6, 7 and 8 are all connected in series and are insulated from the support wire 18 and the supporting plates 26 and 27. It will be seen that the thermostat 28—9 which is normally open will when closed provide a direct short circuit for the filament section 8.

The envelope 11 is provided with a built-in bump 13 in which a flexible supporting assembly 20 seats. The lower end of this assembly engages the upper ends of the two legs of the wire support 18 which may be welded thereto so as to provide a centering device for the entire internal assembly at the upper end of the lamp. The lead for the cathode 2 is connected to the frame 18 by means of a flexible jumper 21. The circuit for the lamp of Figure 1 is shown in Figure 3.

One terminal of the current source passes through the center contact of the screw base to support 17 and flexible lead 42 to one end of filament 16. As shown in Figure 3, this filament is in series with the other filament sections 7, 8, and the filament section 8 is bridged by the normally open thermostatic switch 9. The remaining lead of filament section 7 is directly connected to cathode 3 of the mercury vapor lamp. Cathode 2 of this lamp is connected to the other terminal of the current source and this connection is in turn connected through the normally closed thermostatic switch 5 to the electrode 4 associated with the cathode 3.

When this lamp is not turned on the filament sections being in series are energized to provide light, and incidentally generate heat, which in turn aids in warming up the arc discharge lamp 1. It will be seen that the current source is directly connected across the electrodes of the discharge lamp. These electrodes are made of electron emissive alloys, and aided by the auxiliary electrode 4 and the opening of normally closed thermostatic switch 5, the arc strikes. At first, as is well known, the arc

discharges will not be stable, but after about a minute of operation its operation will have become stabilized and its current demand will become fixed. At this time normally open thermostatic switch 9 will become sufficiently heated to close, short circuiting the filament section 8; the lamp is now in normal operation and is preferably designed so that the proportion of voltage drop between the arc tube and the ballast filament is such as to provide approximately sixty percent of the wattage dissipated in the arc and forty percent in the ballast filament. As stated above, the operation stabilizes in this proportion in about a minute, at which time filament 8 is taken out of circuit.

In a combination of this type where until the arc strikes and stabilizes most of the wattage must be absorbed by the filaments during the initial stage, it is necessary to provide a filament system capable of withstanding this load without damage. By the arrangement disclosed this is accomplished, insuring a long life for the ballast filaments and normal operation at high efficiency.

It is, of course, understood that when the mercury vapor lamp is operating properly its ultra violet light sufficiently excites the fluorescent coating 12 so that it in turn adds its spectrum of light to that produced by the filament sections 6 and 7, of the arc lamp. These spectrums can be adjusted so that they combine to provide a useful visible light source having a desired light spectrum for normal use, or of any desired predetermined spectrum range.

The structure of Figure 2 is generally similar to that of Figure 1, but is specially devised for higher voltage operation. Similar parts have been given the same reference numerals and they need not be described in detail. The differences will be pointed out. In this arrangement normally closed thermostatic switch is eliminated and a suitably proportioned resistor 25 is connected in the circuit between the structure provided by the support 16 and the auxiliary electrode 24 of the arc lamp. In this case the auxiliary electrode is shown as a single piece of metal as distinguished from the coil 4 of the preceding structure. As illustrated, the resistor can be supported by one of the legs of the supporting frame 18.

There is a slight modification of the normally open thermostat at the top of the device in that the flexing arm 9 is provided with a lateral contact member 9′ which cooperates with a properly positioned fixed contact 10″ welded to the metal support 10′.

The circuit arrangement for this lamp is illustrated in Figure 4. As before, the filament sections 6, 7 and 8 are connected in series across the 230 volt A.C. source. The normally open thermostat 9 is arranged to short circuit the filament section when it closes. The other thermostat of the preceding structure is replaced by a suitably proportioned resistor 25 to provide a proper potential difference between the cathode systems to facilitate starting of the arc discharge. When the arc discharge becomes fully operative and stabilized its conductivity will be substantially lower than conduction through the resistor branch, with the result that the resistor 25 is for practical purposes short circuited and ineffective. As before, after about a minute for stabilization, switch 9 will close, cutting out the section of the incandescent filament which is provided to prevent overloading of the useful normally operative sections 6 and 7.

From the above description it will be apparent to those skilled in the art that the subject matter of this invention is capable of some variation without departure from the novelty therein. It is preferred, therefore, that the protection afforded hereby be determined by the claim rather than by the illustrative disclosure.

What is claimed is:

A combination comprising an evacuated envelope having a fluorescent coating on the inner wall thereof, a visible light transmitting and ultra violet light reflecting

layer of magnesium oxide underlying said coating, and a source of ultra violet light excitation within said envelope.

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