Aug. 12, 1958 W. T. ANDERSON, JR., ET AL 2,847,614

ELECTRIC DISCHARGE LAMP

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Fig. 1.

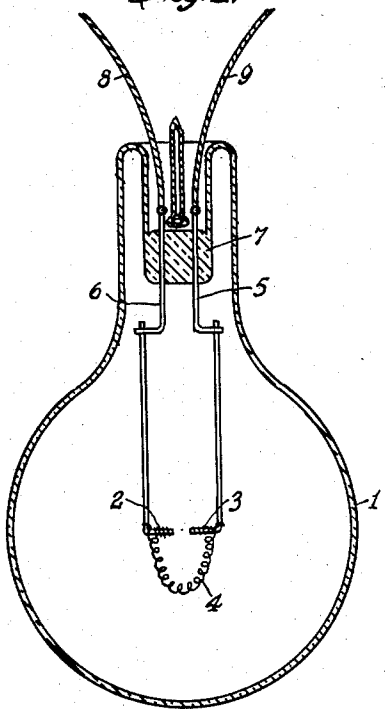


Fig. 2.

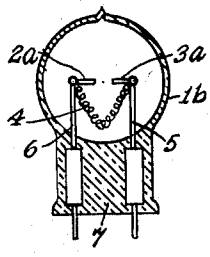


Fig. 3.

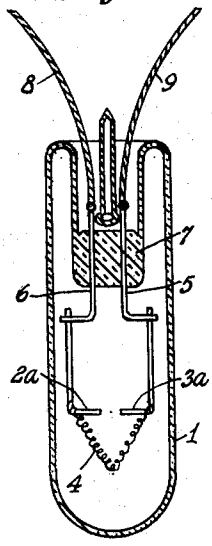


Fig. 4.

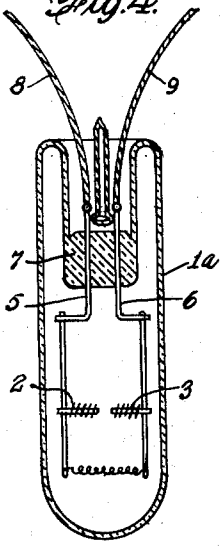


Fig. 5.

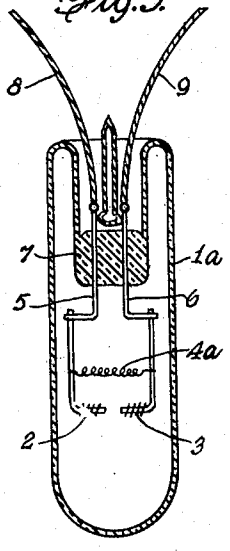
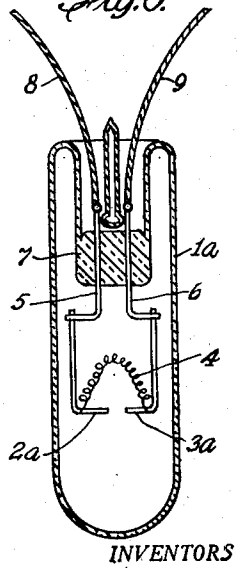


Fig. 6.



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ELECTRIC DISCHARGE LAMP

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Application August 11, 1954, Serial No. 449,083

4 Claims. (Cl. 315—46)

The present invention deals with an electric discharge lamp and more particularly with an electric discharge lamp having improved radiation characteristics.

Various attempts have been made to provide electric discharge lamps having improved radiation characteristics and particularly radiation characteristics simulating sunlight for application in the tanning of human skin.

Although the well known mercury vapor arc lamps produce ultraviolet radiations effective for tanning, the emission of the mercury vapor alone is deficient in the infrared and thereby does not produce such composite radiations of ultraviolet and infrared as would simulate sunlight for tanning purposes. The mercury vapor lamp even though color corrected by the addition of other gases and vapors or supplemented by incandescent filaments still lack sufficient radiation in the red end of the spectrum.

Infrared radiations when available at sufficient intensity and absorbed by the skin produce the sensation of warmth, increase the blood flow to the skin by dilating the capillaries and small superficial blood vessels, and stimulate perspiration. These are all factors which are favorable for tanning production by radiations in the ultraviolet portion of the spectrum.

It is an object of the present invention to provide a light source in a concentrated form and emitting radiations simulating sunlight.

It is another object of this invention to provide a lamp for emitting composite radiations including radiations in the infrared portions of the spectrum which consists of black body type radiations supplemented by an intense line spectrum emission of an ionizable gas whereby a more sunlike infrared emission is obtainable than from incandescent elements alone.

It is a further object of this invention to provide a lamp for producing radiations from an incandescent element and an ionizable gas in an arc and cooperating to produce a light which is sunlike in quality.

It is still a further object of this invention to provide a lamp for cosmetic tanning of live human skin wherein radiations are produced in the long-wave length ultraviolet and the blue end of the visible spectrum together with visible and infrared radiations in abundance to provide for heating of the skin tissues and increase blood flow to the skin, whereby tanning production of the skin is accelerated.

Other objects and advantages of the present invention will become apparent from the description hereinafter following and the drawings forming a part hereof, in which:

Figure 1 illustrates a partly elevational and partly sectional view of a lamp according to the present invention, and

Figures 2 to 6 illustrate modifications of the invention.

This invention relates to a gaseous discharge lamp and incandescent filament combination as a lamp unit for the production of radiations from combined light sources

and emitting predominantly infrared radiations with sufficient long ultraviolet to produce tanning of the human skin under the influence of the infrared radiations thereby substantially simulating the tanning effect of natural sunlight.

The lamp unit of the lamp unit of the present invention produces radiations in the spectral range between 2980 and 4400 angstroms with radiations between 2980 and 3200 angstroms being present as a small fraction of the total radiation output, whereby erythema production is accompanied with pigmentation of the skin as a result of radiations between 2980 and 3200 angstroms and whereby the radiations in the spectral range between 3200 and 4400 angstroms effect darkening of the pigmentation for desirable cosmetic tanning of the skin.

Figure 1 shows one form of lamp unit according to this invention and comprising a hermetically sealed light transmissive bulb **1** composed of fused quartz and the like ultraviolet and infrared transmissive materials, and containing at least a pair of spaced electrodes **2** and **3** with an electrical conductor **4**, such as a resistance or incandescent filament, bridging the spaced electrodes or otherwise in an effective parallel electrical circuit with the arc established between the electrodes. The electrodes may be in a number of forms depending upon the power rating of the lamp and upon the supply voltage upon which it is to operate and these electrodes are spaced apart in order that during operation of the lamp an arc may form between them. For example, the electrodes may be just straight wire as illustrated by Figure 3 and of adequate current carrying capacity when the current is less than 10 amperes and the supply voltage is less than 115 volts at 60 cycles alternating current.

For higher current lamps, e. g. over 10 amperes, it may be desirable to employ in addition to such wires, coils supported on the wires or cores to dissipate heat from the electrodes as illustrated by electrodes **2** and **3** of Figure 1. The electrode material may be tungsten, or tantalum, or such materials with activation materials associated therewith. For example, the activation material may be thorium or the oxides of thorium and barium, but plain tantalum or tungsten are preferred.

The above mentioned electrode spacing depends upon the available voltage for starting the lamp, the pressure of the gas filling in the arc bulb and the application for which the lamp is employed. With 115 volt 60 cycle A. C. supply, the arc gap may be less than one millimeter for a lamp designed for illumination of microscopes, etc., and several millimeters, e. g. 5 millimeters, when the lamp is employed for cosmetic tanning purposes. The electrodes and bridging filament are connected in parallel and to an external electrical circuit by the lead-in members **5** and **6** hermetically sealed through the wall of the arc tube **1** by means of hermetically sealing member **7**, such as ordinarily employed for sealing of input leads through an arc vessel envelope, and to appropriate conductors **8** and **9** for suitable connection to a source of voltage for energizing the lamp.

The electrodes are bridged by an electrical resistance or incandescent filament **4**, which is at all times in the electrical circuit and which during operation of the arc is in parallel electrical circuit with said arc. Switches or means for disconnecting the bridging filament during some stage of operation of the lamp are not used. This resistance **4** when heated by the passage of electric current ionizes the gas by thermal ionization, which enables an arc to be established between the electrodes. After start, the resistance continues to be heated by the passage of current and contributes infrared radiations of long wave length to the sum total of radiations and

thus serves as one of the light sources in the lamp structure.

The second light source in the lamp structure is the arc. The arc is initiated and operates in a gaseous atmosphere consisting of xenon. The xenon gas is employed either as a spectroscopically pure gas or may contain not more than 5% of other rare gases such as krypton or argon. These latter gases may be added to facilitate starting for conditions of low supply voltages or long arc gaps. After start the discharge is almost completely in the xenon gas. The gaseous content filling the arc bulb is at pressures from 0.1 to 50 atmospheres at 25° C. Preferably, xenon pressure is between 0.5 to 2 atmospheres at 25° C. when the lamp is to be started under low voltage conditions, for example 110 volts. When auxiliary starting circuits are employed for ignition at higher voltages, the lamp may contain xenon up to 50 atmospheres' pressure.

The efficiency of light production by xenon increases rapidly with increase in pressure. In the operating gas pressure ranges employed in accordance with this invention, radiation efficiency follows closely the gas pressure. Thus for the same current the lamp wattage in the arc and the radiation output are doubled when pressure is doubled.

For 115 volt operation an arc gap of 1 millimeter and an xenon gas filling of 1 atmosphere at 25° C., the operating pressure will become about 3 atmospheres as a result of the temperature effect in accordance with Boyle's law.

Figures 2 to 6 represent modifications as to arc vessel configuration and positioning of the filament 4 with respect to the electrodes. While electrodes *2a* and *3a* of Figures 2, 3 and 6 may be in the form of spaced wires or rods, the electrodes may also comprise a metallic

core with a metallic winding thereon as shown by Figures 1, 4 and 5. Otherwise the modifications show the positioning of the filaments above or below the electrodes, and the use of conventional bulb shaped envelope 1, tubular envelopes 1a or the substantially spherical envelope **16**.

The filaments may consist of substantially V-shaped coiled filaments 4 or straight coiled filaments *4a*.

What we claim is:

1. An electric lamp comprising a transparent envelope, an ionizable atmosphere and at least a pair of spaced electrodes within said envelope, and incandescent filament bridging said electrodes, means for energizing said filament and said electrodes, said ionizable atmosphere consisting of xenon with not more than 5 percent of another rare gas, said filament and the arc between said electrodes comprising combined light sources emitting predominantly infrared radiations supplemented by long ultraviolet radiations.

2. An electric lamp according to claim 1, wherein said ionizable atmosphere consists of xenon.

3. An electric lamp according to claim 1, wherein said atmosphere is at a pressure between 0.1 and 50 atmospheres.

4. An electric lamp according to claim 1, wherein said atmosphere is at a pressure between 0.5 and 2 atmospheres.

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