Feb. 27, 1934. D. D. KNOWLES 1,948,720

TELEVISION RECEIVING LAMP

Filed Feb. 5, 1929

Fig. 1.

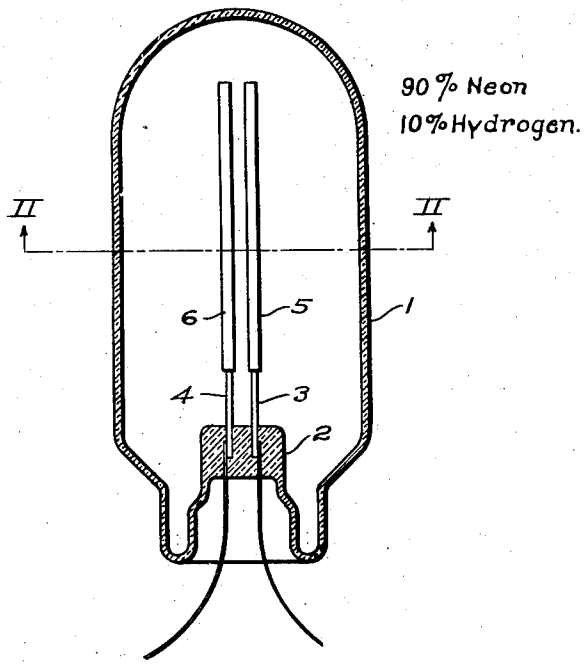
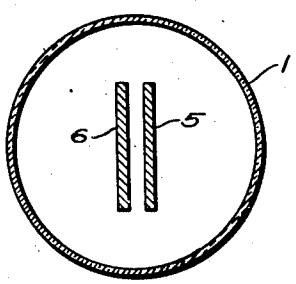


Fig. 2.



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TELEVISION RECEIVING LAMP

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11 Claims. (Cl. 176—122)

My invention relates to glow-discharge lamps and particularly to glow-discharge lamps employed in the transmission and reproduction of pictures and sound.

One object of my invention is to provide an improved light source for systems which require a luminous flux which follows instantaneously the fluctuations of an electrical control current.

Another object of my invention is to provide a luminous discharge device in which the luminosity will disappear instantaneously when the electrical or other exciting force falls to zero.

Another object of my invention is to provide a source of light having a characteristic color which lies near the middle of the visible spectrum and which is capable of following with fidelity the instantaneous fluctuations of an electric field.

A further object of my invention is to provide a method of causing an excited or ionized gaseous discharge path to return to an unionized or neutral condition instantaneously after the reduction to zero of the electrical potential gradient to which it is subjected.

In the arts of television, and of recording sounds photographically, it is necessary to have a light source capable of instantaneously following fluctuations of an electrical controlling quantity varying to the rate of hundreds of thousands of periods per second. It has, heretofore, been attempted to employ gaseous electrical discharges as such light sources; and the electrical discharges through neon have proved, in general, best adapted to this purpose. In order that pictures and sound should be reproduced absolutely without distortion, it is necessary for the light variations to follow instantaneously upon variations of the electrical potential gradient in the discharge path. I have found, however, that as a matter of fact, there is a perceptible time lag between the disappearance of luminosity of a gas discharge in neon and the falling to zero of the electric current therein; and I have also found a similar lag in the case of other similar gases. Such a time lag causes blearing of the image where pictures are being transmitted and causes distortion and unfaithful reproduction in the case of photographic recording of sound.

In accordance with my invention, I have discovered that the time lag above described can be substantially avoided if the vehicle through which the electrical discharge passes comprises an admixture of neon, or one of the other suitable luminous gases with a small percentage of hydrogen, or other gas, the molecule of which undergoes some change of condition not involving the emission of light within the range to which the optical system of the recording apparatus responds, and which occurs at an energy level lower than that at which the luminous gas emits useful radiation.

As a specific instance of the foregoing principle, the hydrogen molecule, which is normally diatomic, dissociates into two atoms of monatomic hydrogen with an absorption of energy which is less than that required to excite the neon molecule emitting luminous radiation.

With the foregoing purposes and principles in mind, my invention may best be understood by reference to the following description taken in connection with the drawing, in which:

Figure 1 shows a view, in elevation, of a glow-discharge tube embodying the principles of my invention; and

Fig. 2 shows a view thereof along the line 11—11.

Referring to the above-mentioned figures of the drawing, a vacuum-tight enclosure 1 which may conveniently be of glass has a stem 2 through which are fused the inleading wires 3, 4 in a manner well-known in the art. The ends of the in-leading wires 3, 4, respectively, support two plate electrodes 5, 6 which may be of a metal such as nickel or of tantalum and which are spaced apart by a distance preferably considerably shorter than the mean-free path of an electron in the gaseous atmosphere about to be described. The container 1 is exhausted to a high vacuum by methods which are standard in the lamp art and is then provided with an atmosphere which may have a pressure of ten to twenty millimeters of mercury.

In accordance with the principles of my invention, the aforesaid gaseous atmosphere may consist of a mixture of neon and hydrogen. I have found that if the mixture comprises 10% hydrogen and 90% neon, a desirable performance is obtained, although considerable variations from the foregoing percentages may at times be preferable, the precise composition of the gas, depending upon the particular purposes for which the lamp is to be employed.

Experiments have shown that the persistence luminosity which characterizes electrical discharge in pure neon is substantially avoided by such an admixture of hydrogen as has just been described. These experiments indicate that the above-described gaseous discharge tube produces a light which follows with absolute precision the variations of potential impressed between its electrodes.

While I have described my invention as em-

ployed in connection with a discharge tube in which the light is excited by impressing a potential difference between a pair of electrodes, similar advantageous results are found to follow in the case of luminous discharges produced by high-frequency induction in tubes which are not provided with electrodes.

While I do not wish my invention considered dependent upon the correctness of the following theory, it is my belief that the immediate response of luminosity changes with variations of electrical gradient in the gas is consequent upon the contact of the molecules of the luminous gas with another substance which absorbs the energy of their excited state almost instantaneously after it is attained and thereby prevents the energy from being emitted further in the form of light quanta. Thus, in the particular embodiment herein described, an excited neon atom almost immediately collides with a diatomic hydrogen molecule. It is a property of the latter that it may be split up into two atoms of hydrogen with the absorption of an amount of energy somewhat less than that characteristic of the excited state of the neon atom; thereby absorbing virtually all of the energy which otherwise the neon atom would emit as visible radiation. In consequence, every neon atom is reduced to the unexcited state very quickly after it has once been excited; and unless a potential gradient sufficient to continuously produce reexcitation exists in the gas, the emission of visible radiation ceases almost instantaneously.

While I have described neon as the particular luminous gas and hydrogen as the particular energy absorbing agent, it will be recognized that the same principles may be applied to other luminous gases than neon and that other energy-absorbing agents than hydrogen are applicable. Thus the other noble gases and mercury vapor may be employed as the principal gas of the discharge path.

While I have described my invention as applied to the rapid elimination of atoms of molecules which are excited to energy levels adapted to cause the emission of luminous radiation, it will be evident that somewhat similar general principles may be applied to the elimination of ionized or electrically-charged particles in a discharge path. Thus, the pressure of charged ions in a mercury vapor path may be quickly ended by the presence therein of some agent, such as hydrogen, which has the property of absorbing the energy required to dissociate the electron from the positive ion, without itself being split up into electrically-charged components.

I claim as my invention:

1. An electrical-discharge device comprising an envelope containing a noble gas, electrodes therein spaced apart by a distance so small that a potential impressed across them causes a glow on one of said electrodes but no glow between said electrodes, and a quantity of hydrogen mixed with said noble gas.

2. An electrical-discharge device comprising an envelope containing a noble gas, electrodes therein spaced apart by a distance so small that no glow appears between contiguous surfaces thereof when the lamp is lighted, and a quantity of hydrogen mixed with said noble gas.

3. An electrical-discharge device comprising an envelope containing a noble gas, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said gas, and a quantity of hydrogen mixed with said noble gas.

4. A gaseous-discharge device comprising an envelope, a plurality of spaced-apart electrodes disposed within said envelope, and a mixture of gases under reduced pressure surrounding said electrodes, said gas mixture being substantially 90% neon and 10% hydrogen and the spacing between said electrodes being of the order of the mean-free path of an electron in said gases, whereby, upon the establishing of a potential difference between said electrodes, a glow appears upon one of the non-contiguous surfaces thereof and is responsive, without appreciable time-lag, to variations in said potential.

5. An electrical-discharge device comprising an envelope containing a principal gas adapted, when excited, to emit light, electrodes therein spaced apart by a distance so small that no glow appears between contiguous surfaces thereof when said gas is excited, and an admixture with said gas of a substance having a critical energy level for a change of physical state which is less than the lowest energy level for excitation of said principal gas.

6. An electrical-discharge device comprising an envelope containing a principal gas adapted, when excited, to emit light, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said gas, and an admixture with said gas of a substance having a critical energy level for a change of physical state which is less than the lowest energy level for excitation of said principal gas.

7. An electrical-discharge device comprising an envelope containing a principal gas adapted, when ionized, to emit light, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said gas, and an admixture with said gas of a substance having a critical energy level for a change of physical state which is less than the lowest energy level for ionization of said principal gas.

8. An electrical-discharge device comprising an envelope containing a principal gas having a monatomic molecule, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said gas, and an admixture with said gas of a substance having a polyatomic molecule.

9. An electrical-discharge device comprising an envelope containing a principal gas adapted, when excited, to emit light, having its maximum intensity near the middle of the visible spectrum, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said gas, and an admixture with said gas of a substance having a critical energy level for a change of physical state which is less than the lowest energy level for excitation of said principal gas.

10. An electrical-discharge device comprising an envelope containing neon, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said neon, and an admixture with said neon of a substance having a critical energy level for a change of physical state which is less than the lowest energy level for excitation of said neon.

11. An electrical-discharge device comprising an envelope containing a principal gas adapted, when excited, to emit light, electrodes therein spaced apart by a distance less than the mean-free path of an electron in said gas, and a quantity of hydrogen mixed with said gas.

DEWEY D. KNOWLES.