

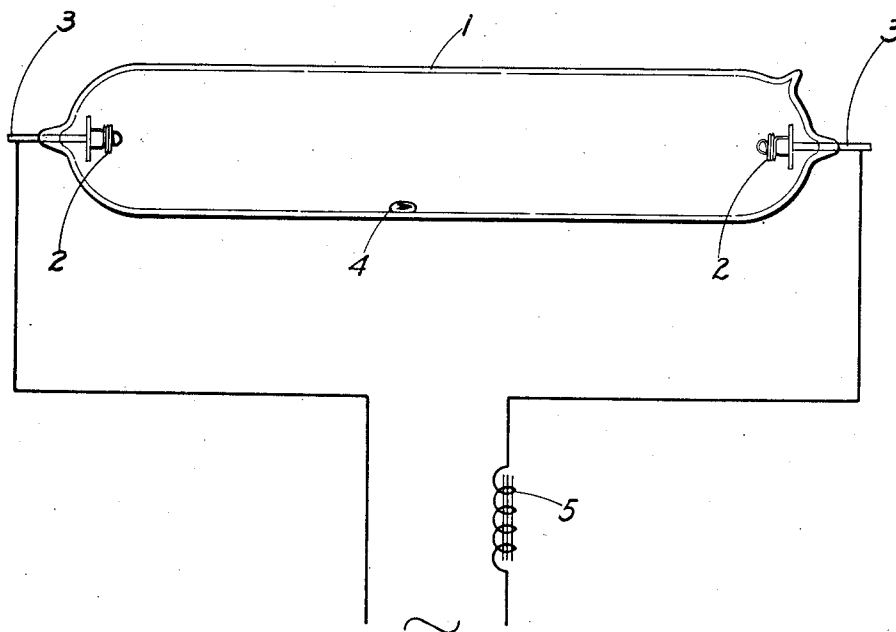
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R. ROMPE

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INFRARED GENERATOR

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INVENTOR
Robert Rompe
BY *Harry E. Dunham*
ATTORNEY

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INFRARED GENERATOR

Robert Rompe, Berlin, Germany, assignor to
General Electric Company, a corporation of
New York

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The present invention relates to generators of infra-red radiations useful in television and signalling.

A particular object of the invention is to provide an efficient source of infra-red radiations. A further object of the invention is to provide a generator whose radiations are confined substantially to the infra-red range of from 8000-9000 Angstrom units. Still other objects and advantages of the invention will appear from the following detailed specification or from an inspection of the accompanying drawing.

The invention consists in the new and novel combination of elements hereinafter set forth and claimed.

The photocells which are available for use in television and signal purposes have only a narrow useful sensitivity region in the infra-red, with the result that only a small portion of the radiations which are generated by an incandescent body, such as the filament of an incandescent lamp, can be utilized, due to the broad spectrum of these radiations. Moreover, not only are the majority of the radiations emitted by such a source useless, so far as response of the photocells is concerned, but they are also a great disadvantage, inasmuch as they greatly complicate the problem of providing adequate ventilation for the devices of which these light sources are a part, with the usual relatively confined spaces. Hence an improved source of infra-red, with selective radiation in the response region of the photocells, has long been desired.

I have now discovered that under certain conditions which I have determined an electric gaseous discharge in caesium vapor has the desired characteristics. According to my invention, my novel source of infra-red radiations is a caesium vapor discharge device containing a rare gas, together with means to operate this device in such a manner that the vapor pressure within the device is maintained within the limits of 0.0001 to 0.001 mm. pressure. This vapor pressure corresponds to a temperature of from about 100° C. to approximately 125° C. The necessary temperature control is provided either by suitably regulating the current density of the discharge, or also in part by regulating the escape of energy from the device, where a higher or lower current density is desired. I have found that when operated under these conditions the caesium vapor discharge emits only several very weak lines in the visible region, while the vast preponderance of the radiant energy is concentrated in the two resonance lines of caesium lying at 8521 and 8943 Å. These radi-

ations thus fall within the range of 8000-9000 Å. to which radiations most of the caesium photocells on the market are especially sensitive.

It is, of course, obvious that my novel discharge device must have an envelope which transmits the resonance radiations of caesium. Practically all of the glasses ordinarily used for electric gaseous discharge devices are highly transmitting in this region, the well known "Thuringer" glass being especially desirable for this purpose. The glass used need not be particularly resistant to caesium, since at the low operating temperature of 100-125° C. the caesium vapor does not chemically attack the glasses ordinarily used for discharge tubes.

Since virtually all of the infra-red radiation of my novel device is confined to the two resonance lines of caesium, there is a singular freedom from the loss producing and troublesome heat radiations, outside of the response region of the photocells, which have been unavoidable with the temperature radiator type of infra-red source used hitherto. Moreover, due to the concentration of the infra-red radiation in these two useful lines, my novel device has an efficiency as an infra-red source for television and signalling purposes far beyond that of any source hitherto available.

In some cases the efficiency of the generation of infra-red radiations in my novel device is still further increased by forming the vitreous envelope of the device of a glass which, while highly transmitting to the desired infra-red radiations, is opaque to visible radiations. In this case the weak radiation from the discharge which lies in the visible region is absorbed and converted into heat inside of the tube wall, so that a smaller wattage input is sufficient to maintain the desired operating temperature.

For the purpose of illustrating my invention I have shown in the accompanying drawing a gaseous discharge device, together with a schematic diagram of the connections thereof, which constitutes a preferred embodiment thereof.

As shown in the drawing my novel infra-red source has a sealed tubular envelope 1 of any suitable glass which is transmitting to infra-red radiations in the region from 8000-9000 Å., such as Thuringer glass, for example. Or, where it is desired to intercept the weak visible radiation, so that all the energy emission will be confined to the infra-red, I use a glass, such as the well known Schott glass RG7, which is opaque to the visible radiations but highly transmitting to the infra-red radiations of a wave-length of from 8000- 55

9000 Å. At each end of the envelope 1 there is located an activated thermionic cathode 2, here illustrated as a well known type which is heated by the discharge, although any other type can be used where desired. Said cathodes are supported on the inleads 3 which are sealed through the ends of the envelope 1. A small quantity 4 of caesium, together with a suitable fixed gas, such as neon or argon at a pressure at which low voltage starting is facilitated, is enclosed within the envelope 1.

The inleads 3 are connected to a suitable source of alternating current, an inductance 5 being included in series with the device. This inductance, together with any ballasting resistance that may be used, is so chosen that the current flow between the electrodes 2 will be just sufficient to keep the coolest spot on the envelope 1 at a temperature of from 100-125° C., that is, to maintain the caesium vapor pressure within said envelope within the limits of .0001 to .001 mm. of mercury. Under these conditions the visible light emitted by the discharge in the caesium vapor will be virtually nil, while the infra-red radiation of the device is confined to the resonance lines of 8521 and 8943 Å. which I have found to be especially useful for television and signalling purposes. Where the Schott glass is used it is obvious that even the weak visible radiations are cut off, the radiations being entirely confined to the desired infra-red region.

This novel source of infra-red radiations is far more efficient for television and signalling purposes than any other source of infra-red heretofore available, due to its concentration of all the radiant energy in the particular infra-region to which photocells are especially sensitive. Furthermore due to this concentration of the energy in the useful region the troublesome problem of disposing of the excess heat which is inherently generated by other types of infra-red sources has been entirely eliminated.

While I have described my invention by reference to a particular embodiment thereof, it is to be understood that various additions, changes and omissions, within the scope of the appended claims, may be made in the structure illustrated without departing from the spirit of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A source of infra-red radiations comprising a sealed envelope of a vitreous material which transmits the infra-red resonance lines of caesium, caesium within said envelope in an amount sufficient to support a discharge having the characteristics of caesium vapor, a pair of electrodes sealed therein, and means to limit the discharge current between said electrodes to a value which will maintain the vapor pressure within said envelope within the range of from .0001 to .001 mm. of mercury, whereby substantially all of the radiant energy emitted by said discharge is confined to the infra-red resonance lines of caesium.

2. A source of infra-red radiations comprising a sealed envelope of a vitreous material which transmits the infra-red resonance lines of caesium but which is opaque to visible radiations, caesium within said envelope in an amount sufficient to support a discharge having the characteristics of caesium vapor, and a pair of electrodes sealed therein.

3. A source of infra-red radiations comprising a sealed envelope of a vitreous material which transmits the infra-red resonance lines of caesium but which is opaque to visible radiations, caesium in an amount sufficient to support a discharge having the characteristics of caesium vapor and a fixed gas within said envelope, and a pair of electrodes sealed therein.

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