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URANIUM PHOTO ELECTRIC TUBE

Filed June 12, 1929

Fig. 1.

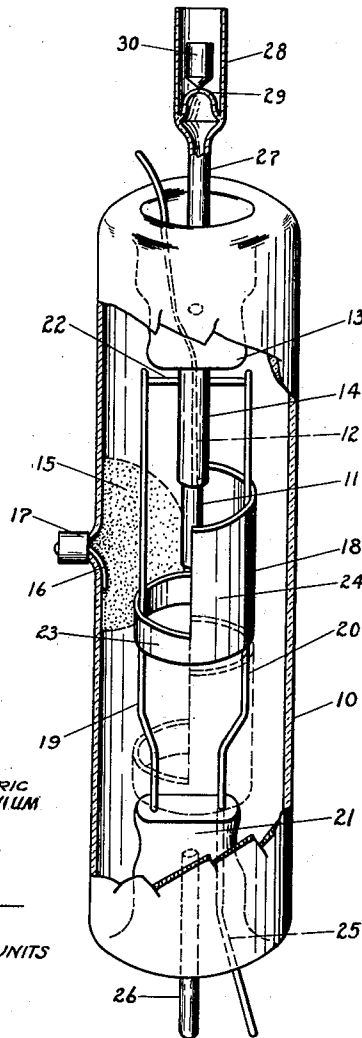
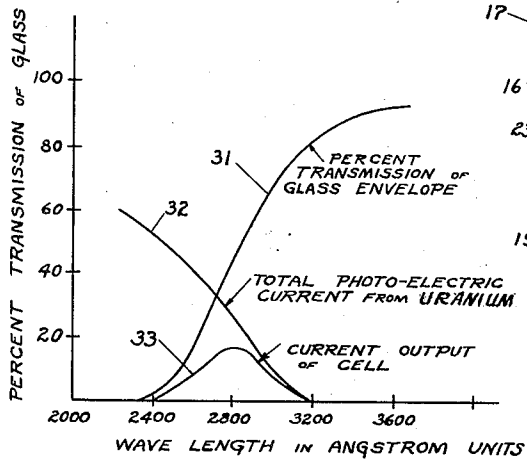


Fig. 2.



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entrance of air into the envelope after the formation of the cathode, since exposure of the uranium cathode to the atmosphere, even for short periods, may impair its sensitivity.

5 In Fig. 2 we have shown the relation between the wave length of the incident light and the current output of a tube employing an envelope which absorbs the ultra-violet light of very short wave length especially  
10 those below approximately 2400 Angstrom units, so as to render the tube sensitive only to a restricted band of frequencies in the region most desirable for erythema treatments. These curves are approximate only.  
15 Curve 31 designates approximately the relation of the per cent transmission of the ultra-violet radiations through the wall of the envelope, curve 32 the total current or photo-electric sensitivity of the uranium cathode,  
20 assuming no absorption of radiations in the envelope, and curve 33 is a resultant curve indicating the effect of the energy absorption of the glass (curve 31) on the current output (curve 32) of the cathode. The form of the  
25 curve 31 will vary somewhat with different glass compositions and may be modified by employing glass of different thicknesses, so that the effect of the absorption of the ultra violet radiations in the glass on the output  
30 of the tube, may be modified.

With the form of curves shown, the maximum sensitivity occurs at about 2900 Angstrom units which is in the narrow region of the spectrum most suitable for erythema  
35 treatment.

The current output of the tube falls off quite rapidly each side of the peak so that the tube is not appreciably sensitive except to a very narrow band of ultra violet radiations.

40 The peak of the curve 33 may be shifted to the lower wave length region by employing a thinner envelope or by employing a thin window in the envelope so as to decrease the absorption of the lower wave length radiations or it may be shifted to the higher wave length region by employing a glass  
45 less transparent to ultra violet.

We are aware that the invention may be embodied in a variety of specific forms without departing from the spirit or essential attributes thereof and we desire that the present embodiment be considered in all respects  
50 as illustrative and not restricted, reference being had to the appended claims rather than the foregoing description to indicate the scope of the invention.

What is claimed is:

1. An electron discharge device comprising an envelope transparent to radiation of wave lengths between about 2400 Angstroms  
60 and about 4500 Angstroms, an anode and a photo sensitive cathode, said cathode being comprised of uranium.

2. A photo electric tube comprising an envelope transparent to ultra-violet light, an  
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anode and a cathode therein, said cathode comprising a film of uranium metal on the wall of the envelope.

3. A photo electric tube comprising an envelope transparent to ultra-violet light, an  
70 anode and a cathode therein, said cathode comprising a layer of a noble metal having deposited thereon a quantity of uranium.

4. A photo electric tube comprising an envelope transparent to ultra-violet light, an  
75 anode and a cathode therein, said cathode comprising a coating of gold on the envelope having a film of uranium thereon.

5. An electron discharge device comprising an enclosing envelope, an anode and a  
80 photo sensitive cathode, said cathode being comprised substantially of uranium and said envelope having a section thereof comprised of glass permeable to radiation of wave lengths less than about 45 Angstroms.  
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6. An electron discharge device comprising an envelope permeable to radiation approximating 2900 Angstroms, an anode and a photo sensitive cathode, said cathode being  
90 comprised of uranium.

7. A photo electric tube comprising an envelope transparent to ultra-violet light, an anode and a cathode therein, said cathode consisting of metallic uranium.

8. A photo electric tube comprising an envelope having at least a portion transparent  
95 to ultra-violet light, an anode and a cathode therein, said cathode being composed of uranium and said envelope being substantially opaque to radiations having a wave  
100 length below approximately 2400 Angstrom units.

9. A photo electric tube comprising an envelope having an anode and a cathode therein, said cathode being composed of uranium  
105 and at least a part of said envelope, being transparent to ultra-violet light of a wave length above approximately 2400 Angstrom units but having a low per cent transmission of radiations of a wave length shorter than  
110 about 2400 Angstrom units.

In testimony whereof, we have hereunto subscribed our names this 8th day of June 1929.

HARVEY C. RENTSCHLER. 115  
DONALD E. HENRY.

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## UNITED STATES PATENT OFFICE

HARVEY C. RENTSCHLER, OF EAST ORANGE, AND DONALD E. HENRY, OF BLOOMFIELD, NEW JERSEY, ASSIGNORS TO WESTINGHOUSE LAMP COMPANY, A CORPORATION OF PENNSYLVANIA

## URANIUM PHOTO-ELECTRIC TUBE

Application filed June 12, 1929. Serial No. 370,223.

This invention relates to a photo-electric tube and more particularly to a tube which is sensitive only in the ultra violet region of the spectrum.

method of producing a photosensitive electrode.

Other objects and advantages will herein-after appear.

I have discovered that the metal uranium when thoroughly cleaned and treated in accordance with a definite schedule exhibits a "normal" photo-electric effect which starts at about 3300 Angstrom units, but which does not produce a measurable current above about 3200 Angstrom units.

The photosensitivity of the uranium cathode is in such region that it is entirely non-sensitive to light filtered through ordinary window glass.

By employing the uranium cathode in an envelope composed of a glass which is opaque to radiations of short wave length and especially those below 2400 Angstrom units, such as Corex glass, the band of the ultra violet region to which the tube is sensitive may be made more narrow than in the case of the thorium photo-electric tube, and the sensitivity of the cell thereby restricted more closely to the particular band of radiations which are effective in erythema treatment.

In producing a photo-electric tube in accordance with our invention we may employ uranium for both the anode and the cathode, although it is to be understood that the anode may be composed of another metal such as nickel. The cathode may consist of a sheet of uranium but preferably is formed as a thin deposit of uranium on the wall of the envelope in contact with the leading-in conductor.

In order to render the uranium cathode active it is necessary to thoroughly clean the surface of all impurities, oxides, etc. This can be conveniently accomplished when employing a solid cathode by creating a glow discharge in an inert gas between the anode and cathode to vaporize and sputter away the impurities while protecting a portion of the envelope for the vaporized or sputtered material.

When employing the cathode as a coating on the glass envelope we preferably employ a uranium anode and produce the coating on the wall by sputtering the uranium from the

5 In a copending application Serial No. 360,667, filed May 6, 1929 in the name of H. C. Rentschler, there is described and claimed a photo electric tube in which the sensitivity starts in the blue region of the spectrum and  
10 extends into the ultra violet region. This restricted sensitivity is obtained by employing as the cathode of the tube a metal of the cerium group of rare earth metals, and more particularly misch metal, which is a mixture  
15 of such metals.

In another copending application of H. C. Rentschler, Serial No. 360,666, filed May 6, 1929 there is described a photo-electric tube in which the sensitivity is restricted entirely  
20 to the ultra violet region starting with radiations having a wave length of about 3600 Angstrom units. This restricted sensitivity is obtained by employing thorium for the cathode. This latter photo-electric tube is  
25 particularly useful for measuring ultra violet light employed for erythema treatment. For such treatment the range of useful rays is restricted to a narrow band each side of about 2900 Angstrom units, and when a thorium  
30 cathode is employed for the tube, in an envelope which is opaque to waves of extremely short wave length, a tube may be produced which has a maximum sensitivity at about 2900 Angstrom units and only a low order  
35 of sensitivity at wave lengths appreciably above and below this value.

One of the objects of the present invention is to produce a photo electric tube in which the sensitivity does not start except in response to still lower wave lengths than the thorium cathode photo electric tube.

Another object is to provide a photo-electric tube which is sensitive only to a very narrow band of radiations having a maximum  
45 sensitivity of about 2900 Angstrom units.

A still further object is to produce a photo-electric tube which is substantially non-sensitive to radiations above about 3200 Angstrom units.

50 A further object is to provide an improved