Oct. 12, 1948. O. T. McILVAINE 2,451,400

PHOTOELECTRIC TUBE

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Fig. 1.

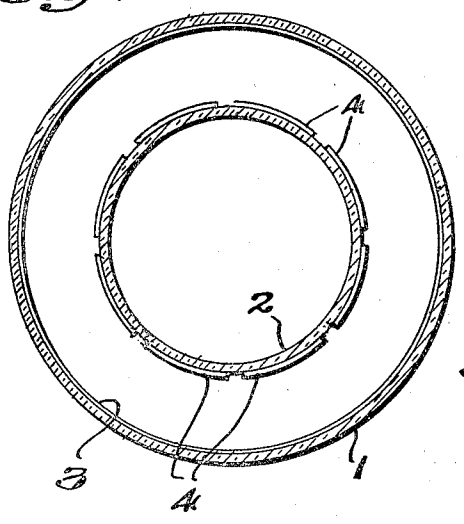
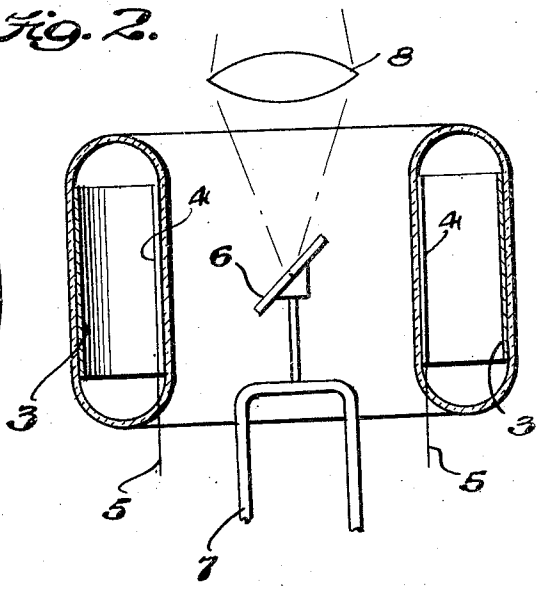


Fig. 2.



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PHOTOELECTRIC TUBE

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2 Claims. (Cl. 250—168)

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This invention relates to improvements in photo-electric tubes.

It has been customary heretofore to construct photo-electric tubes with anodes and cathodes, which are sometimes arranged in multiple in a single envelope, but this has involved multiplying both the anodes and cathodes, whereby a single anode would be arranged in association with a single cathode surface. Where the cathode surface is extended appreciably, this causes the electrons emitted from the cathode to travel in converging or diverging directions toward the anode, whereby such arrangements cannot be utilized to advantage in transmitting intelligence, photographic or code arrangement of dots, or for causing illumination of a bank of lights in a particular code or series, such as is often desired. These arrangements have heretofore required separate photo-electric cells for each point of light or other element to be reproduced or transmitted, which has made it impractical to transmit fine detail in pictures or to depict these on a bank of lights.

The object of this invention is to improve the construction of a photo-electric tube for this purpose, to enable it to be used for the different applications mentioned, one tube replacing the multiplicity of tubes required heretofore which, nevertheless, makes possible the transmission of pictures of fine detail in a more practical manner than has been possible with the multiplicity of photo-electric tubes as required heretofore.

This object is accomplished by utilizing a plurality of anodes associated with a single cathode, so arranged that the electrons emitted from the cathode surface will travel substantially in parallel directions to the adjacent anodes, whereby the electrons from a particular portion or spot on the cathode will go to a certain anode directly opposite this spot or portion. By this means any picture or pattern of shadow put on the cathode will cause the corresponding group of anodes to receive selectively the emission, and by arranging the number of anodes in sufficiently close relation and smallness of shape, the desired definition can be obtained, comparable with the usual photograph for instance. Each anode may be used to control a separate electrical device, such as a lamp, relay or the like in direct response to the passage of light onto the corresponding spot or portion of the cathode. The anodes can be arranged in close relation without interference by reason of their association with a cathode whereby the electrons travel in parallel relation

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from the cathode surface to the corresponding anodes.

I have shown different embodiments of this invention in the accompanying drawings in which:

Fig. 1 is a cross section through a photo-electric tube embodying this construction; and

Fig. 2 is a vertical section therethrough in association with optical directing means.

The invention as shown in Figs. 1 and 2 is applied to a photo-electric tube which is substantially of doughnut shape comprising an annular transparent envelope 1 of cylindrical shape, which envelope may be formed of glass or other suitable material, and is formed with an outer wall at its periphery and also with an inner wall 2 joined together at the opposite edges thereof, so as to form a double-walled annular body provided with an opening through the center thereof as is clear from Fig. 2.

The cathode is shown at 3 formed in the usual way and constructed as a cylinder extending in the annular space between the envelope walls 1 and 2. This cathode is shown as mounted against the inner surface of the wall 1 merely for purpose of illustration, but should be sufficiently close to the anodes of the tube to produce a low drop and a sharp cut-off between the anodes. A plurality of anodes are indicated at 4, being formed as transparent films on the periphery of the wall 2 within the space between the walls 1 and 2. The number of such anodes thus formed will depend upon the use of the photo-electric tube and may be extended as desired, although only eight are shown somewhat exaggerated for clearness of illustration. These anodes should be slightly spaced apart or otherwise separated. They may be formed of metal plated on the glass wall before the evacuation of the tube, and divided into segments for respective connection to electrical devices. Each anode should be formed with a separate lead, as indicated at 5.

Although light can be directed onto the cathode 3 in any desired manner according to the use intended to be made of the device, I have shown as the preferred means for this purpose a rotating mirror 6 supported by a galvanometer structure 7 of the usual character, or otherwise rotatably mounted so as to direct light from the mirror onto different portions of the cathode 3. Light to the mirror 6 may be directed through a lens 8 in the optic system. This light will be reflected by the mirror 6 through the inner wall 2 of the cell and also through the transparent anodes 4 formed on the outer surface of said wall, thence onto the selected spot of the cathode 3.

This will start electronic emission therefrom to the adjacent opposed anode 4 corresponding therewith according to the spot or point on the cathode thus receiving light from the mirror 6. Such arrangement permits the electrons to travel in parallel streams from the cathode to the anode without material divergence of the electron paths, whereby they hold their relative positions and thus maintain the pattern produced by the light.

This principle is operable in many different systems, as for instance, it can be used for operating relays instead of for energizing incandescent lamps merely by making the proper substitution in the energizing system. It may be used as a basis for an automatic tabulating machine operated in response to code or other cards or film, replacing the large number of individual photo-electric cells heretofore required.

The tube may be evacuated and the electrodes treated in the usual way of preparing a photo-electric tube, particularly in preparing the cathode to be light responsive.

The multiple anodes can be replaced, if desired, by one or more fluorescent screens, as for instance a corresponding number of fluorescent screens, in which event the picture can be viewed directly. The picture applied to the photo-electric cathode can be made invisible, as by the use of infra-red light, and yet the picture will be seen on the screen. This may be used when it is desired to transmit a picture through fog, clouds, etc., and obtain the effects of this invention.

I claim:

1. A photo-electric tube comprising a double-walled vessel having an unobstructed longitudinal passageway therethrough and having a transparent window, an open-ended tubular cathode having a continuous photo-sensitive surface and mounted within the vessel substantially concentric with said passageway, and a plurality of circumferentially spaced anodes extending about the passageway and within the cathode, said anodes having peripheral surfaces in opposed relation to the cathode and substantially parallel with the electron emitting surface thereof in positions for electronic discharge from the cathode to the several anodes through substantially parallel paths.

2. A photo-electric tube comprising a vessel having an unobstructed longitudinal passageway therethrough and having one wall transparent, a tubular cathode having a continuous photo-sensitive surface and mounted within the vessel substantially concentric with said passageway, and a plurality of circumferentially spaced anodes extending about the passageway and within the cathode, said anodes having peripheral surfaces in spaced relation to the cathode and substantially parallel with the electron emitting surface thereof in positions for electronic discharge from the cathode to the several anodes through substantially parallel paths.

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