

May 1, 1945.

R. BEHNE ET AL
TELEVISION PICK-UP TUBE

2,374,914

Filed Oct. 9, 1941

FIG. 3

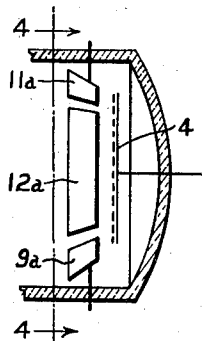


FIG. 1

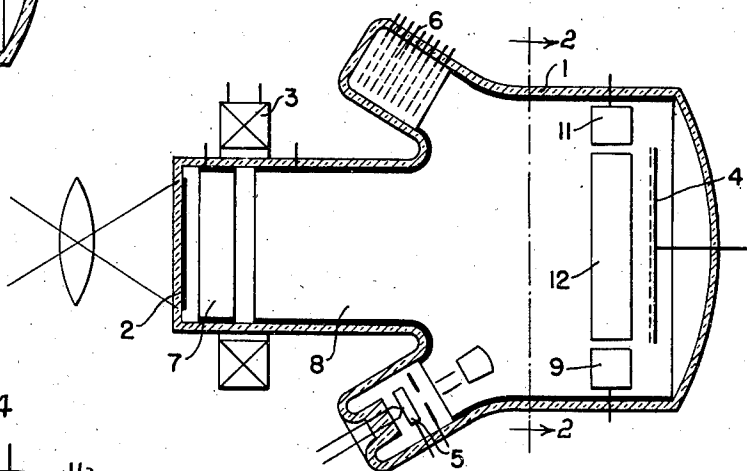


FIG. 4

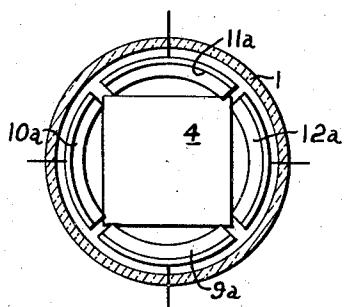


FIG. 2

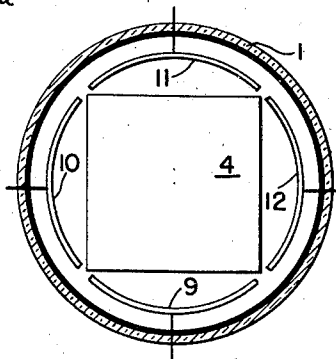


FIG. 6

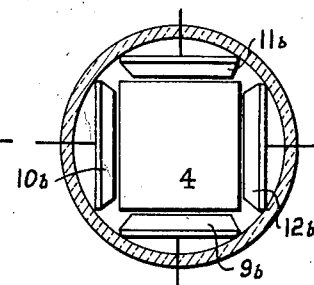
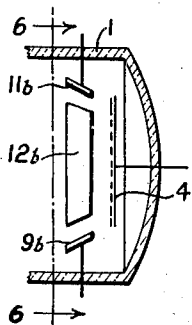


FIG. 5



INVENTORS
RUDOLF BEHNE
WALTER BUHS
BY *Alvin S. Martin*
ATTORNEY

UNITED STATES PATENT OFFICE

2,374,914

TELEVISION PICKUP TUBE

Rudolf Behne and Walter Buhs, Berlin, Germany; vested in the Alien Property Custodian

Application October 9, 1941, Serial No. 414,293
In Germany September 3, 1940

8 Claims. (Cl. 250—175)

The invention relates to television transmission tubes and in particular to pick-up tubes of the charge storage type. The charge storage tubes operating with a scanning cathode ray have the drawback that the video signal is distorted by a signal producing an uneven distribution of the brightness over the picture area.

Usually the presence of the distortion signal is explained by the unsymmetrical distribution of the potentials of the charge storage elements in consequence of the unsymmetrical scanning operation. It is also explained by the fact that in many cases the plane of the screen is not vertical to the central position of the scanning ray. It has also been found that the distortion signal is influenced by the unsymmetrical distribution of light in the image so that the distortion signal depends upon the content of the transmitted pictures.

It is an object of the present invention to provide a cathode ray scanning tube which is free from a distortion signal. It is a further object to improve the compensating means which have been hitherto employed in order to suppress the distortion component of the image signals. It is another object to improve the type of tubes in which additional electrodes are arranged in front of the mosaic electrode in order to produce a more uniform field for drawing away the electrons. A further object is to provide a cathode ray scanning tube including a secondary emission multiplier for immediately multiplying the electrons which are liberated from the storage electrodes by the scanning action. A particular object of the invention is to provide a new and improved input system for the secondary emission multiplier arranged in a cathode ray scanning tube.

According to the invention a tube is employed in which the storage electrode is not illuminated directly but in which the charges are produced by electrons emitted by a separately arranged photoelectric cathode. A tube of this type is combined with a secondary emission multiplier. The first stage of the multiplier is formed by a number of electrodes surrounding the path of the photoelectrons completely or at least partly and consisting of surfaces forming in their combination a frame or ring. The individual electrode elements are insulated from one another. This input electrode has at the same time the function of producing a suitable field distribution by applying different potentials to the individual elements of the complete frame electrode. It has the further effect that the electrons emitted by

the storage electrode during the scanning action are multiplied to a larger or smaller degree in dependency upon the potential of the individual electrode element. The following electrodes of the multiplier are arranged laterally to the path of the photoelectrons and of the scanning ray preferably in an extension of the tube having a similar situation as the extension containing the electron gun system. The unsymmetrical field distribution produced by this extension can be easily equalized or neutralized by a suitable choice of the potentials of the individual electrode elements.

Experiments have shown that very good results have been obtained by an arrangement of this type. The arrangement has also the advantage that it is simple in construction and that the first secondary emissive electrode can be easily activated and sensitized.

Other aspects of our invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but we do not limit ourselves to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawing:

Fig. 1 shows a longitudinal section through a tube according to the invention,

Fig. 2 shows a section of the tube taken on the line 2—2 of Fig. 1,

Fig. 3 shows a longitudinal section of the right-hand end of the tube shown in Fig. 1 and illustrating how certain of the electrodes may be modified,

Fig. 4 is a section taken on the line 4—4 of Fig. 3,

Fig. 5 is a longitudinal section similar to Fig. 3 illustrating still another modification of the electrode structure, and

Fig. 6 is a section taken along the line 6—6 of Fig. 5.

The cathode ray tube 1 contains a photoelectric cathode 2 and a storage electrode 4. The electron image produced by the photoelectric cathode is sharply reproduced by a magnetic lens 3 upon the storage electrode. The storage electrode may for instance consist of an insulating surface. An electron gun system 5 is arranged in a lateral extension of tube 1. A similar extension on the opposite side of the tube contains a system of secondary emissive grids 6 arranged one behind the other. The tube contains wall coatings 7 and 8 forming an electrostatic lens. The tube contains furthermore in accordance with the invention a number of electrodes 9, 10, 11, 12, forming together a ring-like structure. These

electrodes are preferably made of the same material and are sensitized in a similar manner as the secondary emissive electrodes of the multiplier 6. The electrode elements 9, 10, 11, 12 have two effects, namely, to produce the desired field distribution and to produce a multiplication of electrons liberated at the storage electrode by the scanning action. In this manner it is possible not only to draw away the electrons from the charge storage surface on predetermined paths but it is also possible to influence the degree of multiplication in accordance with the spot of the screen from which the electrons are coming so that the differences in signal amplitudes can be easily equalized.

The potential applied to electrodes 9, 10, 11 and 12 varies for instance between 0 and 100 v. against the potential of the wall coating or anode 8. It is however not necessary in all cases to vary the potential over this entire range. It is furthermore not necessary in all cases to operate with a secondary emission factor higher than 1, but it may be preferable to operate with lower values. It is, however, essential that this factor is changed by adjusting the potential of the electrodes.

The electrode arrangement may also be formed in such a manner that it surrounds the space in front of the storage electrode only partly. One or the other of the electrodes may for instance be omitted.

The drawing shows the electrodes in the form of curved metal strips. Other forms of electrodes may be employed instead thereof. The metal strips may be arranged at an angle to the axis of the tube so that they form a part of a cone- or pyramid-like surface opening or widening in the direction to the photoelectric cathode. The angle may be different for different electrodes. The electrodes may also extend further into the direction of the photo-electric cathode or they may consist of narrow strips extending only slightly beyond the surface of the storage electrode.

Figs. 3 and 4 illustrate the manner in which the electrodes may be arranged to form a part of a cone-like surface opening in the direction of the photoelectric cathode or away from the storage electrode 4. Each electrode 9a, 10a, 11a and 12a is in the form of a metal strip having the shape of a section of a cone, the four strips being arranged to form a broken frusto-conical surface adjacent and opening away from the storage electrode 4. Figs. 5 and 6 illustrate the electrodes 9b, 10b, 11b and 12b arranged in the form of metal strips which together form a broken frusto-pyramidal surface adjacent and opening away from the storage electrode 4 for the purpose of directing the secondary electrons toward the electron multiplier shown at 6 in Fig. 1.

What we claim is:

1. An image scanning cathode ray tube including a charge storage electrode, a secondary emission multiplier having a number of secondary emissive electrodes, and a group of secondary electrodes forming a broken annular surface at one side of and adjacent the charge storage electrode for directing a stream of electrons toward said multiplier.

2. A tube as described in claim 1 wherein said

broken annular surface is in the form of the frustum of a cone widening in the direction away from said charge storage electrode.

3. Image scanning cathode ray tube including a charge storage electrode, a secondary emission multiplier having a number of secondary emissive electrodes adapted to emit secondary electrons upon the impact of primary electrons, and a group of electrically distinct secondary emissive electrodes between the charge storage electrode and said multiplier each electrode of said group bounding a part of the space in front of the charge storage electrode to form a stream of electrons in accordance with the electron emission of said charge storage electrode and direct it toward said multiplier.

4. Image scanning cathode ray tube including a charge storage electrode, a secondary emission multiplier having a number of secondary emissive electrodes adapted to emit secondary electrons upon the impact of primary electrons, and a group of secondary emissive electrodes consisting of electrode elements insulated from one another, said electrode elements being between said charge storage electrode and said multiplier and surrounding partly the space in front of the charge storage electrode.

5. Image scanning cathode ray tube including a charge storage electrode, a group of electrically distinct electrodes, each electrode of said group bounding a part of the space in front of the charge storage electrode, and a second group of secondary emissive electrodes mounted in an extension of said cathode ray tube in the path of electron emission from said first group.

6. Image scanning cathode ray tube including a charge storage electrode, a secondary emission multiplier having a number of secondary emissive electrodes adapted to emit secondary electrons upon the impact of primary electrons, and a group of electrodes having the form of strips forming a broken cylindrical surface adjacent the charge storage electrode for directing a stream of electrons toward said multiplier.

7. Image scanning cathode ray tube including a charge storage electrode, a secondary emission multiplier having a number of secondary emissive electrodes adapted to emit secondary electrons upon the impact of primary electrons, and a group of electrodes having the form of strips forming a broken frusto-conical surface adjacent and opening away from the charge storage electrode for directing a stream of electrons toward said multiplier.

8. Image scanning cathode ray tube including a charge storage electrode, a secondary emission multiplier having a number of secondary emissive electrodes adapted to emit secondary electrons upon the impact of primary electrons, and a group of electrodes having the form of strips forming a broken frusto-pyramidal surface adjacent and opening away from the charge storage electrode for directing a stream of electrons toward said multiplier.

RUDOLF BEHNE.
WALTER BUHS.