

Aug. 29, 1950

H. A. IAMS
TELEVISION PICKUP TUBE
Filed Sept. 5, 1946

2,520,244

Fig. 1.

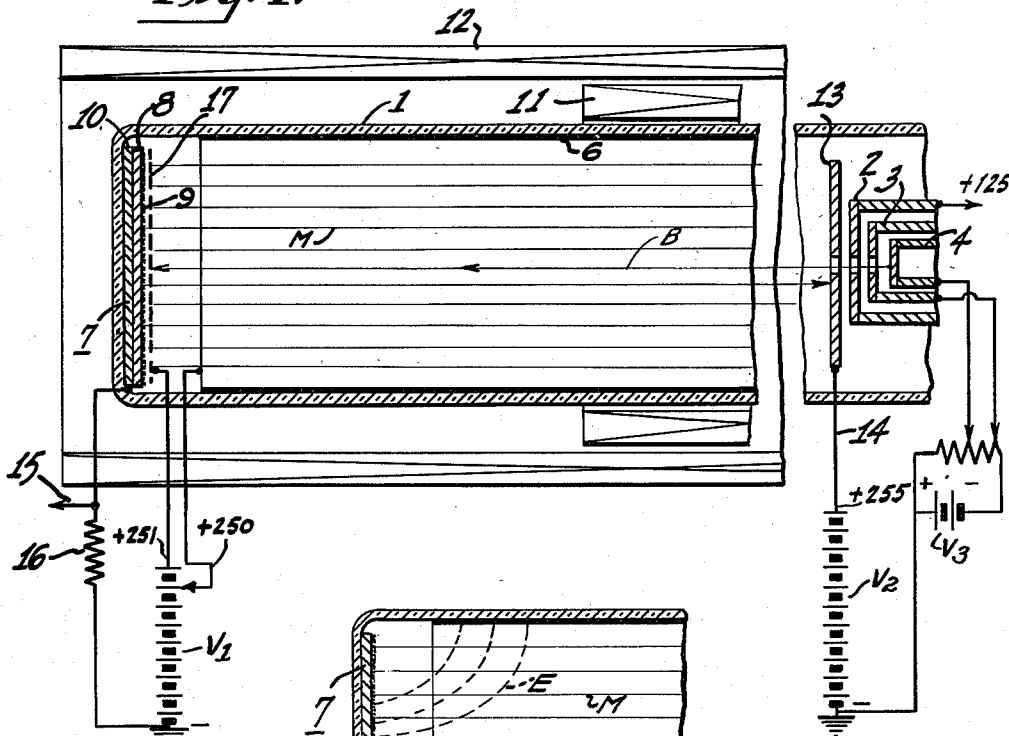
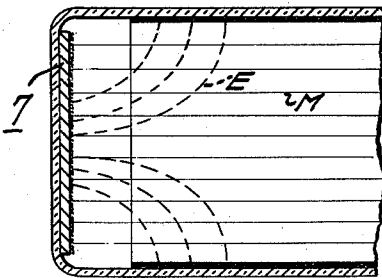


Fig. 2.



Inventor
Harley A. Iams
By *William A. Zalusak*
Attorney

UNITED STATES PATENT OFFICE

2,520,244

TELEVISION PICKUP TUBE

Harley A. Iams, Princeton, N. J., assignor to
Radio Corporation of America, a corporation of
Delaware

Application September 5, 1946, Serial No. 695,013

2 Claims. (Cl. 315—10)

1

This invention relates to television tubes and more especially to tubes for televising photo images.

The invention is particularly useful in pick-up tubes in which the beam electrons are focused on the target by a magnetic field and land on the target at substantially zero velocity, such as described in my Patent No. 2,213,175, granted August 27, 1940. A number of objectionable features have appeared in pictures transmitted by this type of tube, one being the appearance of a smear of bright light in the transmitted picture, usually in the center. Another difficulty is in obtaining a picture of high resolution, even though the beam spot on the target is made adequately small. A further difficulty is the distortion of the shape of the picture, so that the reproduced lines are curved instead of straight.

It is an object of this invention to provide means for transmitting a true picture at all parts of the raster and particularly to eliminate concentrated light effects at the target center.

Another object is to produce improved resolution in the picture transmitted.

Another object is to provide means for preventing the distortion of the picture shape.

Other objects will appear in the following specification, reference being had to the drawings, in which:

Figure 1 illustrates a tube having my improvement for overcoming the objectionable features; and

Figure 2 is a diagrammatic illustration of the forces in a tube that produce objectionable results.

The objectionable features mentioned have not heretofore been eliminated because no one understood what it was that produced them. Research on pick-up tubes has enabled me to trace the causes of the difficulties and to provide a remedy therefor. I have found that the first objectionable characteristic of spurious light area in the center of the transmitted picture is caused by positive ions produced by collision of the electrons with gas molecules, even though the tube envelope is well evacuated. The production of these ions would not ordinarily be objectionable, but in tubes employing combined electrostatic and electromagnetic fields the positive ions are not spread over the entire picture but are directed to the center of the target by the shape of the resultant of the electromagnetic and electrostatic fields.

I also found that poor resolution with a proper size of beam spot was due in part to the grid-like

2

control of the photo emission by the neighboring areas less positively charged. When the lighted areas in an image are small, the relatively negative potential of the darker border areas has a grid action preventing proper emission of the photoelectrons, giving poor resolution. The effect is reduced as the lighted areas increase in size and it is not noticeable with fairly large white spots. The poor resolution is also caused by the bending of the beam by positive areas on the target, due to the low electron velocity in front of the target.

I have also found that the distortion of the shape of the picture referred to is due to the crossed magnetic and electrostatic fields near the target, which produce a resultant force giving the electrons a tangential component. Since the direction of the electrostatic field is not uniform across the target, the electrons are scanned across the target in curved lines instead of straight lines. To reduce this action rotator rings have been placed near the target and operated at some intermediate voltage. This worked well but the difficulty was not entirely overcome.

I have found that all of the enumerated defects can be eliminated by placing near the target, in a plane parallel thereto, a very fine mesh wire screen that is highly transparent to the beam electrons and operating this screen at a potential that sustains almost up to the screen the velocity of the electrons toward the target. This screen repels the ions produced by collision of the electrons with the gas molecules and also overcomes the grid action of the border areas of small light spots. This potential may have various values within reason, but I have found it quite satisfactory to apply to the fine mesh screen a potential the same as, or slightly higher than, that applied to the wall coating. If the wall coating has 250 volts, then the screen may have 251 volts.

Referring to the drawings, the evacuated envelope 1 and other parts are shown broken away to reduce the size of the figure. The tube may be of any desired construction, but I have shown by way of example a tube of the orthicon type disclosed in my Patent 2,213,175, filed August 27, 1940. The first anode 2 surrounds the grid 3 and the latter surrounds the cathode 4, which encloses the usual heater (not shown). This cathode may be connected to the negative terminal and the grid to a somewhat more negative potential point. The wall coating anode 6 usually called the second anode extends from adjacent the first anode to the vicinity of the target assembly 7.

3

The target assembly 7 may comprise a thin transparent sheet 8, such as mica, having a photo-sensitive mosaic 9 or photocathode adapted to have a charge image on the side facing the gun and a thin transparent coating of metal 10 at the other side. The thicknesses of these target parts, of course, are not made to scale and are conventionally indicated. The metal coating may be connected to a terminal of the power supply having about the same potential as the cathode, so the electrons of the beam B will land on the mosaic 9 at substantially zero velocity to discharge the target as the beam is scanned thereover by the deflecting unit 11, comprising two coils having fields at right angles to each other and to the focusing field of coil 12. Electrostatic deflection may however be used if desired. The electrons not landing on the target surface return toward the anode 2 and are collected by electrode 13. The signal may be taken off either the conductor 14 connected to electrode 13 or off the conductor 15 connected to the load resistance 16, the latter being shown.

In the prior art tubes, the electrostatic field lines E bend toward the center of the target (Fig. 2), while the magnetic focusing lines M are parallel to the tube axis, the coil being long enough to substantially place the fringe field outside the tube. The combination of the electric and the magnetic forces produces the tangential component that distorts the shape of the picture. In my improved tube, shown in Fig. 1, the electric and magnetic lines are parallel at the target, due to the screen 17. By way of example, the screen may have 230 wires per inch with an open area of about 46% of the total area. With a tube diameter of about 4 inches, the spacing of the screen from the target may be about four-tenths of an inch. This keeps the electrons moving perpendicular to the target surface, and their velocity is high until they are quite close to the surface. The distortion is eliminated by screen 17 and the other defects are remedied.

The various electrodes may be connected to a power source shown conventionally as batteries V₁, V₂ and V₃.

While certain specific embodiments have been illustrated and described, it will be understood that various changes and modifications may be

4

made therein without departing from the spirit and scope of the invention.

What I claim as new is:

1. A television pick-up tube system comprising an evacuated envelope containing a cathode ray beam gun having cathode, grid and anode electrodes, a target having a photo-sensitive surface, said target having substantially the potential of said cathode, a second anode electrode and a fine mesh screen between the second anode electrode and the target, said screen being sufficiently close to the target to prevent formation of ion spots at the center thereof, means for producing a uniform magnetic field between the gun and the target and a voltage source connected to said electrodes, said target and said screen to maintain accelerations of the beam electrons beyond said second anode electrode and up to the plane of said screen and deceleration of the electrons substantially to zero velocity in the space between said screen and said target.

2. A television pick-up tube system comprising an evacuated envelope containing a cathode ray beam gun having cathode, grid and anode electrodes, a target having a photocathode and having substantially the potential of said cathode, a second anode electrode, and a fine mesh screen spaced from said anode and having a positive potential relative to that of said target, said screen being parallel to said target and being spaced a predetermined distance therefrom, said potential and said distance being of such value as to prevent the control of photo electrons emitted from positive charged areas of the photocathode by grid-like action of neighboring less positively charged areas thereof and a voltage source to apply potentials to said electrodes, said target and said screen.

HARLEY A. IAMS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,213,175	Iams et al.	Aug. 27, 1940
2,306,272	Levy	Dec. 22, 1942
2,313,886	Nagy et al.	Mar. 16, 1943