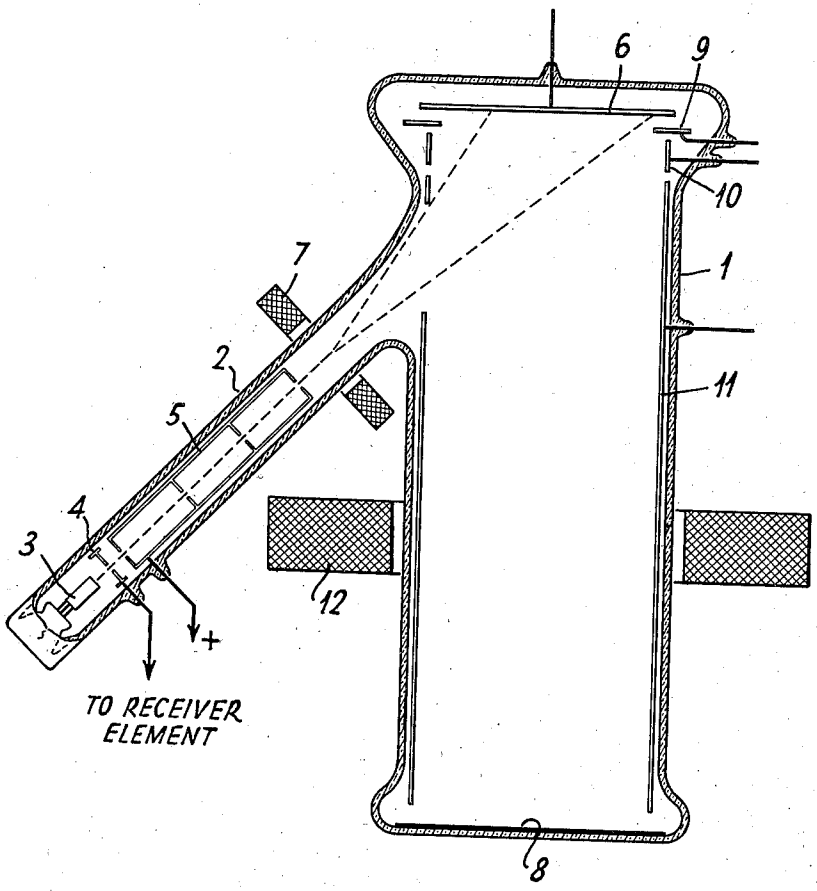
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CATHODE RAY TUBE

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CATHODE RAY TUBE

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This invention relates to cathode ray tubes.

In the specification of British Patent No. 381,306, a cathode ray receiving tube is described in which a modulated cathode ray beam is caused to traverse a grid-like structure and to cause the emission therefrom of secondary electrons which are thereafter accelerated and focussed on a fluorescent or thermal type target or screen to reconstitute the received signals. The result of the secondary emission is to cause the picture reproduced on the fluorescent target or screen to become more intense than would otherwise be the case if the cathode ray impinged on the fluorescent screen directly.

While the apparatus described in the aforesaid British patent is advantageous in that it provides a ready means for increasing the intensity of the reproduced picture, it is, nevertheless, objectionable owing to the employment of the grid which, due to its finite structure, inevitably masks a certain area of the fluorescent screen resulting in a decrease in the detail of the reproduced picture.

It is the object of the present invention to provide an improved cathode ray receiving tube in which use is made of the property of secondary emission with a view to avoiding the disadvantage mentioned above.

According to the invention there is provided a cathode ray tube comprising means for producing a beam of cathode rays capable of being modulated with received signals or the like, means for causing the cathode ray beam to scan a plain secondary emissive electrode constructed so that secondary electrons greater in number than the incident primary electrons are emitted by said electrode and means for accelerating and focussing the secondary electrons emitted by said electrode onto a further electrode such as a screen which is rendered luminous when the electrons impinge thereon.

Since the secondary emissive electrode is plain as distinct from a mesh-type of screen referred to in the aforesaid patent, the difficulties such as masking arising due to the finite structure of the secondary emissive electrode are obviated. The use of a plain secondary emissive electrode also offers the advantage over a mesh-type of screen in that the number of scanning lines employed is not limited by the structure of the secondary emissive electrode. The cathode ray gun may be so disposed in relation to the secondary emissive electrode that the beam scans the electrode obliquely and the screen which is rendered luminous may be disposed parallel to the secondary emissive electrode and opposite to the surface of the secondary emissive electrode which is scanned by the cathode ray beam.

In order that the invention may be clearly understood and readily carried into effect it will now be described with reference to the drawing accompanying this specification which illustrates diagrammatically the preferred embodiment of the present invention.

The reference number 1 indicates an evacuated envelope provided with a tubular extension 2 in which a cathode ray gun of known construction is arranged. The cathode ray gun comprises a cathode 3, a modulating electrode 4, to which for example, received television signals are applied, and 5 indicates the first anode of the electron gun which serves to accelerate and focus in conjunction with a second anode not shown the beam of electrons emitted from the cathode 3 and modulated by the applied signals. The second anode may be provided in the form of a coating of silver on the wall of the extension 2. The extension 2 is disposed obliquely to the axis of the envelope 1 and at one end of the envelope a secondary emissive electrode 6 is provided which is arranged to be scanned by the beam of electrons, scanning being accomplished in known manner by the application of deflecting fields produced by coils 7, as shown, or by electrostatic deflecting plates. As the cathode ray beam impinges on the secondary emissive electrode 6, secondary electrons greater in number than the incident primary electrons are emitted from the electrode 6, such secondary electrons are accelerated and focussed onto a fluorescent screen 8 provided on the end wall of the envelope 1 opposite to the electrode 6. In order to accelerate the secondary electrons emanating from the electrode 6, ring electrodes 9 and 10 are provided in conjunction with a cylindrical electrode 11, and for the purpose of focussing the secondary electrons onto the fluorescent screen 8 a focussing coil 12 is provided surrounding the envelope 1. Electrostatic focussing for the cathode ray beam may, if desired, be employed. In operation, the cathode ray gun may be arranged to generate a beam of electrons having energy corresponding to a potential difference of a half to one and a half kilovolts and the secondary emissive electrode 6 may be maintained at earth potential, the electrode 9 also at earth potential, the electrode 10 at a positive potential of about 1.5 kilovolts and the cylindrical electrode 11 at a positive potential of about 5 kilovolts. Higher velocities, corresponding to potential differences of up to 20 kilovolts, for example, may be im-

parted to the electrons by utilizing a further electrode. Electrons having these higher velocities give rise to the advantages of reducing the chromatic aberration of the final electron optical image and of increasing the efficiency of the arrangement, as a screen upon which they are focussed emits more light at these higher electron velocities.

The secondary emissive electrode 6 may be constructed from any insulating or conducting material which is provided with a coating of silver which is subsequently oxidized and provided with a coating of caesium. Alternatively, the electrode may be of the caesiated nichrome metal type which is a stable secondary emitter even at dull red heat or it may comprise a plate of aluminum which is oxidized and subsequently coated with caesium or other constructed as described in the specification of British Patent No. 481,170. Since the electrode 6 emits secondary electrons in greater number than the incident primary electrons, the picture reproduced by the fluorescent screen 8 will be of greater intensity than would otherwise be the case. The picture may be either an enlarged or a reduced image, as required.

The fluorescent screen may be formed of zinc-sulphide or willemite or other materials as is well known in the art.

In a modification of the present invention, the secondary emissive electrode 6 may be composed of tungsten oxide having a coating of barium. In a further modification the electrode 6 may be constructed in a manner similar to the cathodes of cathode ray tubes, that is to say, it may be arranged to be heated and may be provided with suitable emissive coating. The temperature to which the electrode is heated will be arranged to be just lower than that at which emission occurs, whereby on the cathode ray beam impinging on the electrode the velocity of the beam will cause the temperature to be raised so that thermionic emission commences, the thermionic emission being controlled by the intensity of the incident beam.

The embodiment illustrated in the drawing employs an electrode 6 which is shown as being of a plane structure, a curved electrode may, however, be employed, and in such a case the curvature of the electrode 6 may be made such as to tend to reduce distortion in the final image which would otherwise be present.

Further, the embodiment illustrated in the drawing utilizes secondary electrons which are emitted from the electrode 6 in a direction opposite to the direction of motion of the primary electrons which comprise the cathode ray beam. It is known, however, to use plain foils for the emission of secondary electrons moving in a direction substantially the same as the direction in which the primary electrons move. Such foils may be utilized in embodiments of the present invention, the velocity of the primary electron beam and other conditions being suitably adjusted. In these embodiments of the present invention the secondary electrons which are emitted from the electrode would move in a direction substantially the same as the direction in which the primary electrons move, and the accelerating electrodes and focussing means would accordingly be situated on the side of the electrode opposite to that shown in the drawing.

The invention may employ a series of secondary electron emitting electrodes such as 6, the series of electrodes being arranged such that the electrons generated at each electrode are caused to impinge on the succeeding electrode in the series in the manner of an electron multiplier or picture amplifier, the final amplified beam being caused to impinge on the screen 8 and to trace out the amplified image.

By virtue of the invention a cathode ray receiving tube is provided in which the intensity of the reproduced picture is increased by the use of a plain secondary emissive electrode the emission of which is controlled by the incident primary beam.

While the invention is primarily intended for use in television receiving apparatus, it can, of course, be employed for other purposes.

I claim:

1. A cathode ray tube comprising means for producing a cathode ray beam, an electrode adapted to modulate the intensity of the beam in accordance with applied image signal voltage variations, a continuous planar electron impervious secondary electron emissive electrode, means adapted to scan the modulated beam over an area of said electrode to release secondary electrons greater in number than the incident primary electrons of the cathode ray beam to thereby produce an electronic current image, a fluorescent target electrode positioned parallel to and spaced from said secondary electron emissive electrode and adapted to receive the secondary electrons directly from the scanned area of the secondary electron emissive electrode, and means for accelerating and focusing the secondary electrons constituting the electronic current image on to the target electrode.

2. A television receiving tube for producing a television image comprising means for generating a narrow focused beam of electrons, a control electrode adapted to modulate the intensity of the beam of electrons in accordance with applied image signal voltage variations, a substantially planar contiguous secondary electron emissive electrode, means adapted to scan a predetermined area of one side of said electrode by the modulated beam of electrons to release secondary electrons from the scanned area in a number in excess of the arriving electrons whereby an electronic current image is produced, a fluorescent target electrode positioned substantially parallel to and spaced from the said secondary electron emissive electrode and opposite the scanned side of said electrode, said fluorescent target being adapted to directly receive the secondary electrons emitted from said electrode, and means for accelerating and focusing the secondary electrons constituting the electronic current image onto the fluorescent target.

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