

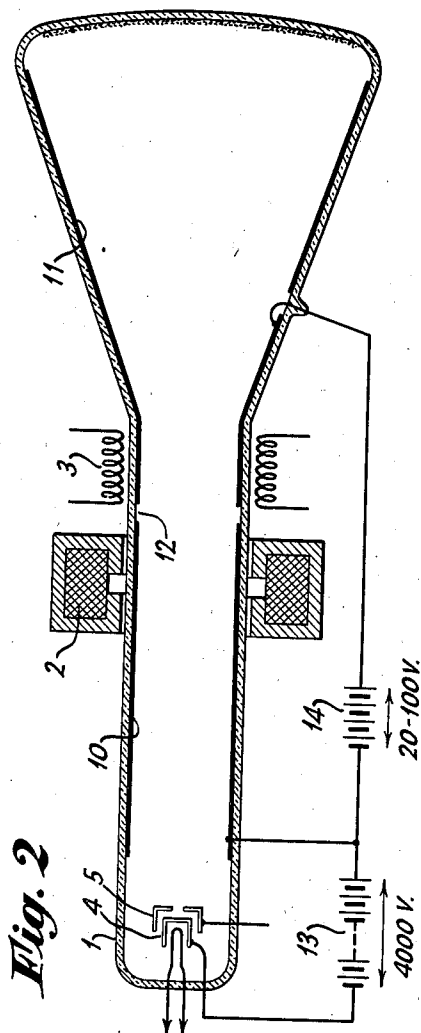
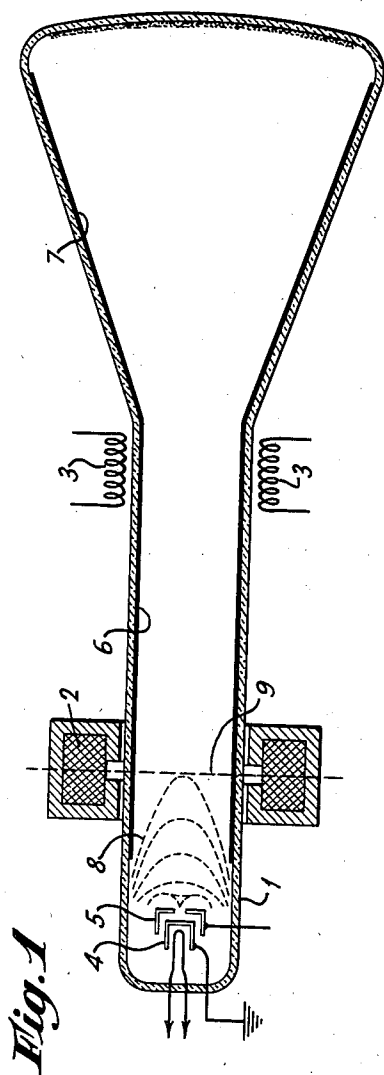
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CATHODE RAY TUBE

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CATHODE RAY TUBE

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2 Claims. (Cl. 250—161)

This invention relates to cathode ray tubes in which the electron beam is focussed by electromagnetic means.

In the production of such tubes it has been found that the lines traced on the fluorescent screen when the beam is deflected by scanning coils are sometimes distorted from strictly linear form and appear to be composed of a series of waves or in extreme cases of a succession of cycloids. This line distortion which results in considerable loss of definition in pictures when the tubes are used for the reproduction of television pictures, is due to oscillation of the beam about its normal axis, and it has been found that the oscillation is due to the interaction of the electron beam in the presence of a magnetic field, with a beam of positive ions which are formed by the ionisation of the residual gas in the tube by electron impact, the positive ions being caused to move towards the cathode by the same electrostatic field which accelerates the electrons away from the cathode. It has also been found that in order that the line distortion referred to shall be produced, the positive ion beam must be concentrated or focussed to some extent near the region in which the paths of the electrons cross and at which the oscillation is presumed to occur.

As the effect referred to is dependent upon the formation of ions within the tube, it will be clear that the distortion could be eliminated by producing such a high vacuum in the tube that substantially no ionisation occurs. The production of the degree of vacuum which would be necessitated is not easy in practice and it is the object of the present invention therefore to provide a simple and efficacious method of removing the distortion without depending on the maintenance of an exceedingly high degree of vacuum within the cathode ray tube.

In arriving at the solution upon which the invention is based, it has been assumed that the focussing or concentration of the positive ion beam is influenced to a considerable extent by the magnetic field set up by a coil provided to focus the electron beam. Although the positive ions are much less susceptible to magnetic concentration by reason of the relative smallness of their charge/mass ratio, yet in cathode ray tubes as constructed at the present time, the magnetic focussing is effective in a region of substantially zero electrostatic field in which the ions have a very low velocity.

According to the present invention, in a method of reducing or eliminating distortion of the scan-

ning lines in a cathode ray tube due to the cause mentioned, the velocity of the positive ions in the neighbourhood of the magnetic focussing coil is caused to increase to a degree such that the magnetic field due to the coil is incapable of producing sufficient concentration of the ions to enable oscillation in the electron beam to be set up.

In carrying out the invention in one arrangement, the focussing coil is disposed relatively close to the cathode, and the ratio of the distance of the mid-plane of the coil from the cathode to the effective diameter of the anode electrode is less than 1.5 to 1. A further modification of the invention applied to a cathode ray tube in which the anode is constituted by a silver or other conductive coating upon the interior wall of the cylindrical portion of the tube containing the electron gun, consists in the division of the coating into two portions, that nearer the cathode of the tube being maintained at a lower potential than that more remote from the cathode.

In order that the invention may be more clearly understood and readily carried into effect, two cathode ray tubes provided with electron beam controlling arrangements designed to operate in accordance with the invention will now be described in greater detail by way of example with reference to Figures 1 and 2 of the accompanying drawing.

Figure 1 of the drawing shows part of a triode type of cathode ray tube 4 of known construction employing an electromagnetic focussing coil 2 and scanning coils 3. The cathode 4 is provided with a screen 5 and the anode 6 is constituted by a silver or other conductive coating extending along the interior wall of the cylindrical portion of the tube from the cathode end to the flared portion 7. The focussing coil 2 normally encircles the cylindrical portion of the tube and the scanning coils 3 are situated between the focussing coil and the flared portion of the tube.

The dotted lines 8 represent the equipotential surfaces of the electrostatic field set up by the cathode and cathode screen which are substantially at zero potential and owing to the distance between the cathode and the focussing coil this field is usually very weak in the region of the focussing coil and consequently the ions present are susceptible to the action of the magnetic field of the focussing coil. In applying the present invention to such a tube, the ratio of the distance of the mid-plane of the coil from the cathode to the diameter of the anode is made smaller than in the known cases, with the result that the field

of the coil is set up in a region in which the electrostatic field is relatively strong. Preferably, the ratio of the distance of the mid-plane of the focussing coil from the cathode to the diameter of the anode coating is less than 1.5:1. The mid-plane of the coil is represented by the dotted lines 9. Such an arrangement enables the penetration of the field due to the cathode screen 5 to set up a sufficient potential gradient near the mid-plane of the focussing coil to hinder the concentration of the positive ions by the magnetic field. In order to maintain the desired image magnification ratio the diameter of the portion of the tube between the focussing coil and the cathode screen is made greater than would otherwise be the case.

In the cathode ray tube, a part of which is shown in Figure 2, the field in the region of the focussing coil is increased by dividing the anode coating into two sections 10 and 11 leaving a circular ring 12 of clear glass at a position where the magnetic field due to the coil 2 is reasonably strong. A difference of potential is maintained between the two sections of the anode, the section 11 nearest the fluorescent screen of the tube, not shown, being maintained at a higher potential than the section nearer the cathode. Conveniently, assuming that the section 11 of the anode nearest the fluorescent screen is maintained at a potential of 3,000 or 4,000 volts by a source of supply 13 then the section 10 near the cathode 4 is maintained at a potential which is between 20 and 100 volts lower, the difference of potential being produced by the source of supply 14. The actual position of the gap between the two sections of the anode is not critical but it is preferred to arrange it at the end of the focussing coil nearer the fluorescent screen of the tube as shown in the drawing. The desired effect may be achieved by maintaining the section of the anode nearer the fluorescent screen at a lower potential than that nearer the cathode but the former method is preferred.

While particular values of voltages for application to the separate sections of the anode have been indicated, it will be understood that a certain amount of latitude is permissible but, on the other hand, the potential difference between the sections of the anode should not be sufficient to create an electrostatic lens of sufficient power to affect the electron beam appreciably.

I claim:

1. A cathode ray device comprising an envelope having a cylindrical portion and a truncated conical portion, a cathode positioned within the cylindrical portion, and in the order named in register therewith a control electrode, a first anode, a second anode immediately adjacent said first anode, the adjacent portions of said first and said second anode having substantially identical physical dimensions, and a target surface, said first electrode lying within said cylindrical portion of said envelope, and said second anode lying both within the cylindrical and conical portion of said envelope, and a concentrated magnetic focused coil surrounding the portion of said first anode immediately adjacent the second anode.

2. A cathode ray device comprising an envelope having a cylindrical portion and a truncated conical portion, a cathode positioned within the cylindrical portion, and in the order named in register therewith a control electrode, a first anode, a second anode immediately adjacent said first anode, the adjacent portions of said first and said second anode having substantially identical physical dimensions, both said first and said second anodes being deposited upon the inner wall of said envelope, and a target surface, said first electrode lying within said cylindrical portion of said envelope, and said second anode lying both within the cylindrical and conical portion of said envelope, and a concentrated magnetic focused coil surrounding the portion of said first anode immediately adjacent the second anode.

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