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2,103,645

BRAUN TUBE

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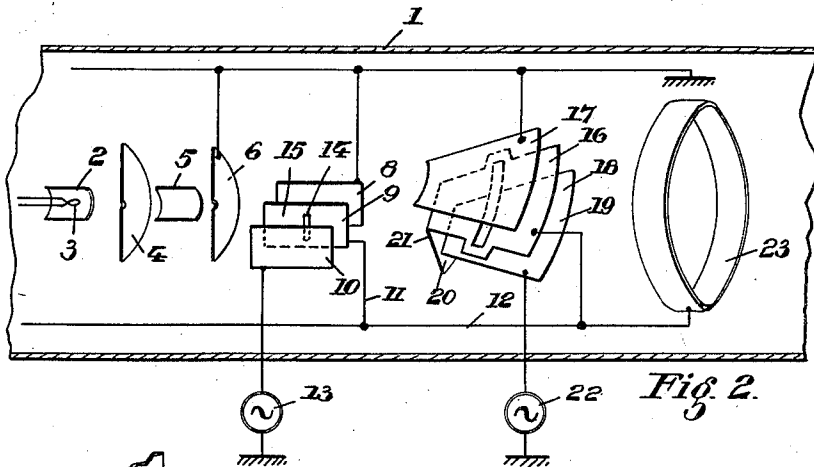


Fig. 2.

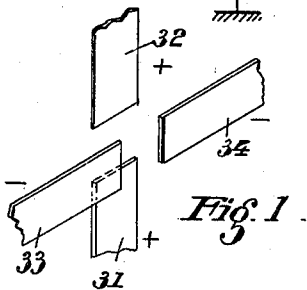


Fig. 1.

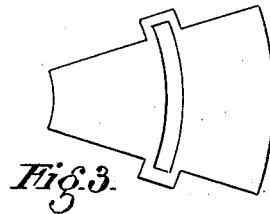


Fig. 3.

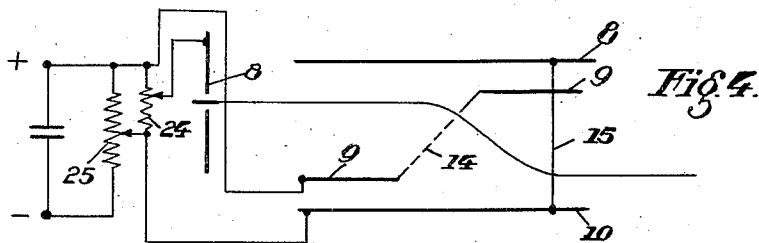


Fig. 4.

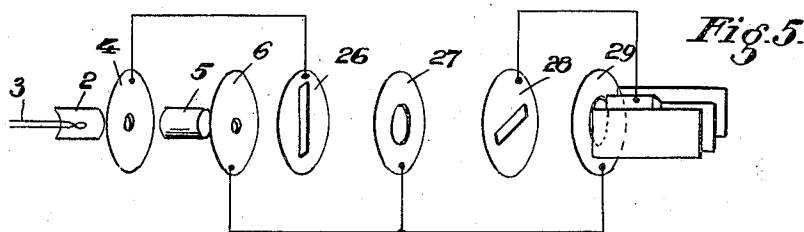


Fig. 5.

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BRAUN TUBE

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3 Claims. (Cl. 250—27.5)

An object of the invention is a method of any arrangement for producing image points of exactly defined form and size in Braun tubes. The generation of points of this nature is necessary more particularly for the production of television images, in which it is desirable to furnish the image points with a rectangular form, the height of which is at least equal to

$$\frac{h}{z}$$

if h is the height of the image and z the number of lines.

Further objects of the invention will be seen from the following description.

The invention will be more fully understood from the drawing, wherein

Fig. 1 shows diagrammatically the basic arrangement according to the invention,

Fig. 2 shows by way of example a form of embodiment of the invention,

Fig. 3 shows a special embodiment of the middle plate of the deflecting system, while

Fig. 4 shows a diagram of the deflecting plates connecting system.

Fig. 5 shows a further embodiment of a Braun tube according to the invention.

According to the invention, there is first produced a bundle of cathode rays of any desired and preferably round cross-section, which bundle is afterwards so formed by the action of suitably selected attraction and/or pressure fields that the image points possess the desired cross-section.

The basic diagram of the arrangement according to the invention is illustrated by way of example in Fig. 1. The preferably pre-concentrated cathode ray of desired form is conducted between two pairs of knife edges 31, 32 and 33, 34.

By applying suitable potentials to these knife edges it is possible to give the ray any desired cross-section. If, for example, it is desired to impart to the ray a rectangular form, whereby the height is greater than the width, the knife edges 31 and 32 are linked up with the same potential, which is positive as compared with the ray, while the knife edges 33 and 34 are furnished either with a slight positive or negative bias as compared with the ray. By varying the potentials it is possible to vary the cross-section of the ray as desired.

To produce a cross-section of the ray which is confined as far as possible by straight lines, it is desirable to dispose the pairs of knife edges in different planes.

In tube systems which contain diaphragms

themselves, and more particularly slot diaphragms, these diaphragms may be employed in place of special pairs of knife edges, more particularly if the length of the slot differs considerably from the width thereof, so that the effect of the two remote edges of the diaphragm may be ignored.

The use of the method according to the invention, employing slot diaphragms already existing in the system, will be described in conjunction with a tube furnished with three-plate systems as is described in the application Serial No. 694,915 filed October 23, 1933.

A tube of this nature is shown by way of example in Fig. 2.

In the drawing 1 is the neck of the tube, 2 the Wehnelt-cylinder, 3 the cathode, 4 the first or screening anode, 5 an after-concentration cylinder, 6 an after-acceleration anode, and 15 and 16 are the two three-plate systems which consist of the outer plates 8 and 10 and 17 and 19 and the middle slotted plates 9 and 18. The two outer plates of the systems may be linked up with anode potential, while the middle plate possesses a potential which is positive in relation to the anode. The cathode ray passing through the anode 6 at first enters the space between the plates 8 and 9, is deflected through the slot 14 and passes out of the system. The final direction of the non-deflected ray is parallel to its direction of entry between the plates 9 and 10. The path of the ray is corresponding in the second system.

To produce a rectangular cross-section of the ray it is necessary, as set forth in the above, to employ two fields vertical to each other, which may be produced by the use of vertically disposed pairs of electrodes which, for example, may have the shape of knife edges.

Now it is possible to replace the pair of knife edges causing the shaping of the ray in the transverse direction, (i. e., in the direction vertical to the line, and accordingly in the longitudinal direction of the slot 14) by the action of the diaphragm 14. For this purpose the diaphragm must be constructed in such fashion that the attraction field of the plate 9, which in itself possesses a positive potential as compared with the ray, produces the desired enlargement of the ray in the transverse direction and does not affect the form of the ray in the longitudinal direction.

The width of the slot, therefore, is preferably increased, while the marginal faces of the slot situated in the direction of the axis of the tube may be approached to such extent towards the

ray as is necessary for obtaining the effect according to the invention.

With a diameter of the pencil of rays amounting to 2 mm. a length of slot 14 amounting to 6 mm. has been found to be suitable assuming the plate 9 possesses a potential of 200 volts as compared with the ray. The plates furnished with the slot may be preferably constructed as cranked plates as described in the application Serial No. 694,915, filed October 23, 1933. The term "cranked plate" means a plate having three parts, the two outer parts being parallel to each other and the middle part being inclined with respect to each of said outer parts, the slot being provided in the inclined portion. The middle plate 18 of the second three-plate system 16 may conveniently be constructed in such fashion that the slot exerts no shaping effect on the ray at all. For this purpose, the slot, as illustrated by way of example in Fig. 3, is constructed in such a manner that the edges of the slot are still spaced to such extent from the ray, even at the greatest possible deflection of the ray, that they are unable to exert any appreciable effect on the same.

By reason of the arrangement as described it is accordingly possible in simple fashion to impart to the cross-section of the ray any desired form in the transverse direction. Corresponding forming in the direction vertical thereto—referred to in the following as the longitudinal direction—may be obtained by a suitably arranged pair of knife edges of suitable potential.

It is, however, also possible in accordance with the invention to obtain this shaping in the longitudinal direction by utilizing the particular properties of the system in question.

It will be quite obvious that the system 15 exerts a deconcentrating effect on the cathode ray when the mean potential of the plates 8 and 9 exceeds the potential of the cathode ray, and that in contradistinction thereto a concentrating effect, which may be increased up to overconcentration, may be obtained when the mean potential of these plates is made negative in relation to the ray.

According to a further object of the invention, the forming of the cross-section of the ray in the longitudinal direction may be obtained by suitable adjustment of the concentrating effect of this system.

A convenient circuit arrangement is illustrated by way of example in Fig. 4. In the same 15 is the three-plate system with the plates 8, 9 and 10, and 6 the anode. The potentials may be adjusted by means of the potentiometers 24 and 25.

Assuming it is desired to furnish the image point with the form of a narrow rectangle in the direction of the line, the system, in accordance with the invention, is to exert a concentrating effect. For this purpose the plates 8 and 10 are furnished with a negative potential in relation to the anode, i. e., the ray, whilst the plate 9 in all cases requires to be connected up with a potential which is positive in relation to the ray. It will be observed, however that the provision of a strongly negative potential at the plates 8 and 10 results in an overconcentration, which leads to an intersection of the pencil of cathode rays, and in turn to an increase in the cross-section. An increase in the cross-section may, therefore, be obtained both by making the plates 8 and 10 positive in relation to the ray as well as by making the same too strongly negative

in relation to the ray. The most convenient potential may readily be determined empirically in the case of every arrangement. It is accordingly possible when employing the method according to the invention to impart to the image point any desired cross-section.

Naturally, the above considerations with regard to the concentrating or deconcentrating effect of the deflecting plate systems also apply to ordinary two-plate deflecting systems.

An arrangement for shaping the ray with the use of special diaphragms is illustrated by way of example in Fig. 5. In the same 2 is the Wehnelt-cylinder having the cathode 3, 4 the preliminary anode, 5 the after-concentration cylinder and 6 the after-acceleration anode. 26 and 28 are the two slotted diaphragms causing the desired forming of the ray.

The degree of forming may be varied as desired both by dimensioning of the width of slot as well as by selection of the potential applied to the slotted plate. According to the invention, those potentials may conveniently be employed which are necessary for the operation of the tube itself. It is possible, for example, to link up the first diaphragm with the preliminary anode, and the second diaphragm with the middle plate of the three-plate system (which plate possesses a positive potential in relation to the anode). The desired shaping may then be obtained without difficulty by proper selection of the width of the slot. In order to avoid variation in the speed of the ray there are preferably connected between the shaping diaphragms or between shaping diaphragm and after-connected parts of the system diaphragms which possess the potential of the main anode. The apertures of these diaphragms are so dimensioned that the edges of the diaphragms, owing to their large spacing away from the ray, exert no or only very little shaping effect on the same. The length of the slots in the shaping diaphragms is such that the shaping takes place solely under the effect of the long bounding faces, and the effect of the narrow faces may be ignored. The method according to the invention may naturally also be performed with the use of magnetic coils.

It will be understood that the described embodiments are only shown by way of example and that the invention is in no way restricted to them.

It is obvious that the invention may be employed in connection with all kinds of Braun tubes and that it may be employed in connection with every kind of deflecting and concentrating means.

The method of the invention enables image points to be produced in any desired form, and accordingly on the one hand a fully marked screen to be obtained, and on the other hand an enhanced quality of the image to be accomplished by diminishing the image element in the direction of the line.

I claim:

1. A Braun tube comprising a cathode and a fluorescent screen, a Wehnelt-cylinder surrounding said cathode, an anode plate arranged between said cathode and said fluorescent screen, a further cylinder arranged between said anode plate and said fluorescent screen, a further anode arranged between said cylinder and said fluorescent screen, a plate furnished with a rectangular slot arranged between said further anode and said fluorescent screen, a screening plate furnished with a central opening arranged between said slot-plate and said fluorescent screen,

a further plate furnished with a rectangular slot, said slot being arranged perpendicularly to the first said slot, said further slot-plate arranged between said screening plate and said fluorescent screen, a further screening plate arranged between said further slot-plate and said fluorescent screen, and two three-plate deflecting systems arranged between said further screening plate and said fluorescent screen, means to connect the first anode with the first slot-plate, means to connect the second anode with each of said screening plates, means to connect said further slot-plate with the middle plate of the first of said deflecting systems, and means to connect all said electrodes with the operating voltages.

2. A Braun tube comprising an evacuated envelope enclosing a cathode and an anode arranged in operative relationship thereto, means for varying the intensity of the ray, said means being arranged between said cathode and said anode, a fluorescent screen, means for deflecting the ray in two directions vertical to each other for scanning said fluorescent screen, and means arranged between said anode and said fluorescent screen for causing the cross-section of the ray proceeding to said screen to assume an exactly

defined constant shape other than that which the ray possesses when projecting from said anode, said means including at least one plate having a rectangular slot, two opposite edges of said slot being arranged in proximity to the path of the ray, the two other edges of said slot being arranged distant from the path of the ray, said plate being adapted to be supplied with a constant potential.

3. A Braun tube comprising a cathode, an anode, electrodes for controlling the intensity of the ray, electrodes for concentrating the ray, a picture receiving screen, at least one deflecting electrodes system mounted between said anode and said screen for applying scanning deflections to the ray, and at least one electrode incorporated between the deflecting electrodes of at least one of said deflecting electrodes systems to produce electro-static fields for causing the cross-section of the ray proceeding to said screen to assume a constant shape other than that which the cross-section of the ray possesses when projecting from said anode, and means for connecting all of said electrodes with the respective operating voltages.

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