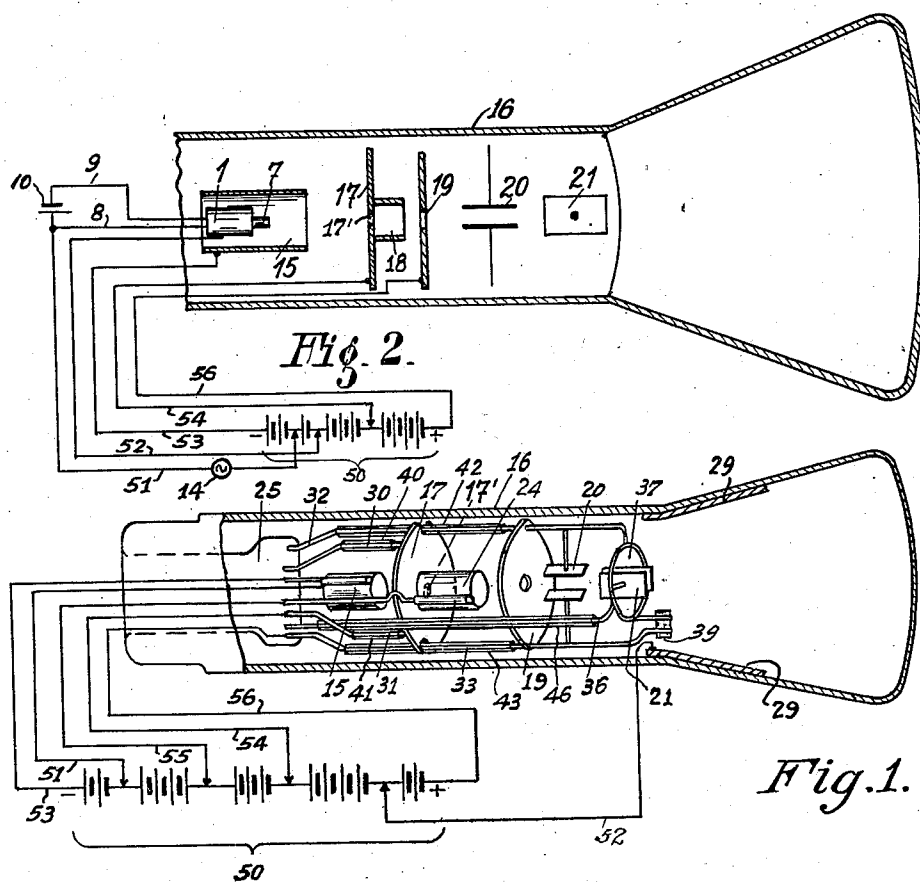


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CATHODE RAY TUBE SYSTEM
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CATHODE RAY TUBE SYSTEM

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The object of this invention is a television arrangement comprising a Braun tube including an electrode system which is so designed and operated with such potentials as to constitute an improved electron optical system.

Structures of Braun tubes which are preferably made use of in arrangements according to the present invention, are described and claimed in the co-pending patent application Ser. No. 70,423 filed March 23, 1936 which is a divisional application of the present one. Those Braun tubes contain intensity controlling means which ensure a constant diameter of the image point with all image point intensities occurring.

I prefer to apply the control potential between the emissive surface of a hot cathode, which is constructed as an equipotential cathode, a cylinder surrounding this hot cathode and furnished with a corresponding positive bias. The cathode is preferably furnished with a two-dimensional, say, circular emissive surface. The control element is constructed in the form of a cylinder, on which there is furnished a tube-like abutment, which is arranged in such fashion that the end surface bearing the tube is still situated within the dark space of the cathode, i. e., in the smallest possible especial disposal to the cathode (for example up to approximately 2 mm.). A spacing of approximately .5 mm. has been found to be particularly suitable. The cathode, together with the cylinder having the positive bias and surrounding the same, is preferably arranged exactly centrally within the Wehnelt cylinder. The ray emerging from the Wehnelt cylinder may then be accelerated and controlled in the manner known per se. There will however hereinafter be described some particularly advantageous systems for accelerating and electron-optically influencing the ray. It is particularly convenient to employ a screening anode, which possesses a relatively low potential, and is of such form that spreading effects between the after-acceleration anode and the cathode are safely avoided. The screening anode may also conveniently be furnished with a tube-like abutment. By corresponding selection of the length of this abutment it may be accomplished in simple fashion that the cathode ray emerging from the screening anode essentially always possesses the same rate of movement. The tube is preferably filled with hydrogen or noble gas of suitable pressure. Naturally it is also quite possible to employ other accelerating and deflecting means.

The arrangement according to the invention acts in the manner of an optical system, in which

the tube aperture of the cylinder constitutes a self-luminous surface of varying intensity, which is reproduced in spot-like fashion on the image screen. The electrical field acts approximately on the lines of an optical system, the focus of which may be varied as desired by suitable selection of the potentials. By corresponding selection of the potentials it is possible to reproduce a desired cross-section of the tube or also if necessary the cathode surface itself on the image screen in spot-like reproduction. It is essential as regards the invention that the direction of the ray, once adjusted, is not varied upon fluctuations in the intensity, i. e., that the spacing between the virtual lens system and the virtual luminous surface remains constant.

The invention is illustrated by way of example in the drawing, Fig. 1 showing an arrangement comprising a Braun tube having an electron-optical system designed and operated according to the invention, while Fig. 2 shows an arrangement comprising a modified structure of the electron optical system.

The cathode cylinder may be arranged inside of the Wehnelt cylinder. It is also possible to arrange the Wehnelt cylinder before the cathode cylinder.

In case it is desired to employ the Braun tube for oscillograph purposes there is applied a constant potential between the cathode container and the cathode instead of a control potential, which enables in a sufficient manner to completely compensate the space charge effects.

In the arrangement described the cathode container serves at the same time for screening off against the fields of the high voltage lines, for centering purposes (since in the arrangement according to the invention it is in substance merely a matter of the position of the aperture 7, while the position of the cathode within the cylinder is not critical, centering is naturally considerably facilitated), for closing off towards the outside, which prevents both rear as well as lateral emission and as space charge network.

In the drawing, 16 is the envelope of the Braun tube, 25 is the stem of the valve, 15 the Wehnelt cylinder. The parts inside the Wehnelt cylinder are not visible in Fig. 1, whereas Fig. 2 shows a metallic cylinder 1 surrounding the cathode and having the tubular abutment 7, which with the assistance of a bias battery is furnished through the medium of the line 52 with a positive potential, which conveniently may amount to approximately 50 volts. The spacing between the end wall of the cylinder

and the emissive surface is made to be as small as possible—approximately 0.5 mm. The filament of the cathode may be fed by the battery 10 over the lines 8 and 9. The control current is supplied from the connection point 14, which is shown as a generator, through the medium of the line 51 to the equipotential surface of the cathode, and accordingly the emissive surface. The emissive surface may be in the form of an oxide coating, or also a metallic emissive surface or the like. 17 is the screening anode with a small aperture 17', 24 the after-concentration cylinder, 19 the after-acceleration anode, 20 and 21 the two pairs of control plates, which may possess the same potential. It has been proved suitable to arrange the cylinder 24 as close as possible to the screening anode. It is also possible to reach the effect according to the invention in case the cylinder is arranged in about the middle between the ante- and the after-acceleration anode; in contradistinction to this it is unsuitable to arrange this cylinder close to the after-acceleration anode. 30, 31, 32, 33, 36 and 37 are parts of the supporting structure, 39 an isolation separator, for instance consisting of mica. Naturally shape, size and arrangement of the system as well as of the electrodes may be different from those illustrated by way of example in the drawing. In the modification shown in Fig. 2, the electron optical system comprises two juxtaposed apertured plates 17 and 19, one having, at its side facing the other one, a tubular abutment 18.

The supporting wires 30, 31, 32, 33, 36, and 37 at the same time serve as leads. They are partly surrounded by insulating tubes 40, 41, 42, 43 and 46.

It is also possible to give the anode a shape of a little casket. The image screen may suitably be furnished with a thin metallic layer, which nearly possesses the potential of the anode or suitably a higher potential than the after-acceleration anode. Instead of metallizing the image screen itself, on the walls of the tube near the image screen a metallic ring, respectively a metallic deposit possessing the above mentioned potential may be arranged. 29 is an auxiliary electrode, which may preferably consist of a thin metallic layer, e. g. of silver. As is clearly shown in the figure the electrode is arranged near the last deflecting plates pair preferably between the said pair and the luminescent screen. The electrode 29 may have a length of 7-14 cm., if the length of the conical portion of the tube is 26 cm., preferably in this case the electrode may have a length of 11 cm. Generally the electrode must be made short as to avoid a deflecting effect of said electrode to the cathode ray. The potential, the electrode is to be supplied with, depends on the length of said electrode and is in each case to be found without difficulty by experiments. If a certain potential shall be employed the length, the electrode must have, is to be found by experiments, by suitable choice of the length of the electrode 29 and of the potential it is supplied with. It is possible to produce television pictures which are entirely clear at all points.

The valve may suitably be used with gas-filling in a manner known per se.

The dimensioning of the potentials to be employed depends upon the distance of the image screen from the electron-optical system, as well as upon the shape, the size and the distance of the electrodes between each other. As a result

of experiments with valves of the usual dimensioning, the potentials of the electrodes required for bringing the cathode ray to a focus on the image screen were found to lie within the following limitations; the potential of the space charge controlling cylinder (Wehnelt cylinder) to about -100 to -200 volts, screening anode +250 to +500 volts; after-concentration cylinder +100 to +250 volts; after-acceleration anode +1500 to +4000 volts. The electrode system once fixed, makes it possible without difficulties to adjust the several voltages to the exact values required to obtain a sharp electron optical image on the screen.

In the drawing the D. C. voltage supply is indicated by a battery 50, which, however, may of course be replaced by any other voltage supply, for instance a main supply apparatus. The cathode is maintained on what is usually defined as zero potential (though it need not be earth potential) by means of the lead 51. (The controlling variations are hereinafter disregarded as they do not appreciably alter the electron optical conditions). The Wehnelt cylinder 15 is negatively biased in relation to the cathode (briefly negatively biased) by means of the lead 53. The first anode 17 is maintained positive by means of the lead 54, the after-concentration cylinder 24 is also maintained positive, but less so than the first anode, by means of the lead 55. A high positive potential is impressed on the second anode 19 by means of the lead 56, and the electrode 29 is maintained slightly, i. e. to about 100 to 300 volts negative in relation to the second anode 19 by means of the lead 56.

Special shaping, size, dimensioning or arranging of the electrodes may make it necessary to deviate in not an unessential manner from the above mentioned dimensions of voltages.

I claim:

1. A television arrangement including a Braun tube comprising an indirectly heated cathode, a Wehnelt cylinder surrounding said cathode, a first anode, a further cylinder, and a second anode, said first anode, said further cylinder, and said second anode being mounted in axial consecution, cathode ray deflecting means, means to impress onto said Wehnelt cylinder a negative bias in relation to said cathode, means to maintain said first anode positive in relation to said cathode, means to maintain said further cylinder positive in relation to said cathode but negative in relation to said first anode, and means to maintain said second anode positive in relation to said first anode.

2. A television arrangement including a Braun tube comprising an indirectly heated cathode, a Wehnelt cylinder surrounding said cathode, a first anode, a further cylinder, and a second anode, said first anode, said further cylinder, and said second anode being mounted in axial consecution, cathode ray deflecting means, means to impress onto said Wehnelt cylinder a bias of about -50 to -150 volts in relation to said cathode, means to supply said first anode with about +100 to +500 volts in relation to said cathode, means to supply said further cylinder with a potential slightly below that of said first anode, and means to supply said second anode with about +1500 to +4000 volts in relation to said cathode.

3. A television arrangement including a Braun tube comprising an indirectly heated cathode, a Wehnelt cylinder surrounding said cathode, a

first anode, a further cylinder, a second anode, and two pairs of deflecting plates, said first anode, said further cylinder, said second anode, and said two pairs of deflecting plates being
5 mounted in axial consecution, a fluorescent screen, an auxiliary electrode consisting of a wall coating applied to the inner side of the tube wall, said coating beginning near the end more remote from said cathode of that one of
10 said pairs of deflecting plates mounted more remote from the cathode and extending towards said fluorescent screen, said auxiliary electrode

having a length of about 8 to 12 centimetres, means to impress onto said Wehnelt cylinder a negative bias in relation to said cathode, means to maintain said first anode positive in relation to said cathode, means to maintain said further
5 cylinder positive in relation to said cathode but negative in relation to said first anode, means to maintain said second anode positive in relation to said first anode, and means to maintain said auxiliary electrode weakly negative in rela-
10 tion to said second anode.

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