June 8, 1937. K. SCHLESINGER 2,083,203

BRAUN TUBE

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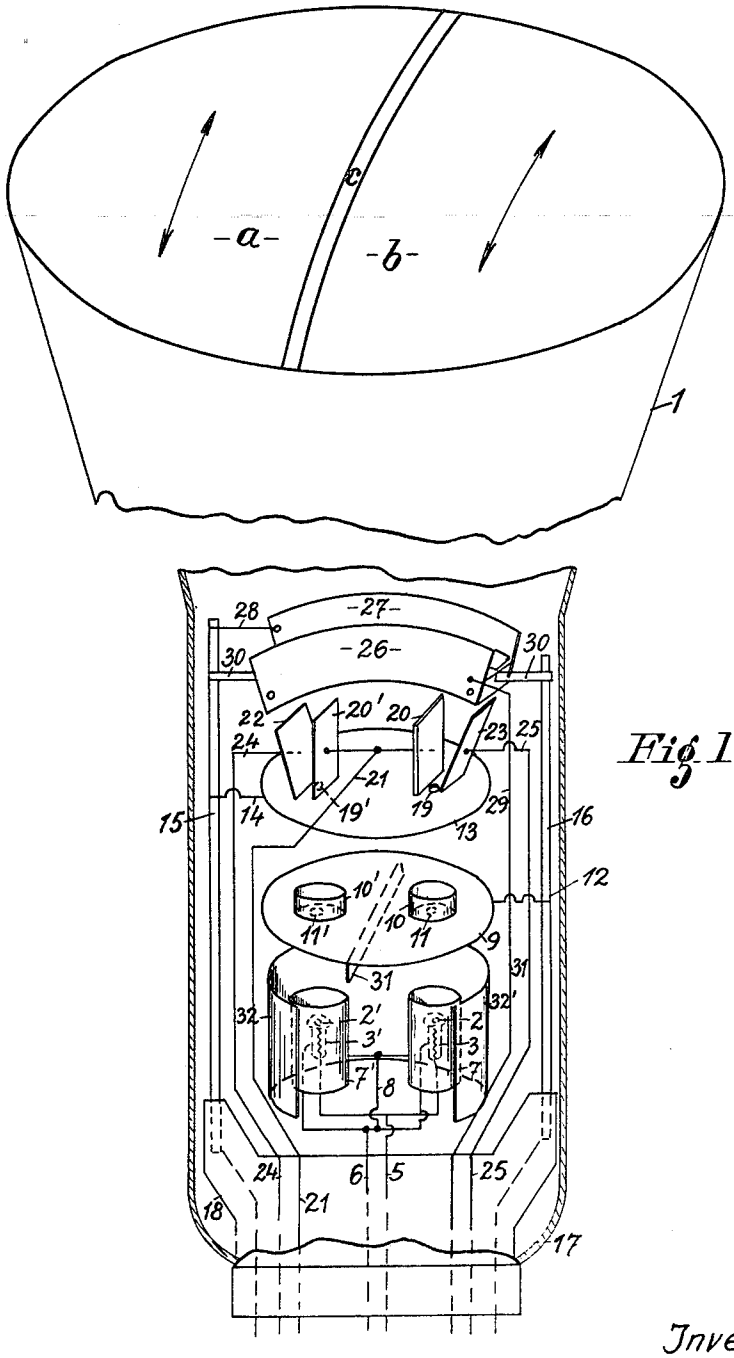

Fig 1.

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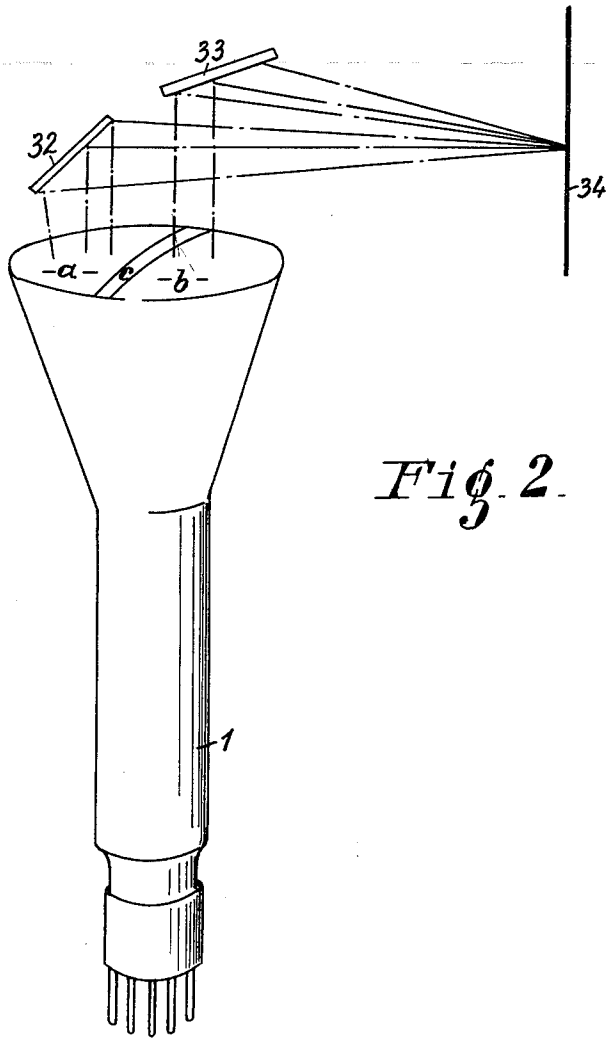

Fig. 2.

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BRAUN TUBE

Kurt Schlesinger, Berlin, Germany

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6 Claims. (Cl. 250—27.5)

The object of the invention is a Braun tube, in which means are provided for producing two or more cathode rays which are independent of each other. The tube according to the invention may be furnished with two or more ray producing and deflecting devices. It is, however, also possible according to the invention to employ merely one single cathode for producing a relatively large number of independent cathode rays, for example a cathode having a subdivided emissive surface.

According to the invention, all corresponding parts of the different systems, insofar as the same possess the same potential, are linked up with the same leads, and in this manner the number of leading-in points, i. e., the sealing points, are very greatly reduced. Thus, for example, in the case of a two-system tube according to the invention, merely one sealing point more is required than in the case of the tubes hitherto known.

The requisite independency of the single rays may be accomplished, in accordance with the invention, by subjecting all rays, or a number of them, to a preliminary deflection (bending of the ray), which is such that the rays, even in the case of the maximum deflection, are unable to pass beyond the range of image screen intended for the same. For this purpose the one plate of each vertical deflection system may be furnished, for example, with a correspondingly selected bias. Naturally, however, it is also possible to employ any other known means for producing a bend in the ray.

The tube according to the invention may be employed, for example, in the measuring art for simultaneously rendering visible or recording the current and potential curves of the same electric occurrence. The tube according to the invention may be employed particularly well for purposes of television in colours. For producing a coloured image there are, in accordance with the invention, produced simultaneously on different parts of the luminous screen, which are furnished with substances emitting light of different colours, a number of differently coloured images corresponding with the number of systems, and these images are projected one over the other in such fashion that the axes thereof completely coincide. If, for example, three systems are employed, and the parts of the image screen corresponding with the three systems are coated with luminous substances which emit light in the three basic colours, it is possible without difficulty to reproduce television images exactly true to colour. The arrangement in this case is particularly simple, as the deflecting plates of all systems may be linked up with the same tilting generator, so that the synchronism of the three differently coloured images is absolutely ensured. The transmission of the different intensity potentials may be performed quite readily with the means known at the present time, through the medium of a plurality of passages or with the assistance of a multimodulated carrier wave.

Of the appended drawings,

Fig. 1 shows by way of example a form of embodiment of a tube according to the invention having two systems.

Fig. 2 shows an arrangement for producing coloured television images.

In Fig. 1, 1 is the bulb of the Braun tube, 2 and 2' are the two cathodes, which in accordance with the invention may conveniently be constructed in the form of indirectly heated hollow-reflector cathodes. The heating of the cathodes takes place by means of the filaments 3 and 3' which are, in parallel to each other, connected with the heating current leads 5 and 6. The equipotential surfaces of the cathodes may be directly connected with the zero point of the heating line. 7 and 7' are two Wehnelt cylinders which—assuming the tube is employed for oscillographic purposes—may possess a zero potential, the preliminary concentration of the hollow-reflector cathode employed in accordance with the invention being such that a further concentration by means of a Wehnelt cylinder is not absolutely essential. Naturally, however, the two Wehnelt cylinders may also be furnished with a corresponding negative bias, and if necessary also employed for purposes of light control. 9 is the preliminary anode. The same is attached to the support 16, which at the same time may be constructed as current lead, and may be connected with the line 17. The screening anode 9 possesses the two apertures 11 and 11', which may be furnished with the two edge-field concentration cylinders 10 and 10'. The main anode 13 receives the anode potential over the connection 14 from the lead 15, which at the same time may be constructed as a supporting member and is furnished with the lead 18. The main anode also possesses two apertures 19 and 19' for the two rays proceeding from the cathodes 2 and 2'. In the vicinity of the anode there are situated the first two pairs of deflecting plates. The two deflecting plates 20 and 20' may conveniently be arranged parallel to the axis of the tube, and receive through the medium of the line 21 a suitable negative bias, which is such that the two rays can-

not pass beyond the marginal lines bounding the image-screen portions *a* and *b* assigned to the same, even in the case of maximum deflection. By means of this ray-bending effect there is simultaneously avoided the so-called centre-point error. Both images are free of the effect known as the "ion cross". The plates **22** and **23** of this pair of deflecting plates receive their deflecting potentials (which are different upon the simultaneous production of different curves) over the lines **24** and **25** and are arranged at a suitable angle in relation to the two plates **20** and **20'**. In front of these two pairs of deflecting plates there are situated, common to both systems, the pair of time-deflection plates, which conveniently may be given the shapes of ring sectors. Those parts of the bounding curves of these plates which confine the zones assigned to the two rays may conveniently be in the form of parts of circles, the centre-points of which are disposed in the geometric centre-points of the first two pairs of deflecting plates.

By the embodiment of the first pair of plates in accordance with the invention, i. e., more particularly by the bias applied to the plates **20** and **20'**, it is accomplished that the ray proceeding from the cathode **2** is unable to pass beyond the confines of the image field *b*, and the ray proceeding from the cathode **2'** beyond those of the image field *a*. In this manner any mutual interference between the two rays is at the same time safely avoided.

In place of the system which has been described for the sake of ready comprehension, systems may conveniently be employed, assuming the tube operates with a filling of gas, in which the formation of an ion cross is safely avoided by a preliminary deflection of the cathode ray prior to its entry into the deflecting systems.

Further, it is also desirable to provide closely above the deflecting plates **26** and **27** an auxiliary electrode preferably in the form of a ring extending practically up to the glass wall and raised to the potential of the after-acceleration anode or a potential which is positive in relation thereto, to metallize partially—for example over a length of 8–12 cm.—the part of the bulb situated between this electrode and the fluorescent screen, and to furnish the metallized portion with a potential which is weakly negative in relation to the auxiliary electrode.

Between the preliminary anode **9** and the main anode **13** there may conveniently be arranged Wehnelt cylinders, which possess a weakly negative potential in relation to the preliminary anode.

It has been found that the two cathode rays do not affect each other in the space between the preliminary anode **9** and the fluorescent screen.

On the other hand the two cathode rays exert in the space between the cathodes and the preliminary anode, in which space the electrons possess a relatively low speed, a repelling action on each other, which may produce undesirable distortions. In the same manner, it has been ascertained that there may be disturbing and fully uncontrollable influence of the high-tension leads on the cathode rays.

According now to a further object of the invention, means are provided

1. For compensating the influence of the two cathode rays in relation to each other, and

2. For precluding the effect of the high-tension leads.

To compensate the repelling effect of the two cathode rays in relation to each other, there is provided, generally speaking, according to the invention, in the space between the cathodes and the preliminary anode an electric field, which with regard to both cathode rays acts as attraction field, the strength of which is so selected that it exactly counterbalances the effect of the mutual pressure field.

This electric attraction field is preferably produced by an auxiliary electrode which may be given any desired form, the desired effect being obtained by the application of a correspondingly selected bias. It is then merely necessary to arrange the auxiliary electrode symmetrically to the cathode rays to be affected.

Careful investigations have shown that the introduction of a special auxiliary potential may be avoided if the auxiliary field is formed and arranged in suitable fashion.

For this purpose the auxiliary electrode, in accordance with the invention, may be constructed as a knife edge **31** conductively connected with the preliminary anode **9**.

Further, there are provided between the pinch and the preliminary anode two, for example semicylindrical elements **32** or **32'** partly surrounding the Wehnelt cylinders **7** or **7'** and preferably adjusted to zero potential.

By suitable selection of the height of the knife edge **31** it is possible without difficulty to compensate absolutely the mutual influence of the cathode rays. At the same time, by reason of the screening effect of the elements **32** and **32'**, the influence of the high-tension leads, which in accordance with the invention are disposed behind these elements, is avoided entirely.

In the tube according to the invention mutual effects of the cathode rays on each other do not occur at any point, so that the faultless production of a plurality of independent images is fully ensured.

The differently coloured images produced by the two rays may now, in accordance with the invention, for example as illustrated in Fig. 2, be projected in such fashion by means of the reflectors **32** and **33** on to the image screen **34** that the axes of the two images coincide, to produce coloured television images.

It is also possible in perfectly corresponding fashion by the method according to the invention to produce independently more than two, preferably three images of preferably different colours and to unite the same optically to form a single image by projection on to the common image screen or by equivalent means.

The tube according to the invention may conveniently be furnished in the manner known per se with a metallic outer coating linked up with a constant potential, for example with earth. A coating of this nature is of particular importance in the arrangement according to the invention insofar as upon the omission of the same the wall charges produced by the one system would also act detrimentally on the other ray. The deflection of the ray in the stationary condition may conveniently be such that upon a complete scanning of the two image surfaces there remains between the same a certain intermediate space, which may possess, for example, a width of 5 mm.

I claim:

1. A Braun tube comprising an envelope, a plurality of systems within said envelope, each of said systems comprising a cathode and an anode arranged in operative relationship thereto for

producing a cathode ray, means for controlling the intensity of the ray, means for concentrating the ray and means for deflecting the ray, a picture receiving screen arranged within said envelope, said screen having a plurality of parts, each of said parts of the screen co-operating with one of said systems for the purpose of producing one independent picture, and means for preventing an influence of the different cathode rays upon each other, said means including deflecting means producing a constant pre-deflection of each of said cathode rays.

2. A Braun tube comprising an envelope, a plurality of systems within said envelope, each of said systems comprising a cathode and an anode arranged in operative relationship thereto for producing a cathode ray, means for controlling the intensity of the ray, means for concentrating the ray and means for deflecting the ray, a picture receiving screen arranged within said envelope, and means for preventing an influence of the different rays upon each other, said means being arranged between the cathode and the anode of the respective systems.

3. A Braun tube comprising an envelope, a plurality of systems within said envelope, each of said systems comprising a cathode and an anode arranged in operative relationship thereto for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the ray and two pairs of deflecting plates, one plate of that pair of deflecting plates, which is arranged next to said anode, being adapted to be supplied with a constant bias for the purpose of producing a constant pre-deflection of the ray, and a picture receiving screen arranged inside said envelope, different areas of said screen each co-operating with one of said systems for the purpose of producing a plurality of entirely independent pictures.

4. A Braun tube comprising an envelope, a plurality of systems within said envelope, each of said systems comprising a cathode and an anode arranged in operative relationship thereto for producing a cathode ray, an electrode for controlling the intensity of the ray, electrodes for concentrating the ray and two pairs of deflecting plates, one plate of that pair of deflecting plates, which is arranged next to said anode, being arranged in parallel to the tube axis, and the other plate of said system being disposed at an angle of at least 20° in relation to the first said one, and a picture receiving screen arranged inside said envelope, different areas of said screen each co-operating with one of said systems.

5. A Braun tube comprising an envelope, a plurality of systems arranged within said envelope, each of said systems comprising a cathode, an anode being adapted to be supplied with a high positive potential, a further anode being adapted to be supplied with a lower positive potential, said further anode being arranged between said cathode and the first said anode and being furnished at its side facing the first said anode with a cylindrical abutment, and two pairs of deflecting plates, a picture receiving screen arranged inside said envelope, the single parts of said screen each co-operating with one of said systems for the purpose of producing a plurality of independent pictures which are entirely independent of one another, and means for preventing an influence of the different rays upon each other.

6. A Braun tube comprising an envelope, a plurality of systems arranged within said envelope, each of said systems comprising a cathode, an anode being adapted to be supplied with a high positive potential, a further anode being adapted to be supplied with a lower positive potential, said further anode being arranged between said cathode and the first said anode and being furnished at its side facing the first said anode with a cylindrical abutment, and two pairs of deflecting plates, connecting means for the first said anode and for said deflecting plates, means for screening off the space between said cathode and said further anode against said connecting means, a picture receiving screen arranged inside said envelope, the single parts of said screen each cooperating with one of said systems for the purpose of producing a plurality of independent pictures which are entirely independent of one another and means for preventing an influence of the different rays upon each other.

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