

Jan. 30, 1940.

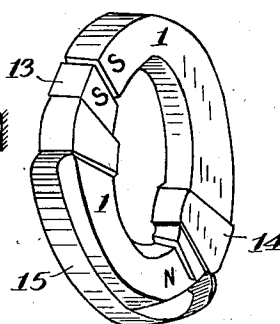
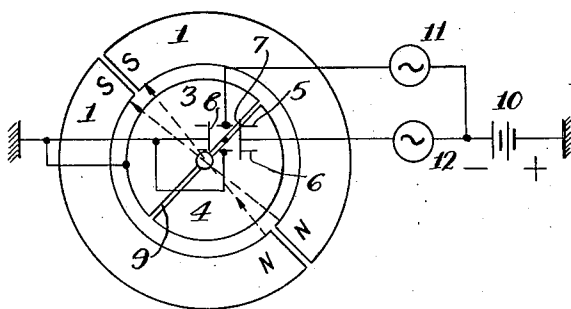
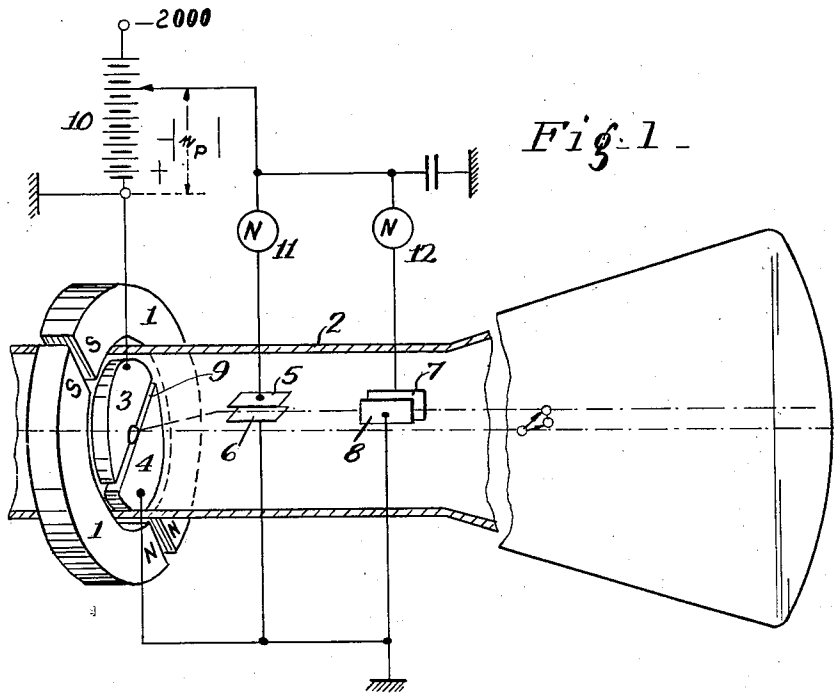
K. SCHLESINGER

2,188,579

CATHODE RAY TUBE, MORE PARTICULARLY FOR TELEVISION PURPOSES

Filed May 19, 1934

2 Sheets-Sheet 1



Inventor:

Kurt Schlesinger.

Jan. 30, 1940.

K. SCHLESINGER

2,188,579

CATHODE RAY TUBE, MORE PARTICULARLY FOR TELEVISION PURPOSES

Filed May 19, 1934

2 Sheets-Sheet 2

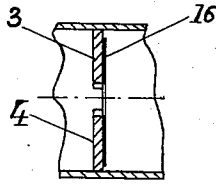


Fig. 4a.

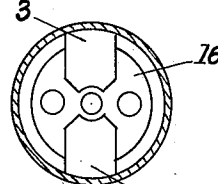


Fig. 4b.

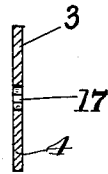


Fig. 5a.

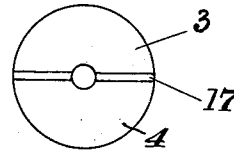


Fig. 5b.

Fig. 5.

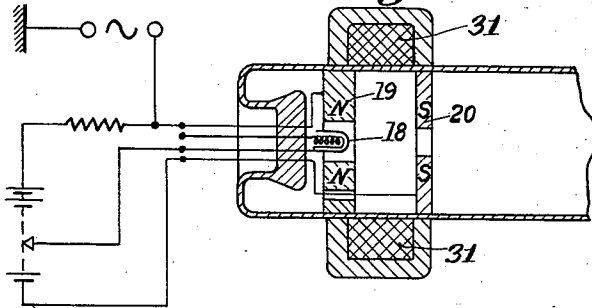


Fig. 6.

Fig. 8.

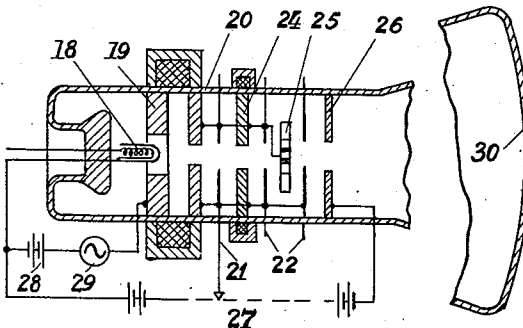
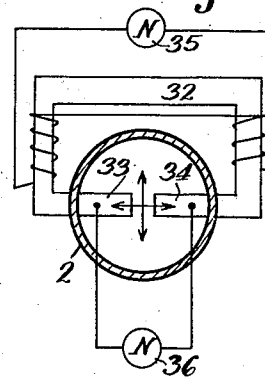


Fig. 7.



Inventor:

Kurt Schlesinger

UNITED STATES PATENT OFFICE

2,188,579

CATHODE RAY TUBE, MORE PARTICULARLY
FOR TELEVISION PURPOSES

Kurt Schlesinger, Berlin, Germany, assignor, by
mesne assignments, to Loewe Radio, Inc., a
corporation of New York

Application May 19, 1934, Serial No. 726,477
In Germany May 27, 1933

8 Claims. (Cl. 250-157)

It has already been proposed to employ magnetic fields for concentration and for deflection of the cathode ray in Braun tubes.

The known arrangements of this kind, in which the fields are produced by coils arranged outside of the tube, possess, however, inter alia, the following disadvantages, by reason of which their use in practice is made extremely difficult:

The coils possess a relatively large variable field of dispersion, so that it is impossible to limit the action on the ray to a certain distance.

Very powerful fields and accordingly high control outputs are required, so that the coils cannot be replaced, or only with extreme difficulty, by permanent magnets, even in those cases in which only a constant deflection of the ray is called for.

Combination of the magnetic action with an electrostatic action on the ray is incapable of being performed in the majority of cases.

To avoid certain of the disadvantages referred to it has already been proposed to arrange the magnet coils within the Braun tube. This proposal, however, is extremely difficult to fulfil in practice owing to the difficulties associated with the outgassing, and moreover causes an increase in the fields of dispersion.

The object of the invention is a Braun tube which avoids the disadvantages referred to, permits of operation without fields of dispersion and with comparatively low outputs, and allows of any desired combination of the magnetic and electrostatic action on the ray.

According to the invention, field generators (magnet coils or permanent magnets) are combined, outside of the tube but as close as possible to the walls of the tube, with pole shoes within the tube vacuum, which shoes likewise extend as close as possible up to the wall.

For deflecting devices the pole shoes may be constructed in the form of a slotted plate, the slot (air gap) of which is situated in the desired direction of diversion.

This most simple form of embodiment may be employed according to the invention for example for producing a constant preliminary deflection of the ray before its entry into the deflecting system—such as necessary when using static deflecting means for producing images devoid of an "ion cross".

For producing a constant deflection of this kind it is convenient in accordance with the invention to employ a permanent magnet.

This magnet may be conveniently constructed, for example, as a double magnet composed of two

half-rings furnished with a gap and surrounding the neck of the tube, and made to be rotatable to permit of adjustment of the deflecting device.

In order at the same time—for purposes of adjustment—also to be able to vary the strength of the magnetic deflection, there is furnished between the two half-ring magnets, in accordance with the invention, a magnetic shunt, the strength of which is adjustable and regulates the strength of the main field. This regulating device according to the invention—which in its most simple form consists of an adjustable wiper of ferro-magnetic material, which enables different points of the two magnets to be connected together—may be employed quite generally for adjusting the strength of field of permanent magnets.

For producing fields free of interference there may be employed in accordance with the invention double-ring arrangements, the rings of which are connected with each other magnetically outside of the tube, and are acted upon in such fashion that the one ring acts as north pole and the other as south pole. Since the field lines in this arrangement are disposed solely in the space between the two annular plates, this arrangement according to the invention does not reveal any fields of dispersion.

An arrangement of this nature in accordance with the invention—particularly if the diameter of the aperture in the plate arranged on the cathode side is considerably larger than that in the second plate—represents an ideal magnetic lens, which may be employed, for example, as concentration lens in Braun tubes for television purposes.

In accordance with the invention, the pole-shoe plates may at the same time also assume an additional electrostatic function which is independent of their function proper, for example may be connected with a suitable potential and employed as anode of the system, control or concentration element or the like.

Instead of producing the entire plate of ferro-magnetic material, it is also possible in accordance with the invention to employ a plate of non-magnetic material (for example copper), and to furnish this on the one or on both sides with coatings of a suitable ferro-magnetic material (for example, permalloy or steel), which in the particular instance concerned possess the most suitable form for the pole-shoes.

This form of embodiment also has the additional advantage that the non-magnetic supporting plate does not require to be slotted over

its entire width, and it is sufficient to make the transverse slot merely of the width necessary for the desired deflection.

It is, however, also possible according to the invention to produce the pole-shoes in the form of a plate of ferro-magnetic material with throughgoing slot, and to fill out the slot—so far as the same is not required as aperture for the cathode ray—with a non-magnetic but electrically conductive material, for example copper, and in this manner to supplement the slotted plate electrostatically to form, for example, a cylinder (perforated disc).

In numerous cases it is desirable to furnish more particularly the side of the pole-shoe electrodes directed away from the cathode with a special, say, mould-like form, as in this manner the concentration effect for example may be additionally amplified.

In order to be able to manage with a control output as small as possible, the magnetic arrangement in accordance with the invention is located—as far as possible—at those points of the tube at which the cathode ray, corresponding with the drop in potential, possesses the least speed.

As will readily be apparent, the arrangement according to the invention permits of a large number of very different combinations of magnetic and electrostatic action on the ray, preferably by the use of the same electrodes, of which merely the following shall be mentioned by way of example:

1. Electrostatic (space charge) control and magnetic concentration.
2. Static anode effect and magnetic deflection.
3. Static concentration and magnetic deflection.
4. Static control, magnetic concentration and magnetic deflection.

The use of the magnetic concentration enables the high-tension anode to be provided after the deflecting system, and the deflection to be performed in the space in which the ray possesses a low speed.

As already set forth, the invention is in no way limited to the stated combinations.

Some possible forms of embodiment of the invention are illustrated by way of example in the drawings, in which

Fig. 1 shows a Braun tube, in which the arrangement according to the invention produces a constant preliminary deflection of the ray (geometric bias), and at the same time is employed as anode of the system.

Fig. 2 shows the same arrangement in section, whilst

Fig. 3 illustrates a form of embodiment of the magnetic shunt according to the invention.

An element according to the invention, in which the pole-shoes are secured to a non-magnetic but electrically conductive base, is shown in section in Fig. 4a, and in plan elevation in Fig. 4b.

A modification in which the two massive pole plates are filled out by filling the ends of the gap with non-magnetic metal, is shown in section in Fig. 5a, and in plan elevation in Fig. 5b.

In Fig. 6 there is indicated diagrammatically a Braun tube with electrostatic control and magnetic concentration, whilst in

Fig. 7 there is illustrated a Braun tube with static control and magnetic concentration and deflection.

Fig. 8 is a cross-sectional view of an arrange-

ment in which both the vertical and the horizontal scanning deflections are effected on the cathode ray in the same cross-section of the tube, one of the said two deflections being produced by electro-magnetic, the other one by an electro-static influence acting on the ray.

In Figs. 1 and 2, 1 is the two-part permanent magnet, which surrounds the neck of the tube 2 with the least possible spacing and preferably is arranged to be rotatable, 3 and 4 are the pole-shoes according to the invention having the slot 9 disposed at an angle of 45° to the deflecting plates 5 and 6, or 7 and 8. To the plates 5 and 7 there is conducted the deflecting potential from the generators 11 and 12, and the constant negative bias necessary for the return of the ray from the potential source 10. The pole-shoes 3 and 4 and also the plates 6 and 8 are earthed. The pole-shoe plate may accordingly be quite readily employed itself as anode of the system.

As shown in Fig. 3, there may be provided at the magnet 1—a magnetic shunt, which comprises the loops 13 and 14 and the connecting piece 15 consisting of ferro-magnetic material, and which does not affect the main field when the loops 13 and 14 connect points of equal magnetic potential, but more or less weakens the main field in all other positions of the loops.

As indicated in Figs. 4a and 4b, the pole-shoes 3 and 4 may be mounted on a plate 16 composed of non-magnetic but electrically conductive material.

According to Figs. 5a and 5b, the gap between the pole-shoes 3 and 4 may be filled out with a strip 17 of non-magnetic metal (for example copper), and in this manner supplemented to form an element acting electrostatically as a plate (cylinder).

In the arrangement according to Fig. 6 the bundle of electrons produced by the cathode 18 is concentrated by the field between the pole plates 19 and 20, which field is produced by a magnet coil 31 arranged outside of the tube, or also by a permanent magnet. The alternating potential controlling the intensity of the ray is located between the equipotential surface of the cathode 18 and the front field plate 19. The plate 20, if desired, may be furnished with a potential which is positive in relation to 18, as the magnetic concentration is so intense that the variation in the static field does not produce any kind of appreciable interference.

A form of embodiment of a complete tube according to the invention is illustrated diagrammatically in Fig. 7.

In the same 18 is the cathode, 19—20 the magnetic concentration arrangement, 24 and 25 are the magnetic deflecting elements, 21, 22, 23 screening means, which are furnished with a constant positive potential and ensure that the ray does not undergo any variation in speed upon its passage through the deflecting systems, 26 is the (high-tension) anode of the system and 30 the bottom of the tube preferably covered at its inside with a fluorescent layer.

The intensity control potential indicated by the generator 29 may be applied direct between the cathode 18 and the plate 19, which if desired may be furnished with a negative bias. The deflecting elements 24 and 25 may be constructed in accordance with Figs. 4a, b or 5a, b. The element 24, if desired, may be furnished with a negative potential, and then acts as after-concentration device.

The bias for the screening means may be made

relatively low (for example 300-500 volts), so, that the ray when passing through the deflecting fields possesses a comparatively low speed.

Particular attention may be drawn to the fact that the forms of embodiment indicated as particularly favorable in the case of the single arrangements may be used in literal adaptation in the case of all arrangements.

In the arrangement according to Fig. 7 the control of the intensity may also take place fundamentally by varying the potential at the anode 26, as a variation in potential at this point of the system does not affect either the concentration or the deflection of the ray.

In an arrangement according to Fig. 8 the elements 33 and 34 act at the same time as pole-shoes of an electro-magnet 32, excited by a deflecting voltage generator 35, and as deflecting electrodes supplied with deflecting voltages from another generator 36. Thus both the vertical and the horizontal deflections are effected on the cathode ray in the same cross-section of the tube.

The arrangement according to the invention is quite readily capable of use both for gas-filled as well as high vacuum tubes. It is particularly convenient, however, to employ the same in conjunction with residual-gas tubes, i. e., tubes in which the gas filling discloses a pressure of approximately 10^{-4} - 10^{-5} mm.

I claim:

1. A Braun tube including an evacuated envelope, means for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen, and pole shoes mounted entirely within said envelope to extend substantially in a cross-section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray; means for producing a magnetic field mounted outside said envelope and arranged in operative relationship to said pole shoes but mechanically separated therefrom by the wall of said envelope.

2. A Braun tube including an evacuated envelope, means for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen, and pole shoes mounted entirely within said envelope to extend substantially in a cross section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray; means producing a magnetic field mounted outside said envelope and arranged in operative relationship to said pole shoes but mechanically separated therefrom by the wall of said envelope; and means for connecting said pole shoes with a potential source.

3. A Braun tube including an evacuated envelope, means for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen and pole shoes mounted entirely within said envelope on a common base consisting of a non-magnetic but, electrically conductive material having a circular cross-section substantially coinciding with a cross-section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray, means for producing a magnetic field mounted outside said envelope and arranged in operative relationship to said pole shoes but mechanically separated therefrom by the wall of said envelope, and means for connecting said pole shoes with a potential source.

4. A Braun tube including an evacuated envelope, means for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen and pole shoes

mounted entirely within said envelope to extend substantially in a cross section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray, the gaps between said pole shoes being filled up with a non-magnetic electrically conductive material for combining said pole shoes mechanically to form an electrically conductive unit of circular cross-section, means for producing a magnetic field mounted outside said envelope and arranged in operative relationship to said pole shoes but mechanically separated therefrom by the wall of said envelope, and means for connecting said pole shoes with a potential source.

5. A Braun tube including an evacuated envelope, means for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen, and two pairs of pole shoes mounted near each other and entirely inside said envelope to extend each substantially in a cross section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray; means mounted outside said envelope for causing the formation of a concentrating field between said two pairs of pole shoes, said last mentioned means being mechanically separated from said pole shoes by the wall of said envelope.

6. A Braun tube including an evacuated envelope, means for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen and pole shoes mounted entirely within said envelope to extend substantially in a cross section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray, the gaps between said pole shoes being filled up with a non-magnetic electrically conductive material for combining said pole shoes mechanically to form an electrically conductive unit of circular cross-section, means for producing a magnetic field mounted outside said envelope and arranged in operative relationship to said pole shoes but mechanically separated therefrom by the wall of said envelope, said last mentioned means including two half-ring-shaped magnets and a magnetic shunt comprising two loops, each of said loops surrounding one of said magnets, and a piece of ferro-magnetic material connecting said loops with one another, and means for connecting said pole shoes with a potential source.

7. A Braun tube including an evacuated envelope, a cathode, means including said cathode for producing a cathode ray directed substantially along the axis of said envelope, a picture receiving screen, and two pairs of pole shoes mounted near each other and entirely inside said envelope to extend each substantially in a cross section of said envelope from a close vicinity of the wall of said envelope to a close vicinity of said ray; means mounted outside said envelope for causing the formation of a concentrating field between said two pairs of pole shoes said last mentioned means being mechanically separated from said pole shoes by the wall of said envelope; means for connecting that one of said pairs of pole shoes next to said cathode with a source of control voltage; and means for connecting the other one of said pairs of pole shoes with an anode voltage source.

8. A Braun tube comprising an evacuated envelope, a picture receiving screen, means for producing a cathode beam and for directing this beam substantially along the axis of the Braun tube onto said picture receiving screen, and a

pair of deflecting elements mounted within the Braun tube to face the axis of said tube from opposite sides, and adapted to deflect said cathode beam to make it approach one of said elements when a voltage is built up between said elements, said elements consisting of a ferromagnetic material and being thus further adapted to have a magnetic field built up between them to extend from one of said elements to the other one, said elements being thus adapted to deflect

said cathode beam in a plane perpendicular to that in which it would move in approaching any of said elements; means for producing a magnetic field mounted outside said envelope and arranged in operative relationship to said elements but mechanically separated therefrom by the wall of said envelope; and means for connecting said elements with a potential source.

KURT SCHLESINGER. 10