April 28, 1936. M. VON ARDENNE 2,039,132

BRAUN TUBE

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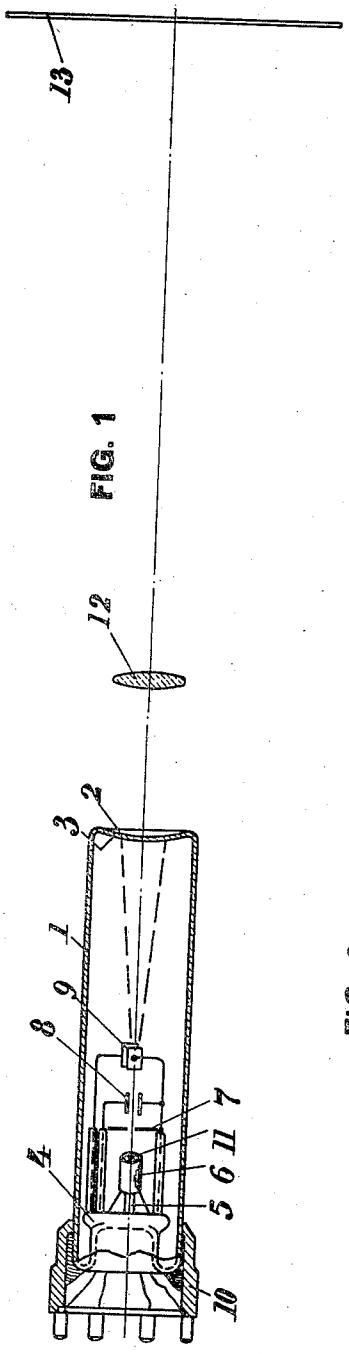


FIG. 1

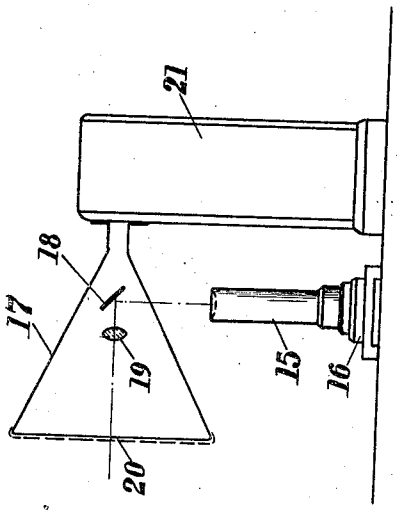


FIG. 3

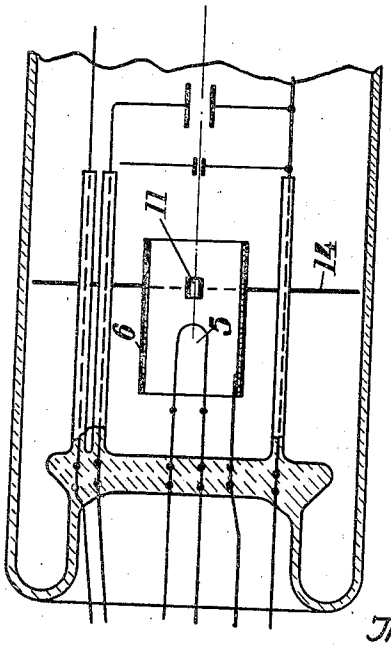


FIG. 2

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2,039,132

BRAUN TUBE

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Application June 14, 1932, Serial No. 617,114
In Germany June 19, 1931

6 Claims. (Cl. 250—27.5)

The subject matter of this invention is constituted by a Braun tube, which is distinguished by the fact that the same, whilst of extremely simple construction, permits of the formation of light-intensive, undistorted images of the light images produced by the cathode ray.

According to the invention, the bottom of the Braun tube bearing the fluorescent screen is, in contradistinction to the tubes heretofore known, constructed with a curvature towards the inside, whereby on the one hand the strength of the bottom of the bulb is considerably increased (in the case of Braun tubes furnished with an outwardly curved bottom a very large number of rejections are to be expected, owing to a pressing in of the bottom due to the large surface and the low internal pressure), whilst on the other hand for the purpose of projection of the fluorescent effect on to a relatively large screen lenses may be employed, which require no correction, or merely a very slight one, to obtain a flat representation of the image produced on the cup-like fluorescent layer.

This projection valve may be furnished with a structural system which is so extremely simple that the valve may be employed, not only for the purpose of scientific research, but also for quite cheap television arrangements.

In order to obtain the least possible distortion of image and to enable the smallest possible and accordingly cheaper lenses to be employed, the valve, and more particularly, therefore, the bottom thereof, is constructed as small as possible, which at the same time results in an increased strength of the valve. The size of the requisite screen is limited only by the permissible heating of the fluorescent material. As my tests have been showing, it is possible without particular difficulty to obtain sizes of image amounting to approximately 10 sq. cm., corresponding to images of the size of 3 x 3 up to 3 x 4 cm., whereby it is quite possible, by means of suitable lenses, to obtain a linear light-intensive enlargement of the image up to 10–15 times the amount.

The invention is described more particularly in the following in conjunction with a possible form of embodiment. In Fig. 1, 1 designates the wall of the valve, which is preferably constructed as a cylindrical tube, and 2 the inwardly curved bottom bearing on its inner side the fluorescent layer 3. In order to obtain the least possible distortion of the image the valve is made as short as possible, for example 20 cm., in length, and possesses a diameter of 4.5–6 cm. The radius of curvature of the depression or focal radius of the lens employed is, in accordance with the additional subject matter of the application, so chosen that the curvature of the depression is somewhat larger than corresponds with the focal radius of the lens. The use of lenses is thus rendered possible, which preclude distortion of the marginal image without aplanatic correction.

In accordance with the additional subject matter of the invention, the single system parts of the Braun tube are provided on a common glass support, whereby, prior to the fixture in the glass bulb, the requisite accuracy in the relative position of the single elements may be so exactly determined mechanically as to conform to the requirements placed thereon by an appreciable enlargement. This glass support is designated 4 in Fig. 1. The same possesses at the centre the cathode 5, the Wehnelt cylinder 6, the anode 7 and the pairs of deflecting plates 8 and 9. In order to prevent a flashing over, which might readily occur in view of the compact construction as a result of the common support, the supporting wires or metallic supporting parts are screened off against each other by means of glass tubes, so that the lines of discharge are considerably increased. The complete valve may now be mounted in a socket 10 possessing the requisite number of contacts, as employed, for example, in the case of the known multi-stage valves.

In valves of this nature, as employed, therefore, more particularly for purposes of television, the short life of the cathode heretofore has been found very disturbing. This is due more particularly to the fact that the cathode, by reason of impinging ions, is very rapidly destroyed. To prevent this the surface of the Wehnelt cylinder is, in accordance with the invention, very considerably increased, or the cathode sufficiently screened off by shutters disposed in front of the same. By means of this shutters, which preferably are constructed in the form of circular or rectangular perforated bands, there is also obtained at the same time a good concentration such as cannot be dispensed with in connection with the great intensity of light required for the projection. The valve illustrated in Fig. 1 is furnished with a perforated shutter 11 of this description.

The second possibility above referred to of appreciably increasing the durability by increasing the surface of the Wehnelt cylinder is illustrated in Fig. 2. In this figure 5 is the cathode, 6 the Wehnelt cylinder, and 14 a metallic screen

located thereon, which screen, owing to its negative potential, more strongly attracts the electrons in space than the cathode 5. Naturally, it is possible in this arrangement to also provide at the same time a perforated shutter 11, thus additionally increasing the protection offered to the cathode. An arrangement of this kind is indicated in Fig. 2 in dotted lines. In the possible forms of embodiment of the Braun tube as described there is preferably employed a cathode, which consists of an electron-emissive cup preferably heated in indirect fashion by means of a spiral. In a cathode construction of this nature there is obtained an extremely concentrated, strong ionic source, such as absolutely essential for producing the requisite small but brilliant cross-section of the beam.

To obtain an effectiveness as faultless as possible as regards the valve according to the invention it is preferable to employ as filling for the discharge space a mixture of noble gases. It is also of advantage to screen off the valve towards the exterior, for example by means of a silver mirror applied to the inside or the outside of the wall of the valve. Further, it is of advantage, in order to prevent disturbing charges of the fluorescent screen, to make the latter conductive, for example by an addition of metallic powder. To obtain the requisite intensity of the beam there is preferably employed an anode potential amounting to 4000–10000 volts.

The projection valve according to the invention may be mounted in simple fashion, as illustrated in Fig. 1, together with a lens 12, and the image thus produced projected on to a screen 13 disposed at a remote point. It is, however, also possible, if the apparatus is to be located within a small space, for instance in a loud speaker, to fit in the valve in such fashion that the same is arranged vertically to the axis of the diaphragm, and projects the image, through the medium of a flat mirror, in a direction in or parallel to the axis of the diaphragm, where the same, through the medium of the optic, appears on a transparent screen arranged in front of the diaphragm. An arrangement of this kind is illustrated in Fig. 3.

In the latter 15 is the valve, which is seated in the mounting 16 and, by means of an orifice in the conical member 17, performs radiation on to a flat mirror 18 which, through the medium of the lens 19, causes the image to be produced on the screen 20. 21 is the loud-speaker system, which, for example, may be constructed in the form of a dynamic loud speaker.

I claim:

1. In an arrangement for producing pictures, preferably for television purposes, a Braun tube having a hot cathode, an anode, a fluorescent screen on the bottom of said tube, means to control and means to deflect the cathode ray to produce images on said fluorescent screen; and a lens for projecting said images on to a projection screen for obtaining an enlarged copy of said light image, the bottom of said Braun tube being depressed, the focal radius of said lens being just as large as or somewhat larger than the radius of the curvature of the depression of the bottom of said Braun tube.

2. In an arrangement for producing pictures, preferably for television purposes, a Braun tube having a hot cathode, an anode, a fluorescent screen on the bottom of said tube, means to control and means to deflect the cathode ray to produce images on said fluorescent screen, said screen possessing a useful rectangular area of not appreciably more than 12 square centimetres; and a lens for projecting said images onto a projection screen for obtaining an enlarged copy of said light image, the bottom of said Braun tube being depressed, the focal radius of said lens being just as large as or somewhat larger than the radius of the curvature of the depression of the bottom of said Braun tube.

3. In an arrangement for producing pictures, preferably for television purposes, a Braun tube of a very short length in the order of about 20 centimetres, said Braun tube, having a hot cathode, an anode, a fluorescent screen on the bottom of said tube, means to control and means to deflect the cathode ray to produce images on said fluorescent screen; and a lens for projecting said images onto a projection screen for obtaining an enlarged copy of said light image, the bottom of said Braun tube being depressed, the focal radius of said lens being just as large as or somewhat larger than the radius of the curvature of the depression of the bottom of said Braun tube.

4. In an arrangement for producing pictures, preferably for television purposes, a Braun tube having a hot cathode; an anode; a Wehnelt cylinder, the surface of which is increased by metallic parts not required for the purpose of concentration, preferably by means of circular plate abutments; a fluorescent screen on the bottom of said tube; means to control and means to deflect the cathode ray to produce images on said fluorescent screen; and a lens for projecting said images onto a projection screen for obtaining an enlarged copy of said light image; the bottom of said Braun tube being depressed, the focal radius of said lens being just as large as or somewhat larger than the radius of the curvature of the depression of the bottom of said Braun tube.

5. In an arrangement for producing pictures, preferably for television purposes, a Braun tube including a Wehnelt cylinder; a cathode mounted inside said Wehnelt cylinder; a perforated shutter with preferably circular or rectangular perforation to screen off said cathode, said shutter being preferably connected with said Wehnelt cylinder; an anode; a fluorescent screen on the bottom of said Braun tube; means to control and means to deflect the cathode ray to produce images on said fluorescent screen; and a lens for projecting said images onto a projection screen for obtaining an enlarged copy of said light image; the bottom of said Braun tube being depressed; the focal radius of said lens being just as large as or somewhat larger than the radius of the curvature of the depression of the bottom of said Braun tube.

6. In an arrangement for producing pictures, preferably for television purposes, a Braun tube having its discharge space filled with a mixture of noble gases and including a hot cathode; an anode; a fluorescent screen on the bottom of said tube; means to control and means to deflect the cathode ray to produce images on said fluorescent screen; and a lens for projecting said images onto a projection screen for obtaining an enlarged copy of said light image; the bottom of said Braun tube being depressed; the focal radius of said lens being just as large as or somewhat larger than the radius of the curvature of the depression of the bottom of said Braun tube.

MANFRED VON ARDENNE.