Dec. 31, 1940. B. WIENECKE 2,227,051

BRAUN TUBE

Filed Sept. 21, 1934

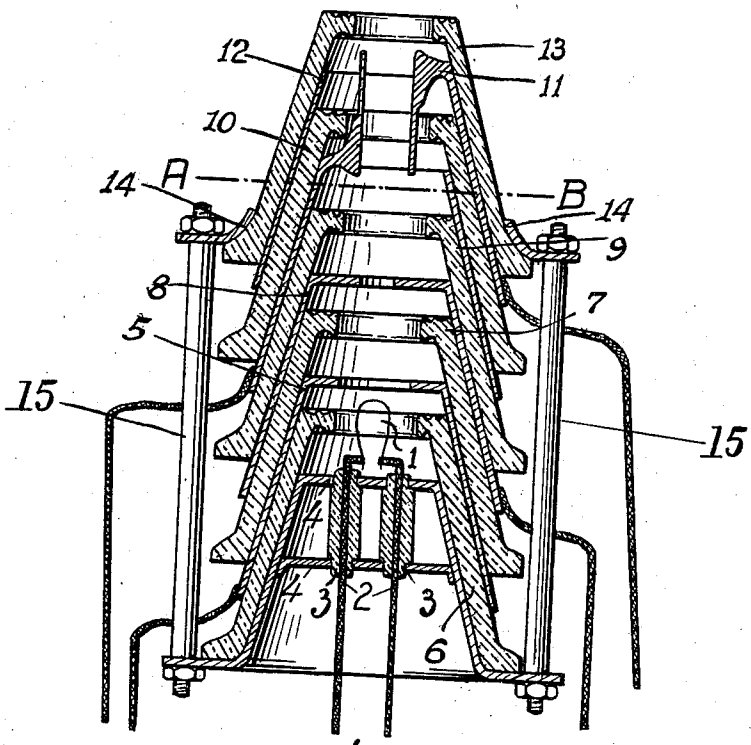


Fig 1

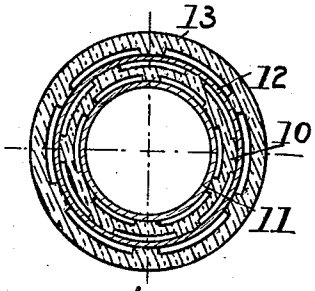


Fig 2

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Patented Dec. 31, 1940

2,227,051

UNITED STATES PATENT OFFICE

2,227,051

BRAUN TUBE

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Application September 21, 1934, Serial No. 744,964
In Germany September 23, 1933

16 Claims. (Cl. 250—155)

In discharge tubes having a narrowly concentrated and carefully directed discharge, as for example cathode ray tubes of the Braun type, it is an important condition that the electrodes necessary for producing the electronic ray be well arranged centrally to the middle of the path of discharge. If this condition is not fulfilled, the production of a straight discharge free of interference is impossible. Even in the case of a slight deviation the ray leaves the electrode system in an inclined direction and, assuming for example that a cathode ray tube with luminous screen is concerned, does not impinge on the screen at the desired point. If, however, the deviation is considerable, the cathode ray does not leave the system at all, and the tube is wholly unserviceable.

In the construction heretofore of tubes of this nature the accomplishment of good centering depends to a great extent on the skill of the person performing the assembly. It also frequently occurs that a system carefully assembled, for example with the assistance of gauges, discloses nevertheless upon the subsequent evacuating process, in which for degassing purposes the entire discharge vessel requires to be greatly heated, errors in centering observable after this operation. This is due to the fact that the electrodes, by reason of stresses in the material owing to the heat, have become relatively deformed.

All of these errors are avoided by the construction according to my invention. This construction is also very simple to assemble in well centered fashion, even by unskilled persons. In principle the same is based on the fact that the different electrodes possess the form of conical tube portions, in each of which the angle between the jacket line and the middle axis is the same, so that they may be inserted firmly one into the other. A total angle of the aperture amounting to approximately 45° has been found to be suitable. The individual electrodes are separated from each other by means of similarly shaped and fitting members composed of insulating material. All of these nested parts may then be held together by means of a simple tensioning device, which exerts a pressure in the direction of the longitudinal axis. The whole then results in a structure which is stable in itself and comparatively rigid.

In this construction all metallic parts, and more particularly the cup-like conical tube portions, may readily be produced in exact and identical form by stamping and drawing. In the same manner the insulating parts, which preferably are composed of a ceramic material, are capable of production readily and cheaply on mass-scale production lines in sufficiently exact and identical form without special expenditure by the methods usual in the ceramic art.

An example of the construction according to the invention is illustrated in the drawing, Fig. 1 showing a longitudinal section and Fig. 2 a cross-section in the plane A—B. The drawing, omitting the parts not pertaining to the invention, and more particularly the glass body, show the system of a cathode ray tube producing the ray with a pair of deflecting plates. The portions of the electrodes and of the insulating members shown in section are differentiated by the respective cross-hatching or shading. The originating point of the discharge is constituted by the hot cathode 1, which may consist, for example, of a platinum band having at its centre a small spot of Wehnelt oxide substance. The platinum band is secured to two leads 2 composed of strong wire, which in turn are passed through two small tubes 3 of insulating material. The tubes are secured in holes in the cup-shaped metallic member 4 and in a plate-like counter-bearing 4' welded, for example, to the member 4. The tubes 3 and also the leads 2 are secured in any suitable fashion against displacement and rotation in their bearings, for example by triangular or square cross-sections and by heading the metallic leads, viz., at the ends projecting out of the tubes. A second cup shaped similarly to the metallic member 4 is located at 5. The same has at the center of its transverse portion an aperture, which exerts the effect of the so-called Wehnelt cylinder serving for concentration of the ray. Between the two cups 4 and 5 there is situated the first of the insulating members 6. An additional, similarly shaped insulating member is shown at 7. The same carries the cup 8, which also possesses an aperture at the narrow end. This cup 8 constitutes the anode of the system. In the same manner, separated from each other by the insulating members 9 and 10, there are provided two additional cups 11 and 12, of which each carries a deflecting plate. Each plate is secured to its cup in such fashion that the plates in the finally assembled system are situated opposite to each other as shown. In similar fashion it is naturally also possible to provide still further electrodes. Further, the cathode composed of platinum band may naturally also be replaced by one with indirect heating, and the emissive surface itself may possess a suitable form and size. The final cup 12 carries in turn

an insulating member 13, about which there is placed the conical ring 14, which in conjunction with the threaded pins 15 and an outwardly projecting flange at the wide end of the cup 4 serves to hold the system together.

The entire system is now a rigid structure, the individual parts of which are maintained in positive fashion in relation to the center axis. In this form the same, by suitable attachment methods and means, may be mounted on the glass base of the vacuum tube. Conveniently there may be employed, for example, for this purpose the threaded pins 15—if necessary, extended in length.

As material for the insulating members all substances may be employed which are vacuum-proof, heat-resisting and sufficiently non-conductive, such as glass, quartz, mica, porcelain, steatite, oxides of metals or mixtures thereof, such as aluminium oxides, for example sinter corundum, magnesium oxide, beryllium oxide, zirconium oxide or also powdered mica mixed with a suitable, preferably organic binding agent, and similar substances which more recently have been placed on the market under different names by the ceramic trade. It is desirable to employ those substances which may be furnished with a vacuum-proof glaze. The surfaces of the insulating members not touched by the metallic cups may be increased by the provision of grooves or the like for the purpose of increasing the surface path between the electrodes. Further, the surfaces covered by the metallic parts may also be furnished with ribs in order to increase the insulating value and permit of a more rapid degassing of the metallic parts and insulating members. For the purpose of clear disclosure, a rib construction of this nature is illustrated in Fig. 2.

I claim:

1. A Braun tube comprising electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate shaped portions for deflecting the cathode ray, each of said electrodes except said cathode having a conical portion and a plurality of insulating elements of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another to exactly align all of said electrodes with one another.

2. A Braun tube comprising a cathode furnished with a metallic holder having a conical portion, two deflecting plates, each of said deflecting plates being provided with a metallic holder having a conical portion, a control electrode mounted between said cathode and said deflecting plates, at least one anode mounted between said control electrode and said deflecting plates and insulating elements for insulating each two of said electrodes from one another, said control electrode, said anode and each of said insulating elements having a conical portion, all of said conical portions having the same shape, each two of said portions being fitted within one another.

3. A Braun tube comprising a cathode furnished with a metallic holder having a conical portion, two deflecting plates, each of said deflecting plates being provided with a metallic holder having a conical portion, a control electrode mounted between said cathode and said deflecting plates, at least one anode mounted between said control electrode and said deflecting plates and insulating element for insulating each two of said electrodes from one another, said control electrode, said anode and each of said insulating elements having a conical portion, all of said conical portions having the same shape, each two of said portions being fitted within one another, means for pressing all of said parts against one another and means for connecting all of said electrodes with their respective circuits.

4. A Braun tube comprising electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate-shaped portions for deflecting the cathode ray, each of said electrodes, except said cathode, having a conical portion, and a plurality of insulating elements of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another, so that said electrodes form a system of exactly axially aligned electrodes, two annular fittings, one of said fittings being secured to each end of said system of axially aligned electrodes, and pins connecting said annular fittings with each other to hold said system together.

5. A Braun tube comprising an envelope having a glass-base, electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate shaped portions for deflecting the cathode ray, each of said electrodes, except said cathode, having a conical portion, and a plurality of insulating elements of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another, so that said electrodes form a system of exactly axially aligned electrodes, means for assembling said system to form a structural unit, and means for securing said structural unit as a whole to said glass base.

6. A Braun tube comprising an envelope having a glass-base, electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate-shaped portions for deflecting the cathode ray, each of said electrodes, except said cathode, having a conical portion, and a plurality of insulating elements of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another, so that said electrodes form a system of exactly axially aligned electrodes, two annular fittings, one of said fittings being secured to each end of said system of axially aligned electrodes, pins connecting said annular fittings with each other to hold said system together so that said system forms a structural unit, and means for securing said structural unit as a whole to said glass base.

7. A Braun tube comprising electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate shaped portions for deflecting the cathode ray, each of said electrodes, except said cathode, having a conical portion, and a plurality of insulating elements

of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another to exactly align all of said electrodes with one another, the surfaces of said insulating elements at the parts thereof not covered by the respective electrodes into which said insulated elements are fitted being provided with recesses to increase the effective surfaces.

8. A Braun tube comprising electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate-shaped portions for deflecting the cathode ray, each of said electrodes, except said cathode, having a conical portion, and a plurality of insulating elements of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another to exactly align all of said electrodes with one another, the surfaces of said insulating elements at the parts thereof in contact with the respective electrodes into which said insulating elements are fitted being provided with grooves to improve the insulation between the electrodes.

9. A Braun tube comprising electrodes including a cathode for producing a cathode ray, an electrode for controlling the intensity of the cathode ray, electrodes for concentrating the cathode ray and electrodes having plate-shaped portions for deflecting the cathode ray, each of said electrodes, except said cathode, having a conical portion, and a plurality of insulating elements of conical shape for insulating said electrodes from one another, said conical portions of said electrodes and said insulating elements being alternately fitted within one another to exactly align all of said electrodes with one another, the surfaces of said insulating elements at the parts thereof in contact with the respective electrodes into which said insulated elements are fitted being provided with ribs to improve the insulation between the electrodes.

10. A Braun tube including means for producing a cathode ray and nested flaring electrodes for controlling said cathode ray, two of said flaring electrodes having plate-shaped portions for deflecting said ray.

11. A Braun tube including means for producing a cathode ray, nested flaring electrodes for controlling said cathode ray, two of said flaring electrodes having plate-shaped portions for deflecting said ray, and flaring insulating members interposed between the flaring faces of neighboring electrodes.

12. A Braun tube including means for producing a cathode ray, nested flaring electrodes for controlling said cathode ray, and flaring insulating members interposed between the flaring faces of neighboring flaring electrodes.

13. A Braun tube including means for producing a cathode ray, nested flaring electrodes for controlling said cathode ray, flaring insulating members interposed between the flaring faces of neighboring electrodes, and means for exerting pressure on said electrodes and insulating members to hold said electrodes in contact with said members.

14. A Braun tube including means for producing a cathode ray, electrodes for controlling said ray, and insulating members interposed between neighboring electrodes, the surfaces of said insulating elements being provided with a vacuum-proof glaze.

15. A cathode ray tube for producing a focused beam of electrons including a source of electrons, a plurality of frustro-conical conducting electrodes, a plurality of frustro-conical insulating elements, means for positioning the electrodes and the insulating elements in alternate nested relationship with their axes of symmetry in substantial alignment, beam deflecting plates formed as an integral part of at least two of said electrodes and aligned so as to be opposite each other and symmetrically disposed with respect to the axes of symmetry of the electrodes.

16. A cathode ray tube for producing a focused beam of electrons including a source of electrons, a plurality of frustro-conical conducting electrodes, a plurality of frustro-conical insulating elements, means for positioning the electrodes and the insulating elements in alternate nested relationship with their axes of symmetry in substantial alignment, beam deflecting plates connected individually to at least two of said electrodes and positioned opposite each other and in substantially parallel planes, the plates being symmetrically disposed with respect to and arranged parallel to the axes of symmetry of the electrodes.

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