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ELECTRON TUBE

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Fig. 1

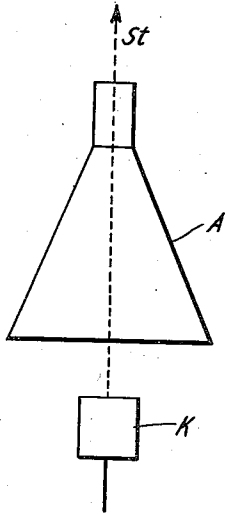


Fig. 3

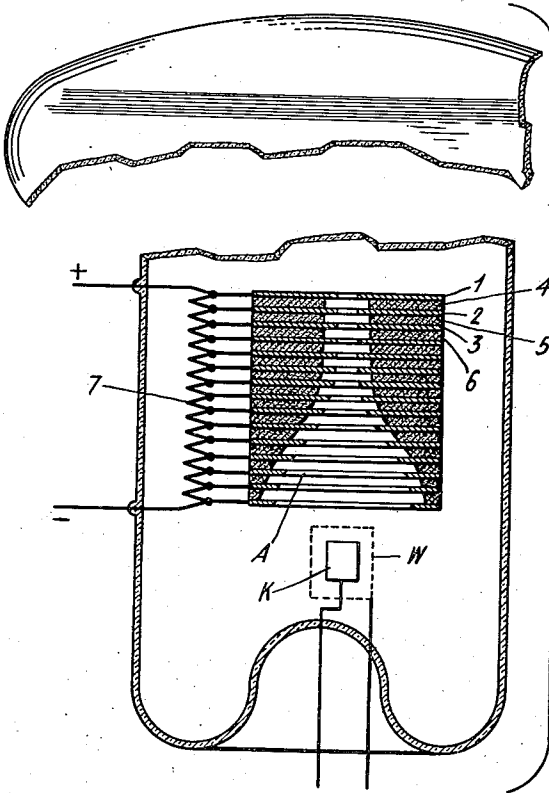
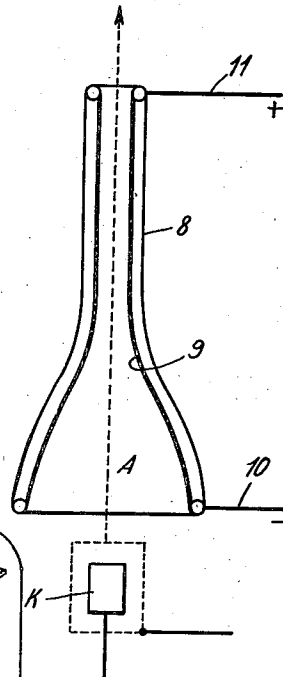


Fig. 2

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ELECTRON TUBE

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4 Claims. (Cl. 250—162)

The present invention relates particularly to cathode ray tubes wherein a funnel-shaped anode with rectilinear or curvilinear contour is provided.

5 In cathode ray oscillographs anodes have been suggested in the prior art which are of conical or flared funnel form, with the large opening being directed towards the cathode. While it is true that with anodes of this kind a sharply
10 focused electron ray pencil is producible, the beam intensity is but low inasmuch as the major part of the electrons drawn away from the cathode impinge directly upon the inside surface of the anode funnel.

15 A principal object of the present invention is to provide an anode funnel of such a form that in the production of the cathode ray pencil a higher efficiency is obtained. The basic idea of the invention is to create along the inside funnel
20 wall a locally variable potential rather than, as has heretofore been customary, making the wall to act as an equipotential surface. This is accomplished by imparting a fall of potential to the funnel-shaped anode between the inlet and the
25 outlet ends thereof. In this manner such a distribution of the equipotential surfaces and such a form is obtained that these surfaces, looked at from an electron-optic viewpoint, may be regarded as a sequence or series of lenticular surfaces
30 with refraction of any desired low value, though by proper distribution of the potential fall any desired shape of path is realizable so that a high proportion of the embraced electrons issuing from the cathode will be practically directed
35 parallel or straightened out so that they are made to contribute to the formation of the ray pencil.

The invention has been illustrated by the accompanying drawing wherein:

40 Fig. 1 shows the direction of the beam through the cone anode;

Fig. 2 represents the anode formed from a series of metal disks according to the present invention; and

45 Fig. 3 illustrates a modification of the arrangement of Fig. 2.

Referring now to the drawing and first to Fig. 1, the cathode K and the cone-shaped anode A are shown in such relation to each other that upon application of suitable voltages the electron ray pencil St emerges through the anode in the direction shown by the arrow. Contradistinct from the form of invention as shown by Fig. 1, various ways and means are adapted to carry out the basic idea of this invention into practice.

55 For instance, the anode A made from metal sheet

in Fig. 1 could be modified in such manner that a slender resistor wire in a large number of narrow turns suitably insulated from one another is wrapped upon a suitably formed support, the ensuing winding form being thereupon stiff-
5 ened in some suitable way, whereupon the resultant structure is traversed by a current with the result that a fall of voltage along the wall of the funnel is occasioned.

However, it is preferable to build the anode
10 in the manner shown by Fig. 2. In this case, perforated metal disks 1, 2, 3, etc., with interposition of insulating rings 4, 5, 6, e. g., of mica are piled on top of one another, with the bores or
15 widths of the holes being so graduated that a suitably formed rectilinear or curvilinear contour results for the anode funnel A, with the cathode K being positioned co-axially and opposite there-
20 to. For intensity control there may be used the usual type Wehnelt cylinder W or the usual type of electrode may be used.

The various metal rings or disks 1, 2, 3, etc., are provided with terminals and these connections are brought to a potentiometer 7 which may be built inside the cathode ray tube. By suffi-
25 cient subdivision it is thus possible to secure any desired adjustment or form of the fall of potential inside the anode A. In fact, by transposition or exchange of potentiometer taps it would even be feasible to set up counter-acting
30 fields, i. e., fields tending to retard the electrons (refractive lenses to use an optical analogy) in order that at each point of the traversed space the ray pencil may be given the desired direction-
35 al components and at all points of the proper size.

In order that the various connections accord-
ing to Fig. 2 may be separated more properly in electrical respect, they could be turned slightly
40 in reference to one another from one metal disk to the next. The simplest embodiment of this kind would be as shown in Fig. 3 where the anode funnel consists of a suitably shaped nozzle-like
45 insulation body 8 (of glass or ceramic material, for example), and in which, by a feebly conducting inside coat 9 the desired voltage fall is produced between the current supply rings or terminals 10 and 11 so that the ray pencil is accel-
50 erated in a continuous manner in the direction of the arrow. However, the practical realization of this scheme is attended with difficulties inas-
much as the conducting powers upon the surface would have to be distributed in a very homoge-
55 neous manner in order that troublesome distur-

tions of the equipotential surfaces may be avoided.

The effect of the exemplified embodiments of the anode funnel according to this invention is predicated upon the formation of a multiply-subdivided or continuously refractive system (to use an optical analogy for electrons) the refraction between sequential elements thereof being so graduated that the large aperture of the cathode ray pencil consisting of slow electrons is changed into the small aperture of the accelerated electron ray pencil. Putting the situation in terms of electrical fields and potentials, the action is so that the electrons travelling towards the anode funnel wall, before they reach the wall, are subjected to electrical forces in which strong components tend to accelerate them in directions parallel to the funnel surface. In this manner, their direct impinging upon the anode is precluded, and the pencil of electrons formed continuously or in small steps or cascades becomes increasingly more axial in direction as it travels towards points of growing positive potential and in the direction of the observation or recording screen (not shown) of the cathode ray tube.

Having now described the invention, what is claimed is:

1. In an electron tube, an electron source, a composite conical member arranged in cooperative relationship with the source so that emitted electrons pass through the electrode, said member comprising a plurality of annular conducting disk members in register with the source and each other and of progressively increasing internal diameter with the member having the smallest diameter most remote from the source, and an electrically non-conducting spacing member between each of the plurality of disk members, and

means for supplying different voltages relative to the source to each of the disk members.

2. An electron tube comprising an electron source, a composite funnel-shaped contoured annular member in register with said source and having its apex most remote from the source, an internal voltage divider having connections therefrom to points in said member spaced at different distances from the source, and being adapted to have applied thereto voltages to produce a potential gradient along the axis of the member along which axis electrons from the source pass.

3. An electron tube having means for producing an electron beam, comprising an electron source, a plurality of conducting annular disks, an insulating member between each annular disk, said annular disks and insulating members forming a composite member having an internal frusto-conical shape along the axis of which electrons from the source pass, and whose axis coincides with the beam axis, said member being located adjacent to the source and having its apex most remote from the source, and a conductor connected to each of the independent conducting sections of the member.

4. In an electron tube having means for producing an electron beam comprising a cathode as a source of electrons, an apertured funnel shaped anode member adjacent to and in register with the cathode, said member having its apex most remote from the cathode, and means for producing a voltage drop along the axis of said member along which axis electrons from the source pass and whose axis coincides with the beam axis.

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