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TRANSVERSALLY CONTROLLED ELECTRON TUBE

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Fig. 1

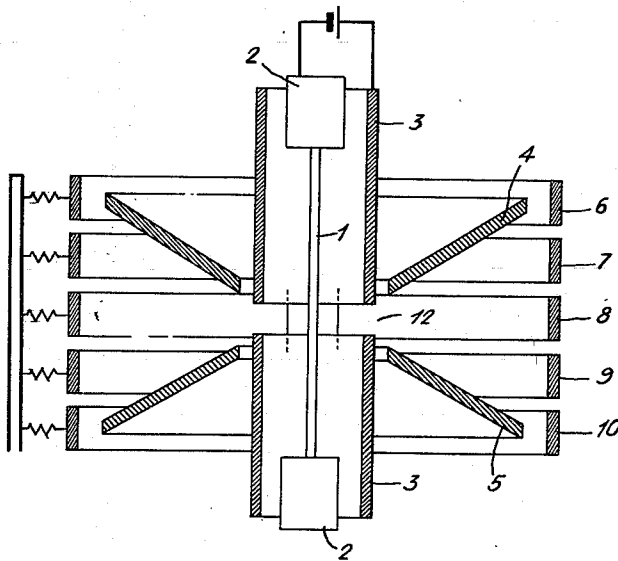
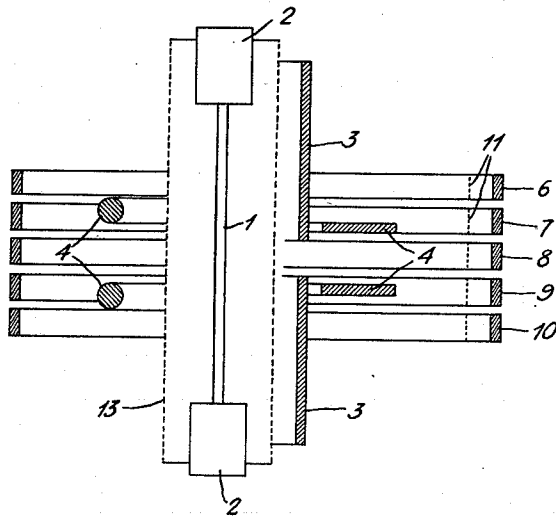


Fig. 2



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TRANSVERSALLY CONTROLLED ELECTRON
TUBE

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6 Claims. (Cl. 250—27.5)

Electron tubes are known in the prior art in which the direction of the electron current is arbitrarily or at will influenced by means of magnetic or electric fields rather than, as is customarily done, varying the intensity of the emission or electron current by the action of control potentials. By the aid of such devices it is possible to direct the electronic pencil ad libitum to different anodes being insulated from one another. An arrangement of this sort is capable of the most varying applications, for instance, in the form of an inertialess relay or for the control of glow-tubes or Kerr cells in connection with the re-conversion of electric impulses into pictures or images of varying brightness.

Tube arrangements of the kind here indicated, without exception, are nothing but copies of constructions known from the art of cathode oscillographs. As a general rule, they involve a more or less slender, conical or else cylindrical ray pencil which is obtained by the ray-focusing ways and means known from the cathode-ray oscillograph art.

Now, the use of these means is attended with a considerable loss of emission current seeing that only a small part of the total emission from the heated cathode is utilized, unless this disadvantage is made to reside in the more complicated form of the heated cathode.

Shortcomings of the said sort, according to the invention, are obviated by an arrangement as hereinafter to be described which is predicated upon the utilization of this fact that sufficiently short and stout heated wires whose cooling in the main is occasioned by virtue of thermal conduction towards the supporting means, and only in an accessory or secondary way by virtue of radiation, are made to emit electrons only inside a range that is extremely short in comparison with the entire length of wire. The droop of the curve of the specific emission (in other words, the electron current per unit of area or surface) measured along the wire presents a great steepness, and in the presence of sufficiently great field intensity at the surface of the hot wire, the electrons arise substantially at right angles to the microscopic surface of the heated wire, with the result that one could speak of a virtual dish-shaped or fan-shaped emission.

This physical form of the electronic current allows of the arrangement of such construction parts as are required for the transversal control of the electron current in any desired or convenient manner, though in rotation symmetry in reference to the filamentary hot cathode. Figs.

1 and 2 illustrate schematically cross-sectional views of electron tubes according to the invention.

Referring to Fig. 1, the heated wire is indicated at 1. 2 are the supporting means. 3 is a cylindrical and slotted anode. The slot runs all around the filament though, for constructional reasons, for instance, struts or stays may be provided at some points whereby the two halves of the anode are mechanically interconnected. 4 and 5 are the control electrodes which influence the direction of flight of the electrons which issue from the anode slot 12, by virtue of the electric field prevailing between them. 6 to 10 are the annular collector electrodes so-called which, according to the size and the direction of the voltage applied to the control electrodes 4 and 5 are impacted at will by the electron current. The control electrodes 4 and 5 (unless they are to be made still simpler such as shown, for instance, in Fig. 2) should most suitably be so formed that the electric force-lines of the deflecting field will intersect the trajectory of the electrons everywhere at right angles as far as this is feasible. In this connection, there could, of course, be used also surfaces presenting a double curvature.

If the potentials applied to the collector electrodes 6 to 10 are so high that a field intensity at the heated filament is bound to be present which will secure an emission of the electrons at right angles to the wire surface, then, if desired, the slotted anode 3 may be dispensed with. In this case, to be sure, all of the collector electrodes will carry a certain, though small, current and this current is due to the small portion or share in the emission which is furnished by the parts of the cathode surface located outside the middle of the heated wire.

If in addition to the change in direction of the electron current, there is desired also a variation of its intensity, then, in a way as well-known in the art, control grids 11 (Fig. 2 right-hand side) may be mounted either in front of each collector electrode 6 to 10, or else a single control grid 13 (left-hand side, Fig. 2) between the heated filament and the anode 3.

In the cases here illustrated, each collector electrode requires a distinct lead-in or seal in the glass wall of the tube. In some instances, a circuit scheme may be chosen in which resistances of different value are connected with the various collector electrodes so that upon the passage of the current from one electrode to the other, the fall of potential of the anode current

across the external resistance will occur suddenly, by leaps and bounds. In this case, a number of lead-ins could be dispensed with if the collector electrodes in the interior of the tube are inter-
5 connected by means of suitably chosen resistances. In such an arrangement the said resistances could at the same time be employed to act as the supporting means for the annular electrodes.

10 What I claim is:

1. An electron discharge tube comprising an electron emitting electrode, a cylindrical member concentrically arranged about the cathode and being provided with an annular slot, said
15 member permitting the flow of electrons through its slot in substantially all radial directions from a comparatively narrow annular portion of the cathode, a plurality of electron collecting electrodes concentrically arranged about and axially
20 disposed along said member and said emitting electrode, and a control electrode disposed on either side of said slot.

2. An electron discharge tube according to claim 1, wherein each of the collecting electrodes
25 has connected to it within the tube a resistance which serves also as an electrode support.

3. An electron discharge tube comprising a linear cathode, means having a circumferential slot surrounding the cathode for insuring emis-
30 sion from a comparatively small section of the cathode, a plurality of cylindrical electron collecting electrodes of substantially equal diameters surrounding the cathode and disposed along the

length of the cathode, and a pair of electron control members interposed in the space between the cathode and the collecting electrodes, one on either side of the small emitting section of the cathode.

4. An electron discharge tube comprising a linear cathode, means surrounding the cathode for insuring emission from a comparatively small section of the cathode, a plurality of cylindrical electron collecting electrodes of substantially
10 equal diameters surrounding the cathode and disposed along the length of the cathode, and electron control means in the form of a pair of symmetrically disposed substantially conical members interposed in the space between the
15 cathode and the collecting electrodes.

5. An electron discharge tube according to claim 4, wherein each of the collecting electrodes has connected to it within the tube a resistance which serves also as an electrode support.

6. An electron discharge tube comprising a linear cathode, a pair of tubular anode sections surrounding opposite ends of the cathode, which sections are in alignment and having their adjacent edges in spaced relation and defining an
25 annular opening, a plurality of ring-shaped electron collecting members surrounding the anode sections, and electron control means interposed in the space between said anode sections and the collecting members on either side of said annular
30 opening.

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