Dec. 6, 1938. A. BOUWERS 2,139,487

ELECTRIC DISCHARGE TUBE

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Fig. 1

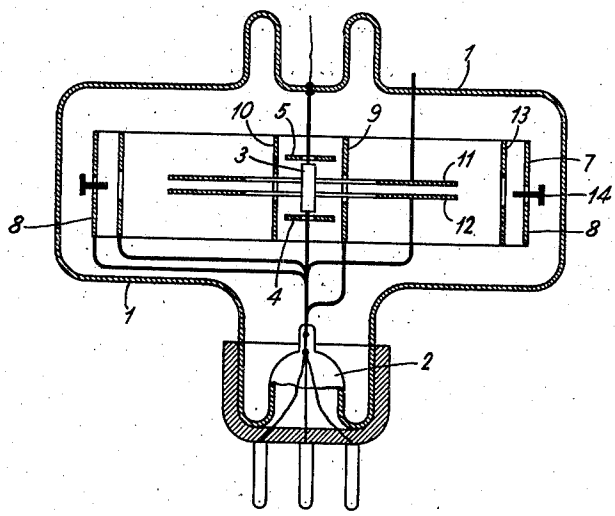
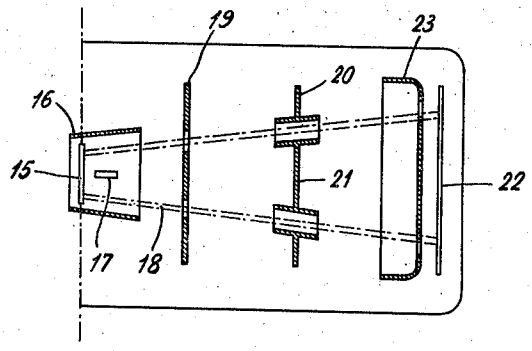


Fig. 2



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ELECTRIC DISCHARGE TUBE

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5 Claims. (Cl. 250—150)

The invention relates to electric discharge tubes for amplifying, producing and receiving electrical oscillations, and more particularly to tubes in which the electrons emanating from the cathode are united to a beam which is laterally deflected and impinges upon one or more anodes.

It is known to utilize tubes in which the beam of electrons is laterally deflected, of which tubes the cathode ray type is the almost universally employed form of construction, for various purposes. Thus, for example, it is possible to utilize such a tube for television while a tube of this type may also serve, for example, for the amplification, production or reception of electrical oscillations.

As is well known, these tubes are so constructed that the electrons emanating from the cathode are united with the aid of a concentrating device to form a beam which is electro-statically or magnetically controlled with the aid of deflecting members and finally impinges on one or more anodes.

The applicant has experimentally found that although in different fields satisfactory results may be obtained with this form of construction of the tube, an appreciable improvement of the qualities of such a tube may be obtained if within the tube a beam of electrons of particular shape is produced.

In fact, it has been found that in many cases it is desirable to utilize a beam of electrons of such a shape that the beam has the highest possible sensitiveness relatively to the influence of the deflecting members. To that end, in an electric discharge tube for the amplification, production or reception of electrical oscillations, in which the electrons emanating from the cathode are united to form a beam the shape of said beam is, according to the invention, so chosen that at the point where the beam impinges on the anode its dimension in the direction of the deflection is small relatively to the dimensions in other directions.

The place where the beam impinges upon the anode or anodes must have in general the shape of a strip, the longitudinal direction of which is perpendicular to the direction of the deflection of the beam.

The construction according to the invention renders it possible to obtain a beam of electrons which is as sensitive as possible, which is very important more particularly when the tube is employed as an amplifying tube. According to one particular form of construction according to the invention, the beam is given a shape such that the paths of the electrons form the generatrices of a conical surface. By this expression is meant any shape of the beam with which the place of impact has a circular shape; the beam may consequently also have, for example, the shape of a cylinder (angle at the apex of the cone 0°) or that of a disc (angle at the apex 180°). According to one particular form of construction the beam may have the shape of the surface of revolution.

With the particular form of construction according to the invention above described, one obtains the additional advantage that it is possible to utilize a cathode of any desired shape, for example, also a circular cathode as completely as possible and thus to ensure a very economic utilization of the tube while in addition the characteristic properties, of the tube, for example, in the case of electro-static control, considerably improve the slope.

In one particular mode of realization of the present invention the tube is not provided with one but with a plurality of conical beams owing to which a particular efficient construction of the tube according to the invention is obtained.

According to another embodiment of the invention use is made of a tube construction in which the cathode has a circular shape while the other electrodes and members utilized are circularly arranged around said cathode. One obtains in this case a beam which forms a flat disc with which a complete utilization of the cathode and, in addition, a considerable improvement of the qualities of the tube are obtained.

The tube according to the invention may be employed for different purposes; one particular possibility of its application resides, for example, in the use as a discharge tube for the amplification, production, etc., of electrical oscillations.

The invention will be explained more fully with reference to the accompanying drawing which represents, by way of example, two embodiments of the present invention.

Fig. 1 shows an amplifying tube designed in accordance with this invention; and

Fig. 2 shows an arrangement for producing a beam of electrons free from A. C. anode hum effects.

In Figure 1, 1 denotes the wall of an electric discharge tube which may act more particularly as an amplifying tube in push-pull connection. Within the tube there is provided a pinch 2 through which some of the supply leads of the electrodes are passed to the outside. Within the tube there is a cathode 3 of cylindrical shape the whole of the surface of which is utilized. The

electrons starting from the cathode are united with the aid of concentrating devices 4 and 5 to a beam which then passes through a plurality of cylindrical members and finally impinges on two anode cylinders 7 and 8.

In the path of the beam of electrons there is, seen from the cathode, first an auxiliary anode 9, 10 which may bring about an acceleration of the electrons while then the beam on its path to the anode comes in the neighborhood of two deflecting plates 11 and 12 with the aid of which a lateral deflection of the beam of electrons is affected and finally impinges beyond an auxiliary electrode 13 upon the anodes 7 and 8. Between these anode plates is interposed a member 14.

In the tube diagrammatically shown in Figure 2 the electrons starting from a cathode 15 are united to a conical beam 18 with the aid of concentrating devices 16 and 17.

This beam is then accelerated with the aid of an auxiliary anode 19 and beyond said electrode it is laterally deflected with the aid of members 20 and 21 which electrostatically act upon the beam of electrons, while at the end of the tube is arranged an anode 22 upon which the beam of electrons finally impinges. Moreover, at a short distance in front of the anode is arranged an auxiliary electrode having a positive potential and with the aid of which a disturbing effect of the anode alternating potential on the beam of electrons is avoided.

Although only two embodiments of the present invention are shown in the drawing, it will be clear that more forms of construction are possible with which the advantages aimed at and attainable with the invention can be realized.

Having described my invention, what I claim as new and desire to secure for Letters Patent, is:

1. An electron discharge tube comprising an electron emitter, a pair of conducting members, one of which substantially encircles the emitting element, and the other of which is located within the encircling conductor for forming the emitted electrons into a plurality of separate independent beams, means for deflecting each of the beams, an electron collecting element, and means adjacent said electron collecting element for preventing reaction between the collecting element and the electron beams.

2. An electron discharge tube comprising an electron emitter, a pair of conducting members, one of which substantially encircles the emitting element, and the other of which is located within the encircling conductor for forming the emitted electrons into a plurality of separate independent electronic beams of definite cross-sectional shape, means for deflecting each of the beams, an electron collecting element, and means adapted to be positively biased adjacent said electron collecting element for preventing reaction between the collecting element and the electron beams, said latter means comprising a conducting shield containing a plurality of apertures for the passage of electrons through said shield.

3. An electron discharge tube comprising an electron emitter, a pair of conducting members, one of which substantially encircles the emitting element, and the other of which is located within the encircling conductor for forming the emitted electrons into a plurality of separate independent beams, means for deflecting each of the beams, electron collecting means, means interposed between said electron emitting means and said electron collecting means for accelerating the electron flow, and a conducting shield adapted to be positively biased containing a plurality of apertures, said shield preventing reaction between the electron collecting means and the electron beam.

4. An electron discharge tube comprising an electron source, means at least partially surrounding said electron source for concentrating said electrons, means co-operating with and immediately adjacent to the electron concentrating means for developing from said concentration of electrons a plurality of separate and independent electron beam formations, means for accelerating the flow of electrons in said electron beam formations, said accelerating means being located adjacent said beam forming means, target means for collecting the electrons from said beam formations, and means positioned adjacent said target means for preventing reaction of the target means upon the electron beam formations.

5. An electron discharge tube comprising a substantially cylindrically shaped electron source, means at least partially surrounding said electron source for concentrating said electrons, means co-operating with and immediately adjacent to the electron concentrating means for developing from said concentration of electrons a plurality of separate and independent electron beam formations, means for accelerating the flow of electrons in said electron beam formations, said accelerating means being located adjacent said beam forming means, target means for collecting the electrons from said beam formations, and means positioned adjacent said target means for preventing reaction of the target means upon the electron beam formations.

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