April 10, 1934. R. GÜRTLER 1,954,203

THERMIONIC TUBE THREE-PHASE CATHODE

Filed July 21, 1930

Fig. 1

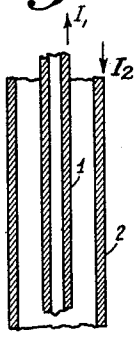


Fig. 2

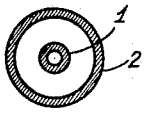


Fig. 3

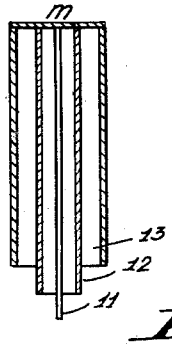


Fig. 4

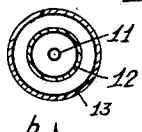


Fig. 5

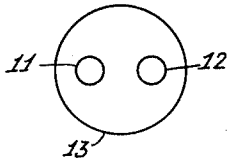


Fig. 6

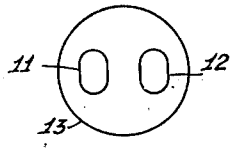


Fig. 7

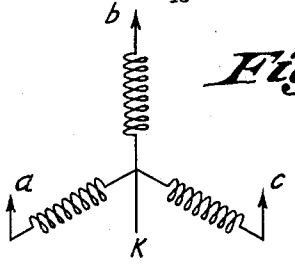
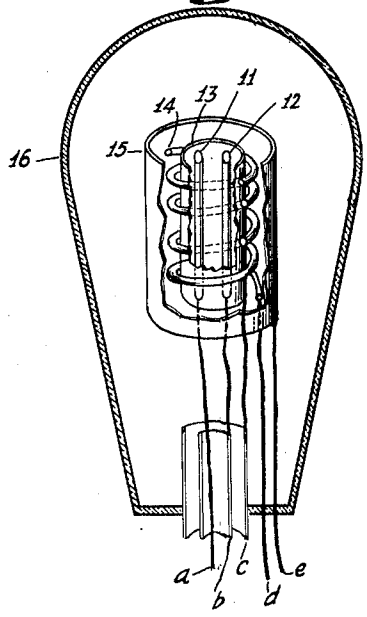


Fig. 8



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THERMIONIC TUBE THREE-PHASE CATHODE

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Application July 21, 1930, Serial No. 469,561
In Germany September 9, 1929

1 Claim. (Cl. 250—27.5)

In a thermionic tube whose filament is directly heated by an electric current, a magnetic field is set up around the filament, and this field, in the presence of large heating currents, is apt to assume such proportions that the travel or motion of the electrons is impaired thereby. This is what is known as the magnetron effect.

A manner of eliminating this effect resides in the fact that two co-axial conductors of cylindrical form set up no external field if the current flowing through one conductor is equal and opposite to the current flowing in the other conductor.

The invention will be more clearly understood with the aid of the accompanying drawing, in which

Fig. 1 represents a longitudinal cross section of a tube according to my invention wherein the cathode comprises two co-axial tubes.

Fig. 2 is a horizontal cross section of the cathode shown in Fig. 1.

Fig. 3 is a schematic longitudinal showing of a modified form of my cathode which comprises three heating tubes.

Fig. 4 is a schematic horizontal showing of the cathode shown in Fig. 3.

Fig. 5 is a schematic horizontal showing of another modification of my cathode.

Fig. 6 is a schematic horizontal showing of still another form of my cathode.

Fig. 7 represents the multiphase current source and the leads to the cathode.

Fig. 8 shows in section a thermionic device constructed according to my invention.

In Fig. 1, the cathode is adapted to be heated by two-phase current. The two tubes, which may have any shape in cross section but shown here as circular, are connected to the heating source so that current I_1 flows up in tube 1 while current I_2 flows down in tube 2. If I_1 and I_2 are equal, the resultant external magnetic fields will be very small. In fact, so far as practical purposes are concerned, the resultant field is zero.

Such an arrangement is useful for tubes heated by three-phase current or other symmetric multi-phase current. The three phases are connected with three concentric heater tubelets 11, 12, and 13, (Fig. 3), all of which are in conducting relationship at the other end *m*. The inner tubelet or rodlet 11 yields its heat by radiation to the second concentric tubelet 12, while the latter in turn also yields its heat by radiation to the outer one 13 having an electron-emissive surface and being additionally heated by the current flowing therethrough.

No matter what the resistances of the different phases of the cathode heated by three-phase current, the outer field will always be zero, because at any given instant the sum total of the currents of two phases will be equal and opposite to the current of the respective third phase.

It is possible to insure still another advantage compared with the cathode heated by two phases of an a. c., if the different tubelets 11, 12, and 13 are so made that they will present the same resistance under operating conditions. Then the sum total of the squares of the current will be constant, and hence also the heating energy will be constant at any given instant; and the cathode itself will undergo no thermal fluctuations even if its thermal capacity should happen to be very small. For the same reason it may also be desirable to use current having more than three phases, provided the cathode is suitably constructed to that end.

The cathode here disclosed, as will be noted, is useful also for small types of tube in which normally no a. c. heating is possible.

If a tube is to be designed for three-phase current heating, primarily for the reason of insuring constant heating energy, then two adjacent wires may be chosen for the two inner parts 11 and 12 of the cathode. Two executional examples are illustrated schematically in Fig. 5 and Fig. 6. Although the magnetic field set up on the outside of the cathode will not be zero, it will at least turn out to be extremely feeble.

In all three phase heated tubes, the star or neutral point of the heating transformer should most suitably be used as the cathode connection point, it being, of course, understood that also the joint point *m* of the three cathode phases could be brought out as the cathode point, or that outside the tube a star or cathode point could be provided by the star-connection of like active or reactive resistances. The leads *a*, *b*, and *c* of the three phase transformer shown in Fig. 7 are respectively connected to tubes 11, 12, and 13.

It is further more desirable to dispose the arrangement of the leads through the holder, and, if desired, also the outer supply leads of the heating current in a co-axial manner.

Fig. 8 shows a tube according to my invention. The device comprises an envelope 16, an anode 15, a grid 14, and the three cathode members 11, 12, and 13. The leads *a*, *b*, and *c* to the cathode members are all brought out concentric to one another. *d* and *e* are the leads for the grid and anode respectively.

I claim:

A three-phase cathode for an electron discharge device comprising three tubular conducting sections concentrically arranged in spaced relation and a common electrical connection between adjacent ends of said sections.

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