Aug. 27, 1940. R. M. WUNDT ET AL 2,212,578

ELECTRON TUBE

Filed Oct. 24, 1936

Fig. 1

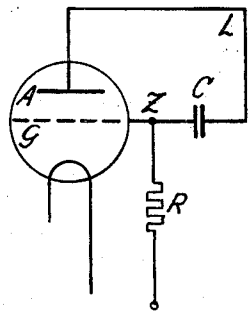


Fig. 2

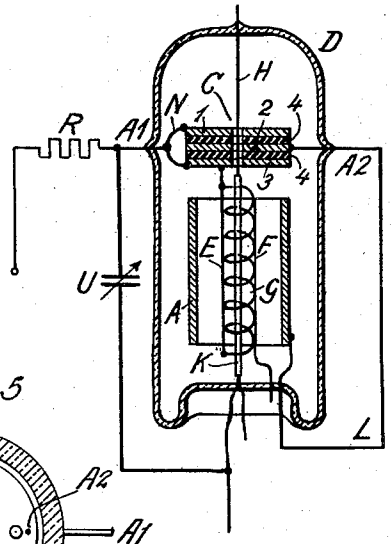


Fig. 5

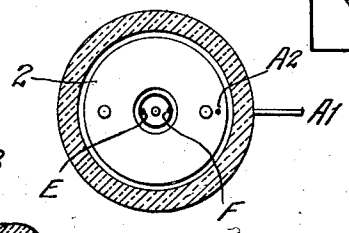


Fig. 3

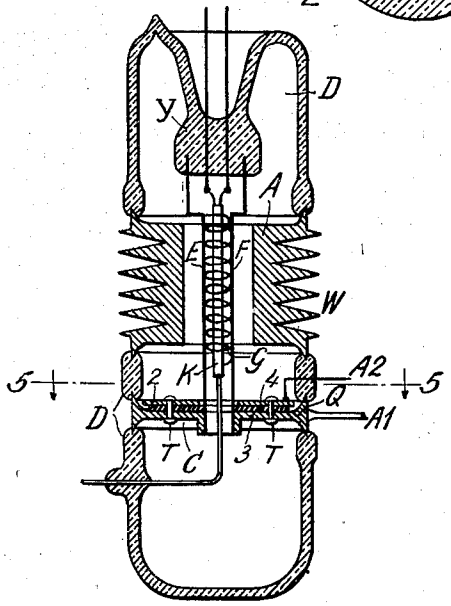
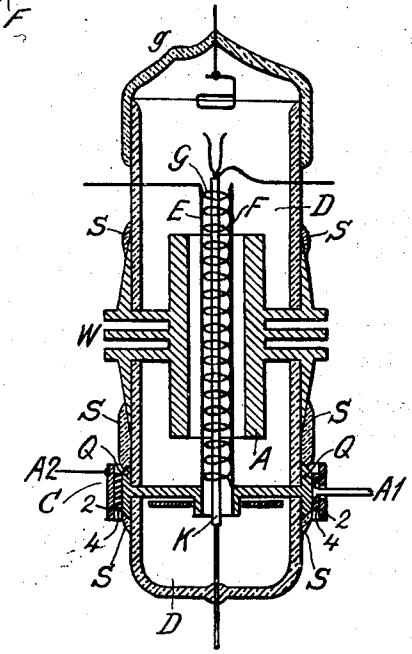


Fig. 4



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ELECTRON TUBE

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5 Claims. (Cl. 250—27.5)

The invention relates to electron tubes of the kind containing a condenser connected to one of the electrodes, such as the grid, for example, and it consists in certain features of novelty that will appear from the following description and be particularly pointed out in the appended claims, reference being had to the accompanying drawing in which

Fig. 1 is a wiring diagram of a known arrangement, Fig. 2 is a somewhat diagrammatic sectional view of one embodiment of the invention, Fig. 3 is a view similar to Fig. 2 and relating to a modification, Fig. 4 is a somewhat diagrammatic sectional view of still another embodiment of the invention and Figure 5 is a sectional view taken along section 5—5 of Figure 3.

In order to produce very short electric oscillations, such as so-called centimetre or decimetre waves, an arrangement of the kind shown in Fig. 1 may be used, as is well known. The anode A of the electron tube here represented is in direct connection with the grid G thereof by a self-induction L. The requisite capacity of the oscillatory circuit thus formed is given by the internal capacity of the tube itself. A condenser C serves to block the grid with respect to the direct current anode-voltage. The grid bias is supplied over a resistance R. Experiments have shown the conductor Z, interconnecting the condenser and grid, to have an influence upon both the wavelength to be shortened and the efficiency, and they have shown that this conductor Z being here a self-induction should be as short as possible.

In order to perform this, the invention makes use of disposing the condenser within the tube. This mode of construction is well known with arrangements having several tube systems comprised in a single device. However the known arrangements with internally disposed condensers are those concerned with the range of broadcast waves and therefore permit the leads to be of a certain length. As regards the range of ultrashort waves, however, special precautions are necessary which involve changes in the construction of such tubes. Without such precautions, that is, if the condenser were arranged within the tube in the manner known from the said combined tube devices, it would not be possible, to connect the grid in the manner required in the case of tubes of a certain great efficiency, because the grid would then be insulated whilst for circuit-technical reasons also resistance R would have to be disposed within the tube. This however is not desirable for other reasons.

The invention deals with the precautions adapted to overcome these difficulties. Arrangements as provided by the invention have an additional direct lead connected to the electrode, such as the grid, to which the outer high frequency circuit is joined by means of the condenser, such additional lead extending to the exterior of the tube.

The constructional arrangement of a tube improved in this way will be understood by reverting to Fig. 2. The grid here shown by way of example is a wire helix whose windings are supported by shanks E, F in a well-known manner. The cathode K is heated indirectly, for instance. Connected to the emitting layer thereof is a conductor H which extends through the glass or other wall of the discharge vessel D. Condenser C comprises three circular plates 1, 2, 3 and insulating material 4, for instance mica, between these plates. The two outer plates 1, 3 are connected with each other by a conductor N. To plate 3 the shank E is welded, so that there is a direct connection between condenser and grid. Tubes as provided by the invention have two leads A1, A2 extending through the wall of the vessel D. Lead A2 is in direct connection with plate 2 and thus in capacitive connection with the grid. Lead A1 is joined to plates 1, 3 and hence connected directly to the grid. To lead A2 and anode A the high frequency circuit L is connected whereas to lead A1, joined to conductor N, the grid leak resistance R is connected. The condenser here represented has been chosen in order to obtain the best possible constructional arrangement with the most appropriate electric conditions, an advantageous location of the leads being afforded in this way.

The invention thus renders it possible to arrange condenser C within the vessel D and yet to dispose the grid leak resistance R outside thereof. Furthermore, additional means may be provided for affecting the operation of the tube. For example, a variable condenser U may be interposed between grid and cathode and outside of the vessel D, as indicated. Such a condenser acting to increase the capacity which there is between grid G and cathode K, may serve to establish such feed-back conditions as are most appropriate in each case.

The invention is not only applicable to tubes having a condenser connected to the grid but may be employed also in connection with tubes of a similar type, such for instance as screen grid tubes wherein an oscillatory circuit is provided for the production of local or heterodyne oscillations.

In Figs. 3 and 4, parts equivalent to those shown in Fig. 2 are denoted by the reference characters used there. The arrangements shown in Figs. 3 and 4 are particularly suitable as regards mechanical strength.

In the arrangement according to Fig. 3 the electrode connected to one coating of the condenser C, in the represented grid G, is connected to a ring Q arranged to form a portion of the discharge vessel D, being united with the glass wall thereof by melting. The cylindrical anode A has cooling fins W and likewise forms part of the vessel D. The shanks E, F supporting the grid helix G, as described with reference to Fig. 2, are fastened in the glass press Y at one end while the other ends thereof are fastened in a socket of a metal disc 3 integral with the ring Q. This ring is preferably of the cross-sectional shape represented in Fig. 3, in order to be safely held in place by the glass wall of the vessel D. The ring may be given such shape by upsetting it. The heating leads of the cathode K are embedded in the press Y. The other connection of the cathode extends through the end of the vessel remote from the press. The condenser C here comprises the part 3, Q, forming one coating thereof, a circular disc 2 forming the other coating, and a dielectric 4, such as mica, disposed between these coatings, bolts T or other suitable fastenings being arranged to hold these parts together. It is immaterial whether coating 2 is arranged to face the anode A, as shown, or disposed on the other side of the disc or coating 3. Connected to coating 3 is the lead A2 that extends through the glass wall of the vessel D. As will appear from Fig. 3, vessel D thus consists of several parts united with each other by melting, namely the glass portion provided with the press Y, and forming one end of the vessel, the anode A with fins W, a glass ring, the metal ring Q and finally the other end portion which likewise is of glass.

During operation the anode is cooled by means of an air current.

As shown in Fig. 4, the disc-shaped coating 2 represented in Fig. 3 may be replaced by an annular coating 2 arranged to encircle ring Q, the dielectric 4 between these two rings being likewise annular.

The construction represented in Fig. 4 is such that the vessel D may be made of a ceramic material and thus be of a relatively great mechanical strength while permitting of an accurate shaping by grinding. Vessel D has only at one end a glass portion *g* in order to be here provided with a tubular extension where the tube is connected with the pump, and where it is sealed off, as is well known with devices of this kind. No press is provided here, the leads extending directly through the wall of the vessel. The electrode A and ring Q are not united with the vessel by melting but are shrunk thereon. The elementary parts of the vessel here require to be shaped very accurately. The vacuum within the vessel is maintained by melting glass or a ceramic glazing onto the butt joints. Such melting spots are denoted by S. Anode A is so constructed and arranged that during this melting the least possible amount of heat shall be carried away from the melting spots S to the anode. This is attained by the cylindrical main body of the anode being as far as possible remote from the spots S, so as to add to the length of the heat path from the spots S to the anode, whereby the melting operation may be quickly and accurately accomplished.

The annular condenser Q, 4, 2 shown in Fig. 4 may be fitted also to the tube represented in Fig. 3, that is to say, may be used with part Q instead of the disc-shaped condenser 2, 4, forming part of the arrangement shown in Fig. 3.

What is claimed is:

1. An electron tube having a vessel and electrodes, a condenser having two elements disposed within the vessel, a lead connected to one element of this condenser and extending through the wall of the vessel, a ring integral with the other element and forming a wall portion of the vessel, a lead connected to said ring, and a connection between one of said electrodes and said condenser.

2. An electron tube according to claim 1, wherein the said elements are disc-shaped.

3. An electron tube according to claim 1, wherein the said elements are centrally perforated discs, a sheet of insulating material between said discs, and bolts holding said sheet and discs together.

4. An electron tube according to claim 1, wherein said one of said electrodes is supported by said other element which is a disc integral with said ring.

5. An electron tube having a vessel and electrodes, a condenser having two plates disposed within said vessel, one of said plates being in close proximity to and directly connected with one of the electrodes, and leads connected with the two plates of the condenser and extending through the wall of the vessel.

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