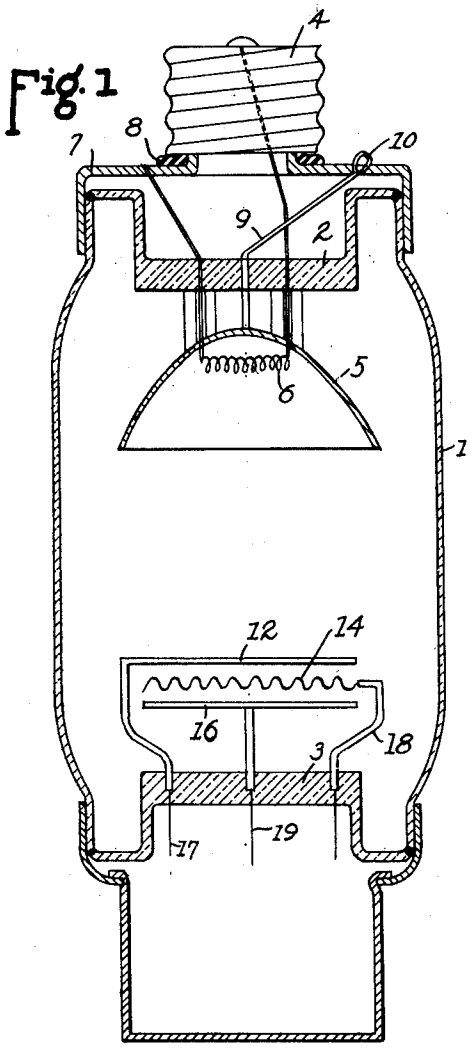
Dec. 22, 1931. O. T. McILVAINE 1,837,566

THERMIONIC TUBE

Original Filed July 2, 1925

Fig. 1



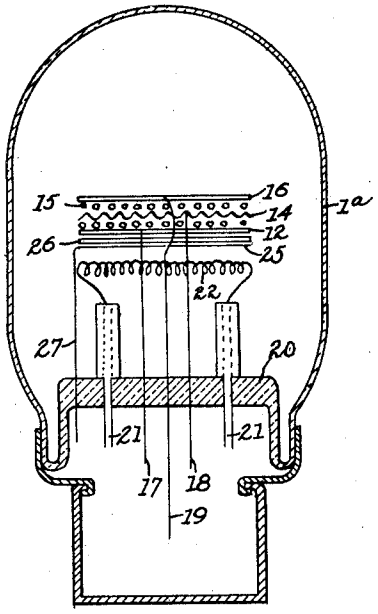


Fig. 3

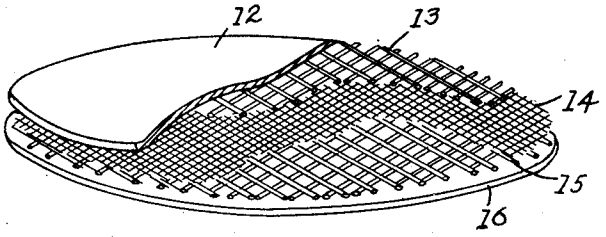


Fig. 2

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UNITED STATES PATENT OFFICE

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THERMIONIC TUBE

Application filed July 2, 1925, Serial No. 41,070. Renewed May 18, 1931.

This invention relates to thermionic tubes such as are employed in the reception, detection, amplification and repeating of sounds and signals as in wireless, radio, telephone, and the like and has for its objects the provision of a new and improved tube which shall be much more sensitive to incoming electric signals and much less sensitive to mechanical shocks and blows than previous devices of this nature and shall exhibit a higher capacity at a given working temperature; the provision of a new and improved type of tube adapted to be operated from an alternating electric light current without a transformer, rectifier, battery, wave-smoother, or any other accessory; while further objects and advantages of the invention will become apparent as the description proceeds.

In the drawings accompanying and forming a part of this application Fig. 1 is a central sectional view through an improved radio tube embodying my improvements; Fig. 2 is a similar view through a modified form of tube; and Fig. 3 is a perspective view with parts broken away showing the preferred construction of tube elements.

My improved tube comprises the usual evacuated glass globe in which the tube elements are mounted. In Fig. 1 I have shown a double ended tubular container or globe 1 made of glass, that is to say, each end of a glass tube is closed by a press, 2 or 3, and each end of the container so formed outside of the press is provided with a base member of suitable design. In the present case I have shown the globe or container as provided at the end having the press 2 with a screw-threaded base 4 adapted for the reception of the standard socket employed in electric house lighting. Inside the globe the press 2 carries, suitably insulated thermally, a small parabolic reflector 5 inside of which, adjacent the parameter, is an incandescent electric resistance wire 6 preferably coiled into a thin coil so that the heat and light rays cast by the reflector may be thrown downwardly in a close, concentrated, intense beam. The end of the globe adjacent the member 4 is covered by a metal cap 7 from which the terminal members are insulated by an insulating layer 8. A wire 9 is preferably secured to the reflector 5 and passes through the press 2 where it is preferably formed and adapted for connection to a ground wire (not shown). One mode of effecting this construction is to attach the reflector to the cap 7, the latter being preferably provided with a loop 10 or other provision whereby a ground wire can be secured.

The press 3 at the opposite end of the globe or container is preferably made of the same size and shape in order to facilitate the doing of the work by automatic machinery, and carried by this press are my new and improved electron-emitting and absorbing elements. In their preferred form these consist of circular disks of the necessary materials, located as closely together as is practically convenient and arranged in the path of the heat beam cast by said reflector so as to be heated thereby without electric contact. In its preferred form this combination element comprises a circular disk 12 of some metal which will emit electrons readily at a comparatively low temperature and without becoming modified or injured by long continued use. Next to the disk is an insulating layer 13 which preferably takes the form of a net work of glass or quartz rods, although a series of straight glass threads is sufficient for the purpose in case they can be held in place. Next to this insulating layer is the grid element, which preferably consists of a screen cloth or foraminous metal sheet 14. Next beyond this is a second insulating layer 15 which may, if desired, be of the same material and dimensions as the layer 13; and finally is the circular absorption plate or anode 16. The plate 12 is located nearest to the heat source and constitutes the cathode, the cathode terminal 17 being connected thereto. The face of this plate on which the radiations fall in preferably blackened so as to absorb the largest possible proportion of this radiation, while its opposite face is preferably impregnated, either in the metal state or in the combined form with an alkali-earth- or refractory-earth-oxide compound thereof such as calcium oxide, barium oxide, thorium oxide, etc. I do not limit myself

to the employment of solid insulating materials in the layers 13 and 15, since it is sufficient for some purposes merely to support them sufficiently far apart for the air space to separate them, although one advantage of my improvements is that by the use of solid insulating materials a device is made which is rigid and proof both against sagging and becoming short circuited with lapse of time and also against the effect of shocks or jars. The grid 14 is connected to the terminal 18 and the plate 16 to the anode lead 19, all three of the wires 17, 18, and 19 being fused in the press 3 and thereby supported at the opposite end from the alternating current connections.

In Fig. 3 I have shown a modification of my tube in which all connections are at one end of the container which is here shown as bulb shaped. The container 1ª has its single mouth closed by the press 20 in which are sealed the leading-in wires 21—21 across whose inner ends is connected the transverse heating element 22. Located in close proximity to this filament is the combined element as heretofore described comprising a cathode plate 12, grid 14 and anode plate 16 with interposed insulating layers 13 and 15, the plate 12 being located in such relation to the filament 22 as to be heated by the radiations therefrom. In this case, instead of employing a reflector behind the filament and locating the parts at a distance from each other, I have located the element and filament close together; and in order to shield the operative parts from electro-static influence caused by energizing the filament by alternating current I interpose between the filament and cathode a sheet metal plate 25 separated from the plate 12 merely by a thin layer 26 of some substance which conducts heat readily and is rather a poor conductor of electricity, the plate 25 being grounded by a wire 27 passing through the press. The wires 17, 18, and 19 appear as before, although they are shown merely diagrammatically inasmuch as they preferably lie in planes which do not contain the press.

Owing to the very small distance between the different plates (it will be understood that the drawings herein shown are of enlarged size and that a successful element need little, if at all, exceed the dimensions of a twenty-five cent piece) a sufficient electron emission for successful operation can be obtained at comparatively low temperatures, and an extremely small potential is necessary to produce electron movement, wherefore the device is extremely sensitive, although owing to its small internal resistance its capacity is very considerable. An advantage of using a solid insulating substance between the grid and the members adjacent thereto is that the parts are thereby spaced a fixed distance from each other, which distance is always maintained regardless of age, temperature, or nature of use, but neither this substance nor the layer 26 need possess any high insulating value inasmuch as it is never called upon to withstand a high potential but a single sheet of mica or the like is fully ample for the purpose. The short distance between the grid and plate has the further great advantage of rendering the tube very insensitive to external influences such as that of an alternating current in the heating filament, although it will be understood that my improved tube can be energized by direct current equally as well as by alternating current provided only that the proper voltage be applied.

Having thus described my invention what I claim is:

1. In a thermionic tube, an anode, a control plate, a cathode, a heating device located in the order named and insulated from each other, said heating device comprising a radiation element located in radiating relation to said cathode and out of conducting relation therewith either electrically or thermally, and a grounded element located in closer proximity to said heating device than to said cathode.

2. In a thermionic tube, an anode, a control plate, and a cathode assembled together in the order named and an open meshed layer of electrically non-conducting solid material interposed between said control plate and the other members.

3. In a thermionic tube, an anode, a cathode, means including solid spacing devices of electrically insulating material interposed between said anode and cathode and holding them a fixed distance apart, and an external heating device for said cathode located upon the opposite side from said anode, said spacing devices being open meshed to permit the passage of electrons therethrough.

4. In a thermionic tube, the combination with an evacuated globe of an anode and a cathode inside the same, solid spacing devices of electrically insulating material between said anode and cathode, and a radiation heating device inside said globe at the opposite side of said cathode from said anode.

In testimony whereof I hereunto affix my signature.

ORAN T. McILVAINE.