Sept. 7, 1926. 1,599,180

O. T. McILVAINE

THERMIONIC TUBE

Filed July 2, 1925

Fig. 1

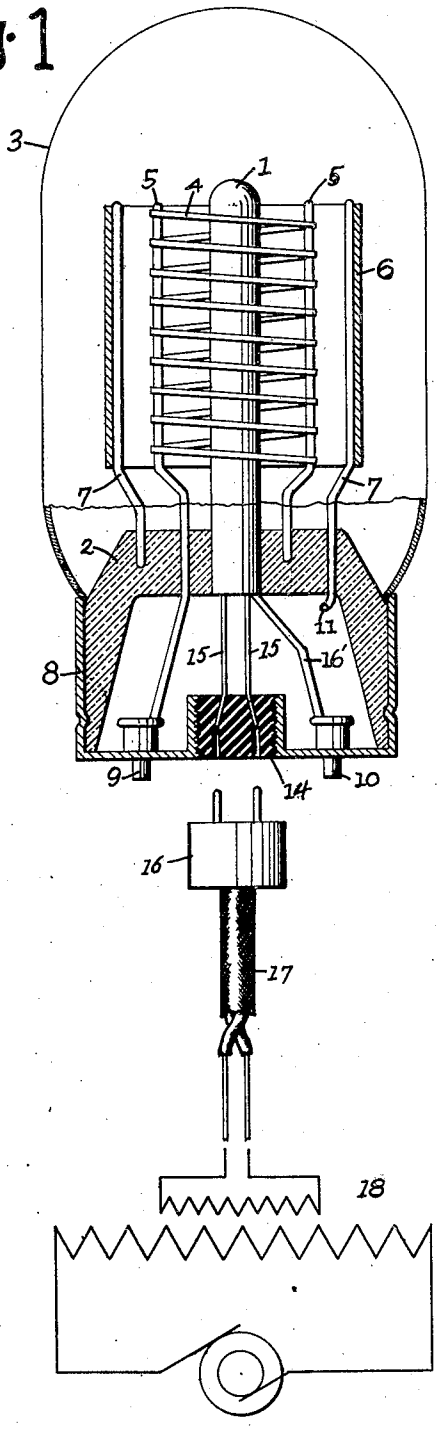
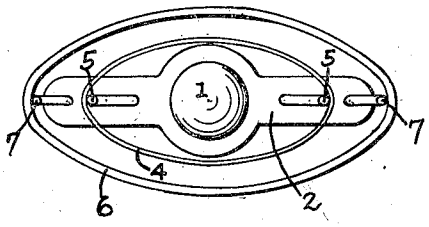


Fig. 2



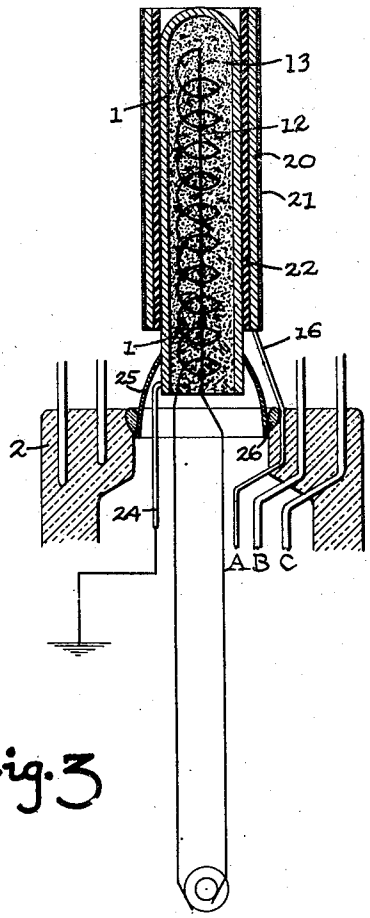


Fig. 3

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UNITED STATES PATENT OFFICE.

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THERMIONIC TUBE.

Application filed July 2, 1925. Serial No. 41,068.

This invention relates to thermionic tubes such as are employed in the transmission, reception, detection, and amplification of sounds and signals as in wireless, radio, telephone, announcers, rectifiers, and the like and has for its object the provision of new and improved expedients for producing a uniform and reliable electronic emission by the use of alternating current, thereby dispensing with the battery hitherto usually employed for the purpose. Another object of the invention is the provision of a thermionic tube wherein the electronic emission is produced by the use of alternating current, the operative parts being so arranged and so shielded from local static influence as to enable the omission of any special biasing battery; the provision of an alternating current tube which can be used in standard radio sets with a minimum of rearrangement; 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 a radio tube of conventional design the same being equipped with my improvements; Fig. 2 is a top plan view of the elements shown in Fig. 1; and Fig. 3 is a sectional view through an emission tube containing my improvements, certain of the arrangements being slightly modified from that shown in Fig. 1.

My invention comprises the use of a closed impervious tube 1 preferably made of metal and hermetically sealed in the wall of the vacuum chamber, the interior of the tube containing the heat producing device and the exterior of the tube carrying the electron emission provisions. In the simplest and most approved form this tube is either directly or indirectly sealed into or otherwise joined to the "press" 2 which constitutes the closure for the base of the glass globe 3, and this press also may conveniently carry any other operating elements which the tube contains, such as the "grid" which is here illustrated as consisting of a loop of fine wires 4 wound on posts 5, 5, carried by the press; and the "plate" 6, here shown as a sheet of metal supported by other posts 7, 7, also carried by the press outside of the first posts. Ordinarily the base of the tube is completed by a cap 8 of some convenient or suitable material provided with suitable insulated terminal posts, certain of which are indicated at 9 and 10 respectively. In Fig. 1 I have shown the contact 9 as connected to the grid and the contact 10 as connected to the tube 1, the plate 6 having a conductor 11 leading therefrom to another contact (not shown).

Mounted inside the tube 1 is a suitable heating element which may be of any suitable or desired construction but preferably comprises a resistance wire 12 of nickel steel, nickel chromium or other suitable alloy wound and generally submerged in or embraced by some kind of electrical insulating material 13 having as high a conductivity for heat as is compatible with the desired electrical properties. This heating element may either be permanently mounted in the tube 1 or removably supported therein, in which latter case it is of course replaceable in the event of failure or "burning out". In case the element is replaceable the tube base is preferably provided with a removable plug 14 as shown in Fig. 1 in order to enable ready access. The resistance element is connected to wires 15 leading to this plug, which may constitute one part of a separable connector, the other part 16 of which is connected to the flexible lead wires 17.

The heating element may be designed for any desired voltage, and this voltage may in turn have some effect upon the construction of the rest of the tube. According to one mode of construction the heating element is made with comparatively large and short resistors and is connected to the alternating current through a step-down transformer 18 as shown in Fig. 1, whereby the voltage in the heating element is reduced. This has several advantages, one of which is that the electrostatic effect of the current is likewise made so small as to be less obnoxious. The exterior of the tube is preferably treated or coated with a layer of some material having a high emissive capacity at comparatively low temperature, such as the oxides of barium, strontium, thorium, etc., and the exterior portion of this tube is made of electric conducting material connected by means of the wire 16′ to one of the tube contacts as 10. In the simplest construction the entire tube 1 is made of metal, some metal of course being used which can be sealed to the glass, although it is equally within my invention to employ a hard glass

tube having a metallic covering to which this wire is attached.

According to another form of my invention a metal sleeve 20 is used as the emitting member, being coated exteriorly with a layer 21 of high emissive material, and suitably connected by the wire 16 to the proper terminal. Interiorly this sleeve is insulated from the tube 1 by means of a layer 22 of some material having a high degree of electrical insulation coupled with the highest possible degree of heat conductivity such as mica, enamel, porcelain, etc., the tube 1 being grounded by way of a suitable conductor 24. This arrangement is particularly desirable in case the tube is designed for direct connection to a 110 volt lighting circuit, since the interposition of this grounded member between the resistor and the tube interior shields the latter from electrostatic effect. Of course this arrangement is not limited to use with high potential, but is particularly important in that connection; and the tube 1 may still, if desired be made of glass, the grounded member consisting of a thin sheet metal shield laid against the walls thereof.

In case the tube be made of metal, however, especial care is requisite in sealing the same into the wall of the globe although numerous expedients have been developed for effecting this as is well understood in the art. For example the entire tube can be made of platinum which has the same coefficient of expansion as soft glass and is readily wet by the molten glass; or the tube may be made of metallic tungsten which has appreciably the same coefficient of expansion as hard glass and can readily be sealed therein; or some special glass or enamel of the necessary characteristics can be interposed between the glass and the metal; or a collar 25 of some special metal like platinum can be interposed between the tube and glass, one end of the same being sealed to the glass by means of a luting 26 of special glass and the opposite end soldered or welded to the tube. The oxide coating can be either formed immediately on the exterior of the tube or on the surface of a sleeve which is slipped thereover as shown in Fig. 3, the latter arrangement being preferable in many ways as a manufacturing expedient, regardless of the employment of any insulating layer 22. When made of metal this tube 1 is preferably itself very thin and hence more readily held in place than a thicker tube would be.

It will be understood that a great many changes in design and arrangements of part can be made within the scope of my inventive idea; and that I do not limit myself to any form or arrangement whatever of grid, plate, or other operating elements; and that my improved tube, while designed for alternating current, can be operated with equal success on direct current of the proper voltage; and that in general I do not limit myself in any wise excepting as specifically set forth in my claim.

Having thus described my invention what I claim is:

In a thermionic tube, a globe, an impervious, thin-walled metal tube sealed therein, electronic emission substance on the side of said tube which faces the vacuum chamber, an electric circuit element connected to said substance, an electric resistance heating element in said tube, and a ground connection leading to a metallic part between said heating element and said emission substance.

In testimony whereof I hereunto affix my signature.

ORAN T. McILVAINE.