March 20, 1934. F. L. HUNTER, JR 1,951,612

VACUUM TUBE STEM

Filed June 30, 1930

Fig. 1.

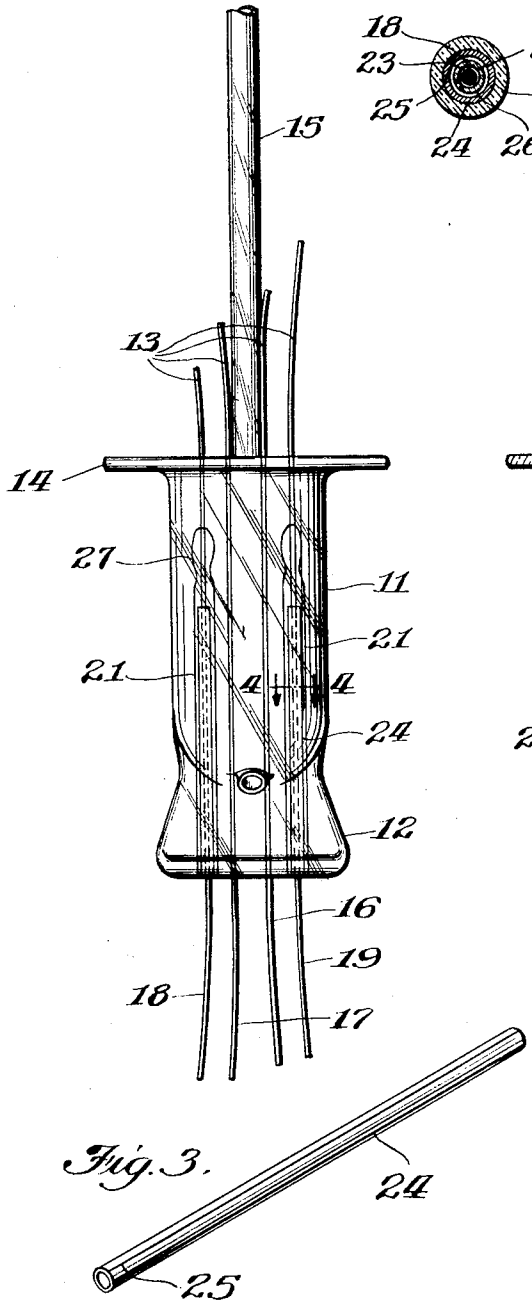


Fig. 4.

Fig. 2.

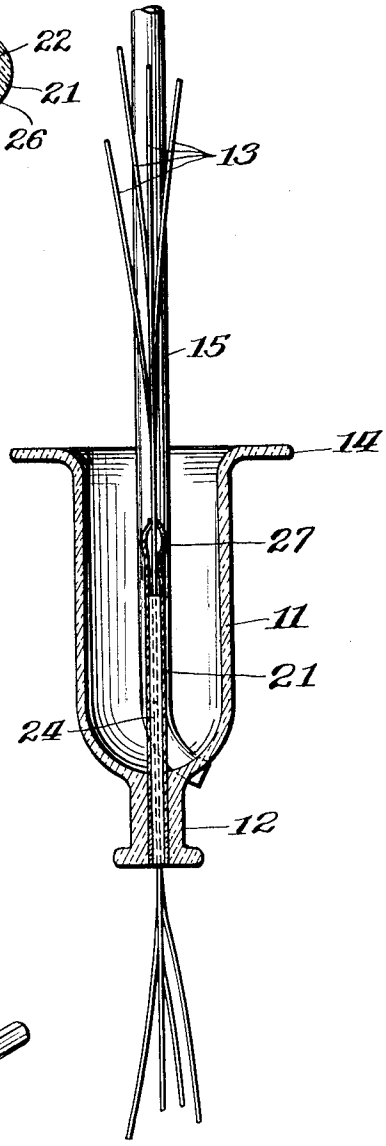


Fig. 3.

Inventor

Frederick L. Hunter Jr.

By Williams, Bradbury,
McCaleb & Hinkle Attys.

Patented Mar. 20, 1934 1,951,612

UNITED STATES PATENT OFFICE

1,951,612

VACUUM TUBE STEM

Frederick L. Hunter, Jr., Lake Bluff, Ill., assignor to Fansteel Products Company, Inc., North Chicago, Ill., a corporation of New York

Application June 30, 1930, Serial No. 464,749

8 Claims. (Cl. 250—27.5)

This invention relates to a reentrant portion or stem which is adapted to carry the conductors for the tube elements and to seal an end of the tube.

The glass reentrant portion or stem of vacuum tubes is subject to heating in the operation of the tube. This stem usually has sealed therein the lead-in wires or tube conductors for conducting electrical energy to and from the tube. When the stem is heated, an electrolytic action between the lead-in wires and the stem is set up which tends to destroy the seals about the conductors in the stem. This heating and electrolysis of the stem seriously impairs, and may even destroy, the efficacy of the seal and thereby tends to shorten the life of the tube.

It is, therefore, an object of this invention to provide a novel vacuum tube stem or reentrant portion for effectively sealing an end of a vacuum tube, the tube conductors carried by such a stem being so arranged in the stem and protected that they are insulated from each other and that they prevent electrolysis of the stem.

Another important object of the invention is the provision of novel sealing and insulating means about conductors of a vacuum tube stem whereby to insulate the conductors from the stem and to prevent excessive heating and electrolysis thereof.

Other objects and advantages of the invention will be apparent as it is better understood from the following description which, with the accompanying drawing, discloses a preferred embodiment thereof.

In the drawing:

Figure 1 shows in elevation a vacuum tube stem embodying the features of the invention;

Figure 2 is a vertical section taken on a plane substantially normal to the plane of the sheet, through the stem of Figure 1;

Figure 3 is a perspective view of an insulating means for use in the stem of Figure 1; and

Figure 4 is a horizontal section taken substantially on the line 4—4 of Figure 1.

While the drawing shows only a vacuum tube stem or reentrant portion, carrying a plurality of conductors, it will be understood that the stem is adapted to be positioned in an end of a vacuum tube (not shown) of usual or preferred construction so that its hollow, cylindrical body 11 will project into the tube and its pressed or pinched and fused end 12 will be conveniently disposed for making the proper connections between lead-in wires or conductors 13 and the elements of the tube.

At the end of the body 11 opposite the closed or pressed end 12, a flange or sealing collar 14 is formed about the body which serves to close the end of the tube and to make a seal therewith. After sealing the vacuum tube, it may be exhausted or evacuated through an exhaust tube 15 formed through the body 11 to communicate with the inside of the vacuum tube and extending outwardly from near the closed end 12 of the body 11, the tube 15 projecting above the flange 14 to facilitate the exhausting operation.

As illustrated, the stem or reentrant portion is adapted for use in a vacuum tube having the usual electrodes, such, for example, as a grid electrode, a plate anode, and a filamentary cathode, disposed in the tube in a manner which is well known and which requires no description for an understanding of the present invention. By way of explanation, however, it may be mentioned that the leads to the filamentary cathode bear a conductive relation to each other while those of the grid electrode and the plate anode bear a capacity relation to each other and to those of the cathode. In the operation of the tube, these elements or electrodes heat the glass stem or reentrant portion thereby causing electrolysis of the stem. The electrical stress between the leads during the operation of the vacuum tube due to the potential difference between the electrodes and the curent flowing in the tube conductors, supplement this heating of the glass stem.

This invention, therefore, provides insulating means for the leads or conductors which have a capacity relation with the others as will now be described. The conductor leads 13 extending longitudinally of the body 11 include a wire 16 and a wire 17 pressed and sealed between the sides of the body 11 at its closed end 12 in a usual manner and adapted to lead an electric current to and from a filamentary cathode so that the leads 16 and 17 bear a conductive relation to each other.

Leads 18 and 19 are provided for connection with the plate anode and the grid electrode of the vacuum tube and bear to each other and to the leads 16 and 17 a capacity relation. These leads 18 and 19 are at opposite sides of the body 11 and extend therethrough longitudinally of the body and are arranged through the closed end 12 so as to be insulated therefrom, from each other, and from the leads 16 and 17. The insulating means for the lead 18 being identical to that for the lead 19, only one such means will be described.

As shown in Fig. 4, a tube or conduit 21 of glass, is provided in the body 11 and projects upwardly from the end 12 at opposite sides of the exhaust tube 15. These glass tubes 21 communicate at their ends through the end 12 with the inside of the vacuum tube and provide means for leading the conductors 18 and 19 into the vacuum tube. Inside of the tube 21 a smaller tube or bushing 22 of quartz, glass, or other electrical insulation fits loosely about the lead or conductor 18 to provide a space 23 about the conductor which, with the tubes 21 and 22, provides heat and electrical insulation between the conductor and the glass in the end 12 of the stem.

The tube 22 serves as insulation between the conductor or lead and a split tube or sleeve 24, preferably of nickel, which telescopically engages in the tube 21 between the walls of the tube 22 and the outer tube 21 so that it is retained therein by the resilient engagement provided by its longitudinal slit 25. This tube 24, as seen in Fig. 4, is inserted in the tube 21 before pressing and closing the end 12 of the stem to prevent the tube 21 from closing when the end 12 of the stem is closed. The tube 24 provides a space 26 about the glass tube or bushing 22, further insulating the conductor 18 from the other conductors and the end 12 of the stem, and provides means for conducting heat away from the end 12.

These tubes 21, 22 and 24 are substantially coaxially arranged through the pressed end 12 and the outer tubes 21 make at their inner ends a seal with the end 12. The other ends of the tubes 21 extend beyond the ends of the metal tubes 24 where they are beaded and formed about the conductors 18 and 19 as at 27 where the tubes are suitably sealed around the wires to provide an effective seal of the conductor openings leading into the vacuum tube.

Thus the conductors having a capacity relation with other conductors are insulated, electrically and thermally, from the stem body so that the stem is protected against electrolysis begun as a result of its being heated during the operation of the tube. By so protecting the leads as to prevent electrolysis of the stem, or electrolytic action between the conductors, the seals about the conductors through the stem are protected against destruction due to such heating and electrolysis, thereby promoting efficiency in a vacuum tube using this novel stem.

While I have illustrated and described a specific embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details set forth but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I claim is new and desire to secure by Letters Patent of the United States is:

1. A stem adapted to seal a vacuum tube and to carry electrical conductors for the tube, comprising a hollow body portion having a closed end, a plurality of conductors arranged through said closed end, outer and inner glass tubes positioned about said conductors and adapted to extend into said body portion, and metal tubes arranged through said closed end between said glass tubes and spaced from said inner glass tubes to provide heat and electrical insulation between said conductors and said closed end of said body portion.

2. A stem adapted to seal a vacuum tube and to carry electrical conductors for the tube, comprising a hollow body portion having a closed end, a plurality of conductors arranged through said closed end, spaced glass tubes positioned about said conductors and adapted to extend into said body portion, and metal tubes arranged through said closed end between said glass tubes and spaced from said conductors to provide electrical insulation between said conductors and said closed end of said body portion, whereby to protect said body portion against electrical influences from said conductors.

3. A vacuum tube stem comprising a plurality of conductors for conducting current to and from a vacuum tube, outer and inner electrical insulators positioned about said conductors, said outer insulators having ends sealed in said stem, and metal tubes arranged between said outer and inner insulators, and resiliently engaging said outer insulators.

4. A vacuum tube stem comprising a plurality of conductors for conducting current to and from a vacuum tube, spaced outer and inner electrical insulators positioned about said conductors, and metal tubes arranged between said outer and inner insulators, and resiliently engaging said outer insulators, said outer insulators providing seals at their ends about said conductors.

5. A vacuum tube stem construction for preventing electrolysis of the stem, comprising a body portion having a pressed end, a plurality of outer and nested inner tubes, each said outer tube having an end sealed in said pressed end, a lead in conductor concentrically arranged in each said inner tube, and means sealing said outer tubes to said conductors at the ends of said outer tubes remote from the pressed end of said body portion.

6. A vacuum tube stem for lead in conductors, comprising a body portion having a pressed end, a plurality of lead in conductors passing through said pressed end, and a plurality of insulators having open ends, said open ends being sealed in said pressed end and opposite ends within said body portion sealed about said lead in conductors.

7. A vacuum tube stem having a pressed end in combination with a lead in conductor seal for preventing electrolysis of said pressed end, comprising an outer tube having an open end sealed in said pressed end and having another end sealed about a lead in conductor, a reinforcing tube within said outer tube and an inner tube within said reinforcing tube and spaced therefrom.

8. A vacuum tube stem having a pressed end in combination with a lead-in conductor in said stem, and an insulating tube arranged about said lead-in conductor in said vacuum tube stem and having an open end sealed in said pressed end, and having another end sealed about said lead-in conductor in said stem remote from said pressed end.

FREDERICK L. HUNTER, JR.