

A. GREINER & F. J. FARRELLY.

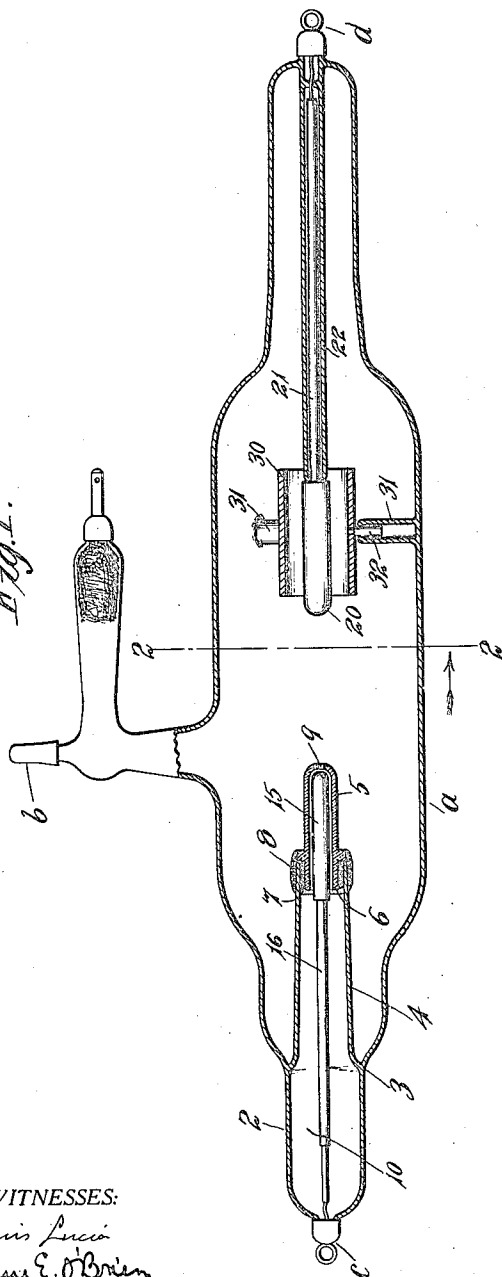
VACUUM TUBE.

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1,295,481.

Patented Feb. 25, 1919.

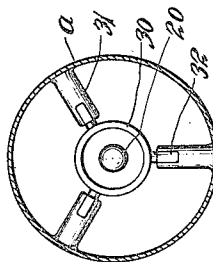
Fig. 1.



WITNESSES:

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Fig. 2.



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VACUUM-TUBE.

1,295,481.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, ALFRED GREINER, a subject of the Emperor of Germany, and resident of Hartford, State of Connecticut, and FRANCIS J. FARRELLY, a citizen of the United States, and resident of Hartford, county of Hartford, and State of Connecticut, have invented certain new and useful Improvements in Vacuum-Tubes, of which the following is a specification.

This invention relates to valve tubes adapted for use in connection with X-ray tubes, such for instance as are coil-excited. These valve tubes are relied upon to cut out the inverse current in the tubes which interferes with the proper action, causes them to rather rapidly harden or to go up in vacuum, and also causes a disintegration of the metal terminals in the tube and the consequent deposit of a metal oxid or other substance upon the walls of the tube, interfering with the action and ultimately resulting in the destruction of the tube. As was said above, the valve tube forming the subject matter of this application is designed to insure to the greatest possible degree the prevention of a change of polarity of the current, and in consequence to guard most effectively the X-ray tube in the circuit of which the valve tube is connected.

The valve tube comprises in general a glass bulb exhausted to a proper vacuum and containing positive and negative electrodes, with conducting wires sealed through the glass in order that these terminals may be connected into the circuit. The novel feature of this invention resides in the complete electrical insulation of the positive electrode except where it is exposed through a small aperture formed in a material which is not subject to disintegration by the action of the electrical current. Porcelain is such a material, and possibly one of the best materials.

One important feature of this invention resides in the provision of a complete and effective connection between the porcelain and the glass in order to produce an effi-

cient electrical seal so that the current within the tube cannot reach the metal parts inclosed within the glass and porcelain except through the aperture in the porcelain.

Another important feature of the invention resides in surrounding the negative electrode by an aluminum shell which is spaced from it and entirely separate from it, and which is supported by the bulb on posts of insulating material, this shell standing as an isolated and insulated member between the negative electrode and the bulb, absorbing the excess heat from the electrode, preventing the radiation of heat in any form from the electrode to the wall of the bulb; and the shell itself, acting somewhat as a reservoir, and being electrically insulated within the bulb, the heat which it absorbs is not forced and cannot to an unreasonable or dangerous degree be radiated to the walls of the bulb to cause an excess of heat at a localized point, which might result in a cracking of the bulb.

Figure 1 is a side view of a tube embodying our invention, shown for the most part in section.

Fig. 2 is a sectional view on the line 2-2 of Fig. 1 looking in the direction of the arrow.

Referring to the drawing in which an embodiment of the invention is illustrated,— *a* denotes the bulb, *b*, the exhausting tip, *c*, the positive terminal at the exterior of the tube, and *d* the negative terminal at the exterior of the tube. At either end the tube is reduced to form necks, and within the positive neck 2 is sealed, as at 3, the end of a glass tube 4, which projects into the interior of the tube and has at its end a cap 5 of porcelain or similar material which is connected with this tube in some such manner as to produce a complete electrical insulation in order that the current cannot flow into the interior of this glass tube 4 through the point of its connection with the porcelain cap. The tip 6 of this porcelain cap is provided with a cushion 7 of mica or some other suitable material, and is fitted into the end of the glass tube

4. The joint then is well covered with a heavy layer of electrically insulating cement 8, producing a complete and effective seal so that current cannot leak in and reach the supporting stem of the cathode. In the end of the porcelain cap is a small aperture 9.

It will be observed from this description that an isolated chamber 10 is formed in the positive end of the tube, open to the interior of the tube only through the small aperture 9 in the porcelain cap. Within the cap and close to the aperture is located the positive electrode 15 supported by the stem 16 which is connected with the exterior positive terminal *c*. It will thus be seen that the only path of the current to or from this positive electrode is through the small aperture 9 in the end of the porcelain cap.

At the negative end of the tube the negative electrode 20 is supported on the stem 21 which is connected with the exterior negative terminal *d*, the stem being preferably surrounded by a glass tube 22. This negative electrode is positioned within the tube with its end in alignment with the positive terminal, and as a result it will be seen that the current passing between these terminals is forced to go through the small aperture 9 in the porcelain cap. To prevent the direct radiation of heat in any form from the electrically charged negative electrode to the walls of the tube, the shell 30 is provided, spaced, as will be seen, from the electrode and entirely disconnected from it, this shell being supported within the tube by the radially disposed glass posts 31 extending inward from the wall of the tube and fitting on to small studs 32 on the exterior of the shell. Other methods of supporting this shell may be utilized if desired, but the main consideration is that the shell shall be without electrical connection and shall be supported by heat insulators. This shield is positioned before the end of the vacuum tube is closed in; the posts 31, are positioned on the pins, and the parts as assembled slipped into position within the tube, when the outer ends of the posts are fused to the tube wall.

Valve tubes made in accordance with the above disclosure have been found to possess a very great degree of efficiency in controlling the polarity of the current, and as a consequence protect the X-ray tube and permit of its being operated for considerable periods of time without material change in the degree of vacuum, either in the valve tube or in the X-ray tube; and by eliminating the inverse current in the X-ray tube, prevents discoloration and the destruction of the tube.

It is obvious that the metallic sleeve around the cathode terminal is adapted for use in other than the valve tubes.

We claim as our invention:

1. The combination with a glass vacuum bulb and electrodes positioned therein and adapted to be connected into one side of the exterior circuit of an X-ray tube, of means for electrically insulating said electrodes from one another, said means made in two parts, one of which is supported from the wall of said bulb and the other carried by the first and arranged adjacent one of said electrodes and having a restricted aperture in line between said electrodes.

2. In a valve tube, the combination with a glass vacuum bulb and electrodes mounted therein and adapted to be connected into an external circuit, of a wall of insulating material sealed about its edge to the wall of the tube and a piece of vitreous electrical insulating material fitted into and secured to said wall by an electrical insulating cement, said vitreous material being arranged closely adjacent to the end of one of said electrodes and provided with a restricted opening forming the sole path for the current passing between said electrodes.

3. In a valve tube, the combination with the vacuum bulb, and electrodes mounted therein and adapted to be connected into an external circuit, of a tubular glass sleeve surrounding the stem of one of said electrodes and with its end sealed to the interior of said bulb, a cap of vitreous electrical insulating material mounted in the end of said sleeve and inclosing said electrode, electrical insulating cement securely fastening said cap to said sleeve, and a restricted opening in the end of said cap opposite the end of said electrode.

4. In a valve tube, the combination with the vacuum bulb, and electrodes mounted therein and adapted to be connected into an external circuit, of a tubular glass sleeve surrounding the stem of one of said electrodes and with its end sealed to the interior of said bulb, a cap of porcelain mounted in the end of said sleeve and inclosing said electrode, electrical insulating cement securely fastening said cap to said sleeve, and a restricted opening in the end of said cap opposite the end of said electrode.

5. A valve tube divided interiorly by a two-part di-electric wall into two chambers, a restricted aperture in one part of said wall, an electrode located at one side of said wall adjacent to the aperture, and a second electrode located at the opposite side of said wall and operatively positioned with respect to the first mentioned electrode.

6. The combination with a vacuum tube and the electrodes mounted therein, of a me-

tallic sleeve surrounding one of said electrodes and spaced therefrom and from the wall of said tube, and glass posts secured to the interior of said tube and engaged with
5 said sleeve to position and hold it.

7. The combination with a vacuum tube and the cathodic and anticathodic electrodes mounted therein, of an aluminum sleeve surrounding said cathodic terminal but out of

contact with said tube and cathode, and 10 means on said tube wall for supporting and holding said sleeve in fixed position.

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