June 12, 1928. 1,673,560

H. M. FREEMAN

VACUUM TUBE STRUCTURE

Filed Nov. 10, 1922

Fig. 1.

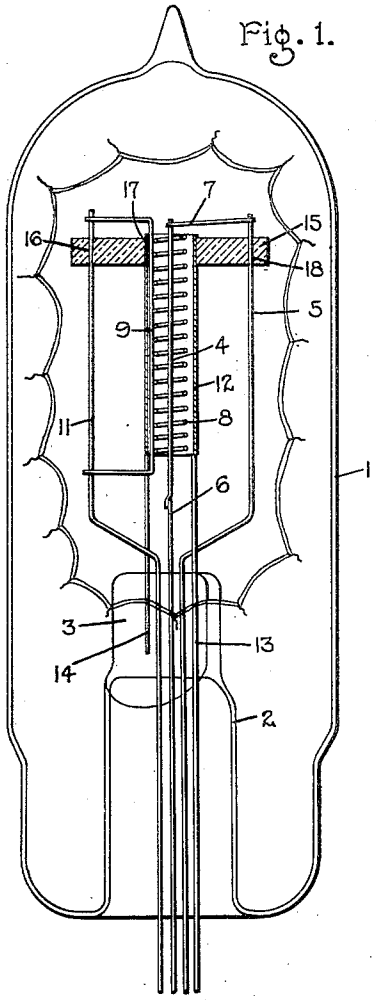


Fig. 2.

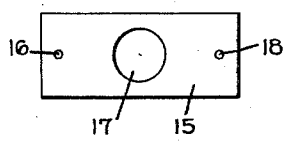
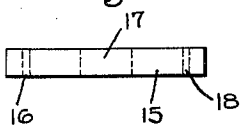


Fig. 3.



WITNESSES:

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VACUUM-TUBE STRUCTURE.

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My invention relates to evacuated electrical devices, having particular relation to the structural details of such devices.

The principal object of my invention is to provide a vacuum-tube construction having highly desirable operating characteristics, wherein the usual microphonic noises incident to the jarring of the tube are substantially avoided.

Another object of my invention is to provide a new material which is adapted for use in the electrode-supporting structure disposed in the evacuated portions of the tube and which is characterized by its high dielectric and mechanical strength and by its low percentage of occluded gases.

In the usual vacuum-tube construction, the several operating elements are supported in such manner that they are free to vibrate at their upper ends. When the several operating elements are set in vibration, as by jarring, the relative motion of the elements causes variations in the operating characteristics of the tube. The result of such variations is to introduce ringing sounds in such telephone devices as are operatively associated with the tube.

According to my invention, I provide a vacuum-tube construction wherein the several operating elements are rigidly secured in position, one with respect to the other. The desired result may be accomplished by employing a block of insulating material which rigidly embraces the upper ends of the operating elements. In practicing my invention, it has been found that the insulating supporting material may comprise vitrified clay.

With these and other objects in view, my invention further consists in the details of construction and arrangement hereinafter more fully set forth in the following description and claims and shown in the accompanying drawing, wherein:

Figure 1 is an enlarged front elevational view of a vacuum-tube device embodying my invention, a portion of the containing walls being broken away and the anode element and supporting block thereof being shown in section; and

Figs. 2 and 3 are top and side elevational detail views of one form of the block for securing the operating elements of the tube rigidly in predetermined spaced relation.

In the embodiment of my invention shown in the drawing, an evacuated electrical device is provided in the form of an elongated tube 1, wherein one end is provided with a re-entrant tube 2 terminating in a supporting press 3. A filamentary cathode element 4, which may comprise a conducting element coated with oxides of the rare-earth metals, is positioned in the axis of the tube 1 and has its upper and lower ends supported by carrier rods 5 and 6, respectively, which are mounted in the press 3. A spring member 7 may be interposed between the carrier rod 5 and the upper end of the filament 4 to provide a resilient mounting for the filament. The filament carrier rods 5 and 6 may be extended through the press 3 to form external supply connections for the filament 4.

A helical grid element 8 is symmetrically disposed about the cathode element 4 and may be supported by means of a structure comprising a rod 9 having a portion thereof welded to the several helices of the grid 8 and having arms which are welded to a main carrier rod 11, the latter being supported in the press 3. The main carrier rod 11 may be extended through the press 3 to provide an external terminal connection for the helical grid element 8.

A cylindrical anode 12 is co-axially positioned with respect to the grid and filament elements and is supported by means of a pair of carrier rods 13 and 14 extending from the press 3. One carrier rod, say 13, may be extended through the press 3 to provide an external terminal connection.

As may readily be seen, in such construction as that just described, the several elements of the vacuum-tube structure are free to vibrate. Hence, when the vacuum-tube structure is jarred and the relative spacing of the several elements is varied in accordance with the vibration thereof, microphonic noises are introduced in the operation of the tube. In the course of much experimental work it was found that the microphonic noises were avoided by rigidly securing together the several tube elements to prevent variations in the relative spacing of the same.

One method for accomplishing the above-mentioned desired result consist in providing a block 15 of insulating material hav-

ing a plurality of perforations 16, 17 and 18 corresponding in diameter and in position to the main grid carrier rod 11, the anode 12 and the upper filament carrier rod 5, all as shown in the drawing. The block 15 may comprise a composition of clay and a vitrifying flux or it may comprise a virtrified clay, that is, porcelain.

The block 15 is preferably positioned immediately adjacent to the upper ends of the several elements just mentioned, with the top portions of the anode 12 and of the carrier rods 5 and 11 extending through the respective perforations. The block 15 may be rigidly secured to the several tube elements by cementing the same with any well-known form of cement, as, for example, a mixture of sodium silicate and flint.

When the vacuum-tube structure of Fig. 1 is jarred, the insulating supporting block 15 prevents the several elements from vibrating independently to vary the relative spacings thereof.

While I have described a specific embodiment of my invention involving a specific application thereof, for the purpose of describing the same and illustrating the various principles and applications thereof, it is apparent that various changes and modifications may be made therein without departing from the spirit of my invention. I desire, therefore, that only such limitations shall be imposed thereon as are indicated in the appended claims or demanded by the prior art.

I claim as my invention:

1. In a vacuum tube, a plurality of concentric electrodes one of which is a cylinder, a plurality of parallel standards supporting the other electrodes and an insulating block embracing said cylinder and having perforations through which said standards pass.

2. In a vacuum tube, a plurality of concentric electrodes, standards for supporting said electrodes having parallel portions outside the outer one of said electrodes and an insulating block having a large perforation into which the upper end of said outer electrode fits.

3. In a vacuum tube, a cylindrical plate, a grid within said plate, a standard exterior to said plate, a body of insulation material secured near one end of said plate and having a perforation through which said standard passes, and a supporting structure extending from said grid to said standard and secured thereto on opposite sides of said boy.

4. In a vacuum tube, concentric electrodes, a flat body of insulating material fitted to and surrounding the exterior electrode, said body having perforations at each side of said exterior electrode, standards extending through said perforations and means secured to said standards on one side of said body and extending from said standards toward each other for supporting the inner electrodes.

In testimony whereof, I have hereunto subscribed my name this 27th day of October 1922.

HUBERT M. FREEMAN.