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FILAMENT SUPPORT FOR VACUUM TUBES

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Fig. 1.

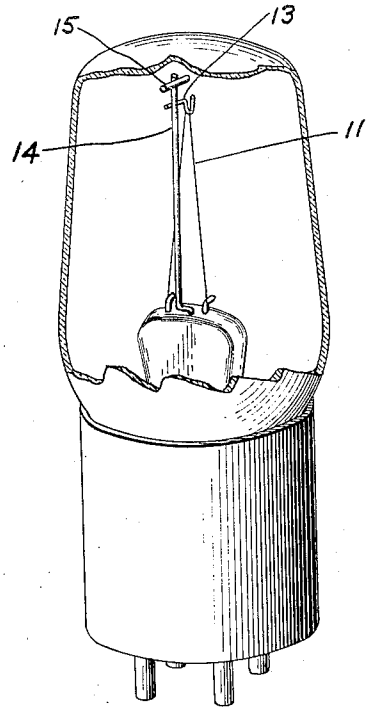
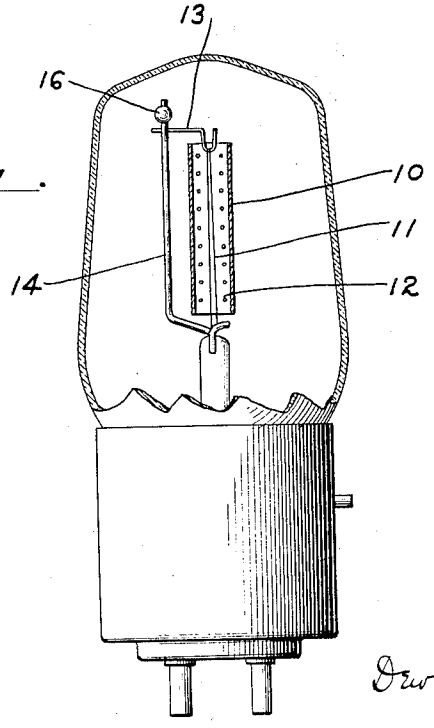


Fig. 2.



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FILAMENT SUPPORT FOR VACUUM TUBES.

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This invention relates to vacuum tubes, particularly of the three-electrode type for use as rectifiers, amplifiers, and electric wave generators. The object of the invention is to reduce the microphonic noises of the tube to such an extent that there can be no reaction between the loud speaker and the various tubes employed in the set, and to prevent what is commonly known as "howling"—an audio-frequency sound caused by the above reaction.

A further object of the invention is to make the tube insensitive to jars and vibrations from the outside, and to prevent such vibrations from causing objectionable noises in the ear-phones or loud speaker of a set.

A still further object is to so control the relative motions of the various elements within the device so that jars or vibrations, either mechanical or air vibrations, will not deleteriously affect the operation of the tube, either by causing noises or by distorting the normal operating currents as they pass through.

Another object is to damp out, by appropriate means, vibrations that are transmitted to the internal elements, so that they will not affect the proper operation of the tube.

In the accompanying drawings,

Fig. 1 shows a side elevation of a three-electrode vacuum tube embodying my invention;

Fig. 2 shows a similar view of a modified form of the same.

In the drawing, 10 indicates a suitable plate, 11 the filament, and 12 the grid. The filament is supported at its upper end by means of a spring 13 secured to a support 14.

In the construction of three-electrode tubes it has been quite common to support the filament by a "dummy" or leadless support, to the top of which a spring is attached which holds up the filament. Any vibration of the tube is transmitted to this "dummy" and in turn causes the filament to vibrate in relation to the grid. This vibration causes the greater part of the microphonic noises in a vacuum tube.

In order to prevent this vibration it has been the custom to solidly attach, by means of a suitable insulating material, the filament support directly to the grid, or plate, or both. This does not, however, eliminate the microphonic noises; in fact it often makes the tube more noisy, because the vibrations are more easily transmitted to the filament because of the stronger support and transmits to the filament the higher-pitched vibrations which are very easily picked up and prolonged as an audio-frequency howl by the loud speaker.

In the present invention I have allowed the filament support 13 to be free and unattached to any other element of the tube, and by suitable means either damp out whatever vibrations tend to travel up the dummy filament support, or by proper loading and relative weighting of different parts of said dummy, reduce the natural period of vibration of the dummy to such a point that it will not transmit vibrations of such a high frequency as to cause the loud speaker to react. In addition I make the natural period of vibration far below the normal range of audio-frequencies in common use in music and speech; and even heavy jars on the outside of the tube, while they cause the filament to vibrate in relation to the grid, the vibrations are at such a low frequency that no interference with normal currents is caused, nor are any objectionable sounds produced.

While it might be possible experimentally to make a filament support flimsy enough to have a low enough period to be non-microphonic, this would not be practical for commercial production, and my approved method is to make the filament support as strong as necessary for commercial practice and then reduce its vibratory period to a very low frequency by weighting in suitable places. The length of the support, its diameter, and its material, will determine its natural period before loading. A weight, consisting of a small piece of metal 15, spot-welded to the support in the proper place, as shown in Fig. 1 or as shown in Fig. 2, a glass bead 16 of suitable size melted on at the right place, will reduce the natural period to such a point as to prevent howling and make jar noises below audibility. Also, by making the size of the support correct the elastic tendency of the support will always return the dummy to its proper position after a jar. It is not necessary to place so large a weight on the support as to tend to permanently bend the support after a jar.

By the use of my invention, tubes made with a stiff filament support, which are very

noisy, microphonic, or "howlers", may be made practically noiseless, non-microphonic, and will not "howl" when the support is loaded. The invention does not alter the strength nor change in any way the electrical characteristics of the tube.

By the use of such loading, no rubber or otherwise flexible sockets are needed for the detector tube in radio sets. These rubber sockets tend to lower the frequency of the transmitted mechanical vibrations of the set and prevent these vibrations from reaching the tube, but they cannot prevent the air vibrations from the loud speaker from hitting the glass wall of the tube and from there traveling up the dummy support on to the filament. My invention prevents these air vibrations from reaching the filament, as well as the mechanical vibrations.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A filament support for vacuum tubes, which support is free to vibrate independently of the other elements of the tube at its upper end, and a weight on the free end, so proportioned as to afford to the support a natural period of vibration at the extreme lower end of the audio-frequency scale.

2. In a vacuum tube, a filament support, free to vibrate independently of the other elements of the tube at one end, and a weight on the free end so proportioned that the natural period of vibration of the support is not within the audio-frequency range used in speech or music.

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