

June 10 , 1924.

W. T. BOOTH ET AL

1,496,768

VIBRATION REDUCING MOUNTING DEVICE FOR SIGNALING SYSTEMS

Filed March 27, 1918

2 Sheets-Sheet 1

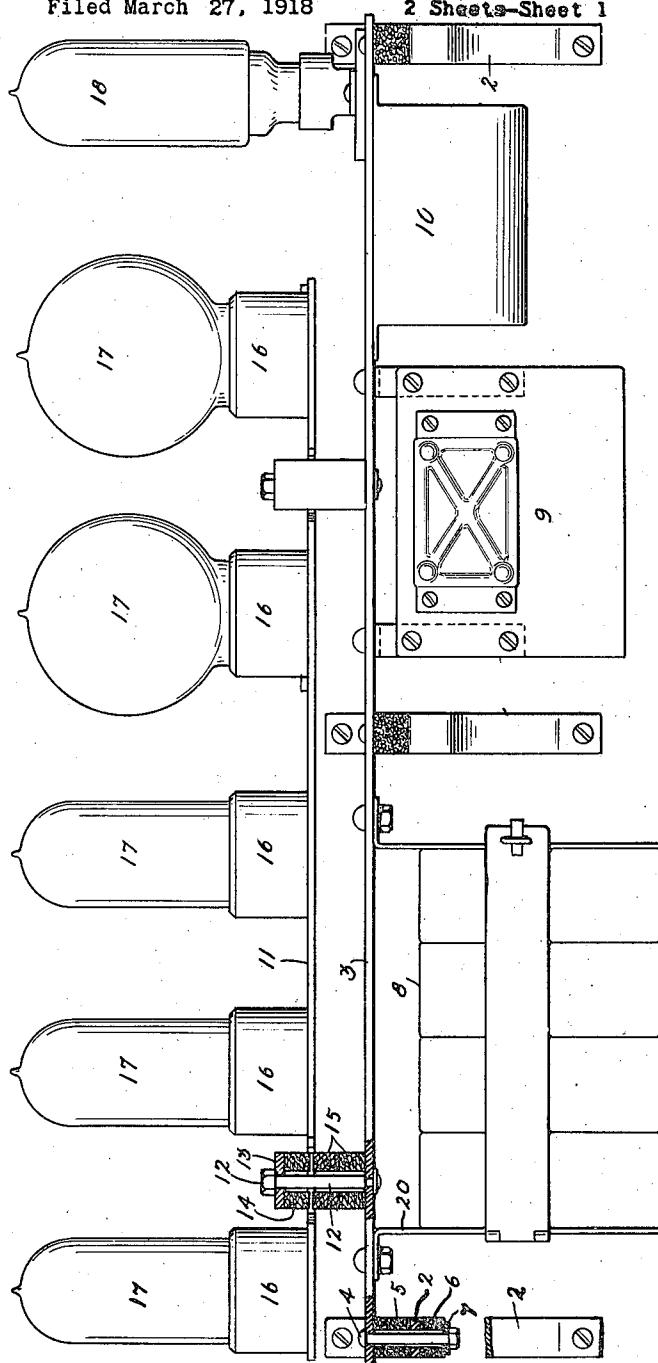
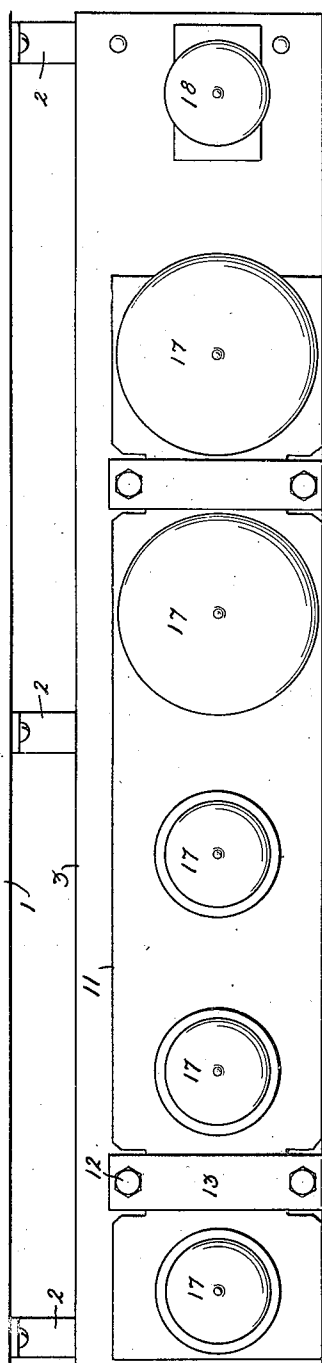


Fig. 2.

Fig. 1.

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Fig. 4.

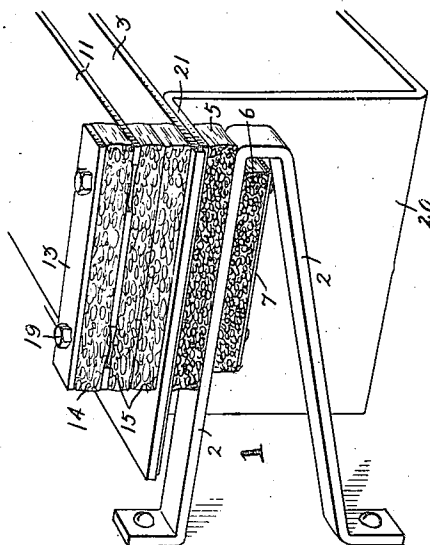
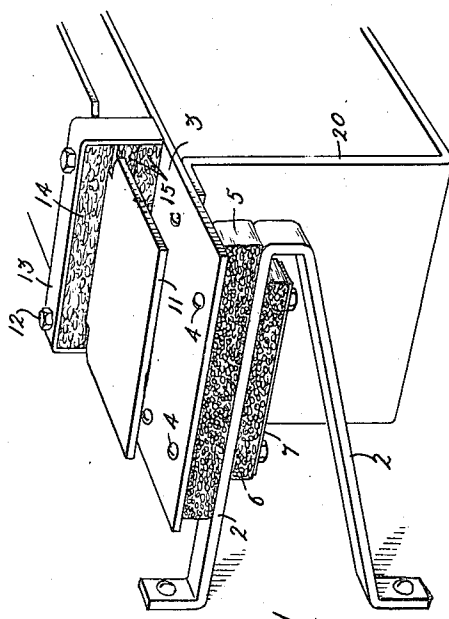


Fig. 3.



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by

Patented June 10, 1924.

UNITED STATES PATENT OFFICE.

WILLIAM T. BOOTH, OF EAST ORANGE, NEW JERSEY, AND WALTER A. BOYD, OF BROOKLYN, NEW YORK, ASSIGNORS TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

VIBRATION-REDUCING MOUNTING DEVICE FOR SIGNALING SYSTEMS.

Application filed March 27, 1918. Serial No. 225,124.

To all whom it may concern:

Be it known that we, WILLIAM T. BOOTH and WALTER A. BOYD, citizens of the United States, residing at East Orange, in the county of Essex and State of New Jersey, and at Brooklyn, in the county of Kings and State of New York, respectively, have invented certain new and useful Improvements in Vibration-Reducing Mounting Devices for Signaling Systems, of which the following is a full, clear, concise, and exact description.

This invention relates to means for mounting electric discharge devices such as vacuum tubes or equivalent elements, particularly for mounting vacuum tubes upon vehicles or in other places where they are subject to shocks, jars or vibrations.

It has been found that the electrodes of vacuum tubes as they are usually constructed almost always tend to act as vibratory systems with small damping factors. In a single vacuum tube there are in some instances two control electrodes or grid elements, two cathode elements and an anode consisting of two or more filament sections. Since any relative movement of the electrodes or parts thereof varies the output or space current which passes in a circuit including the cathode and anode of such a tube, it is seen that shocks or vibrations impressed upon the tube so as to cause the several electrodes to vibrate in their several respective periods will cause troublesome noises in a telephone bridged across the output circuit of the tube. Especially is this true when several amplifier tubes are connected in tandem, when each tube in addition to amplifying the current variations of the preceding tube will add a series of variations due to the vibrations of its own elements. The trouble due to vibrations of the electrodes is not limited to tubes in tandem, but is usually present where vacuum tubes are mounted on any solid structure subject to vibrations, such as an aeroplane or boat. The invention is equally applicable to tubes used as amplifiers, detectors, generators, modulators, or for other purposes.

The object of this invention is to produce a practical structure to overcome the difficulties mentioned. In the drawings, Figs.

1, 2 and 3 represent one form of device for accomplishing the desired results, and Fig. 4 one of the two similar ends of a slightly modified form. Fig. 1 is an elevation partly in cross section, Fig. 2 is a plan view, and Figs. 3 and 4 are perspectives.

Referring particularly to Figs. 1 to 3 inclusive, 1 represents a support, such as the side of a cabinet within which radio apparatus or audion repeaters are mounted. Brackets 2 are mounted upon support 1 and carry the remaining apparatus. Plate 3 is mounted upon the brackets by means of bolts 4 which pass through, in the order named, the plate 3, a layer of sponge rubber 5, bracket 2, a second layer 6 of sponge rubber, and the metal plate 7. Bolt 4 does not touch bracket 2. The plate 3 is therefore resiliently mounted upon the brackets 2 by means of the porous or sponge rubber 5. The small battery 8, condenser 9 and transformer 10 constitute elements of considerable mass and are rigidly attached to plate 3. Any suitable elements of large mass may be used. The metallic plate 11 is supported upon the plate 3 by bolt 12 passing through plate 13, sponge rubber 14, plate 11, pieces of sponge rubber 15 and plate 3. Plate 11 and bolt 12 should not be in contact. Mounted upon plate 11 in any suitable manner are sockets 16 of any suitable construction in which vacuum tubes 17 of the audion or three-electrode type may be fixedly secured. The audions are of the usual type well known in the art, as shown for example, in U. S. Patent No. 1,130,042, to van der Bijl and Nicolson, and, as is well understood, will each contain one or more grids, filaments and anodes. The numeral 18 indicates a ballast lamp and illustrates how any such devices which are less sensitive to shocks or vibrations may be conveniently mounted upon the plate 3 where they will be protected against jars of a violent nature. Since plate 11 is of slight mass and has elements of small weight only mounted thereon, the rubber 14 and 15 is of light texture. Rubber pieces 5 and 6 are, on the other hand, of heavier texture.

In Fig. 4 is shown in perspective one end of a similar arrangement. In this case bolts 19 pass completely through plate 13, rubber 14, plate 11, rubber 15, plate 3, flange 21,

rubber 5, 6, bracket 2 and plate 7. Parts having corresponding reference numerals will be understood by reference to Figs. 1 and 3. Flange 21 of battery box 20 is thus held by bolts 19 as a support for the heavy batteries which may be mounted in box 20. Flange 21 may be rigidly attached to plate 3. One or more vacuum tubes or other apparatus may be mounted upon plate 11. Neither plate 11 nor bracket 2 should touch bolts 19.

The structures shown are admirably adapted for supporting audion tubes and produce a maximum degree of quietness in the output of such tubes under difficult operating conditions, as in aeroplanes. The heavy sponge rubber 5, 6 serves to absorb incoming shocks and vibrations. This action is aided by the large mass of elements 8, 9 and 10 which absorb considerable energy in being set into motion, and at the same time give the plate 3 a low natural period of vibration which may be lower than that of any of the vacuum tube electrodes. The light sponge rubber 14, 15 is an additional protection to the tubes 17 and prevents movements of plate 3 from being imparted to them. Furthermore, the sponge rubber seems to have a certain specific damping effect upon existing vibrations of the tube electrodes. Other materials, particularly any spongy caoutchouc-like material or other material having resiliency and damping properties, are considered the equivalent of sponge rubber for this purpose. However, sponge rubber has been found to be the most efficient of substances tried. In addition to the properties of the rubber itself, the air cells contained therein seem to act somewhat as a multitude of minute dashpots. While five vacuum tubes are shown mounted together, any number of tubes which it is desirable to associate together may be so mounted and may be associated with individual circuits or connected in tandem, multiple, or in any other suitable manner.

It is believed to be broadly novel to mount one or more audions or other elements whose operating efficiency is subject to impairment by shocks or vibrations by a resilient damping means upon an element and support this element by another damping means upon a rigid support. It is also believed to be novel to associate two or more such damping means of different characteristics and to associate therewith an intermediate support bearing a suitable mass. No attempt has been made herein to enumerate or describe all the possible damping materials or means and other equivalent structures and devices which may be used in carrying on the purposes of the invention, but the appended claims are intended to include such equivalents except where otherwise specified.

What is claimed is:

1. In combination, a support, an anti-vibration damping means attached thereto, an intermediate support attached to said anti-vibration damping means, a second anti-vibration damping means attached to said intermediate support, and a vacuum tube secured upon said second damping means, said supports and said tube being attached to said damping means by means whereby their movement in all directions with respect to said damping means is limited solely by the restraint imposed by said damping means.

2. In a combination according to claim 1, a comparatively large mass rigidly connected to said intermediate support.

3. In combination, an element adapted to support one or more vacuum tubes, a support therefor consisting of resilient damping material, said support being mounted upon a second element having a large mass rigid therewith, and a support for said second element consisting of resilient damping material, said elements being connected to said supports by means preventing any movement in any direction relative to said supports unless said movement causes compression or extension of said damping material.

4. A mounting structure for a thermionic device including a socket for holding said device, a supporting body, and a plurality of intervening layers of material having a high damping factor for mechanical vibrations, said layers constituting the connection between said socket and said supporting body, and said socket being incapable of movement in any direction relative to said body without distorting said layers.

5. Electrical apparatus comprising a comparatively rigid body, a second comparatively rigid body attached thereto by means of flexible damping material so that said bodies have limited movement with respect to each other in all planes, a third rigid body attached to said second body by flexible damping material so that said second and third bodies have limited movement with respect to each other in all planes and means for attaching a space discharge device to said third body.

6. In combination a vacuum tube having an anode, a cathode, and a control electrode in fixed relation to each other, a resilient support for said tube for preventing external vibrations from appreciably changing the space relations of said electrodes, and another resilient support of denser material than the first support for preventing vibrations from reaching said first support.

7. A vacuum tube device having an anode, a cathode, and a control electrode, a support for preventing external vibrations from changing the space relations of said electrodes comprising sponge rubber, said device

being supported from a solid body in such a manner that a substantial area of said sponge rubber is placed between two adjacent surfaces of the supporting and supported bodies whereby the supporting and damping effect of a comparatively large volume of the sponge rubber is effective in preventing vibrations from being transmitted to said device.

10 8. A mounting arrangement for a space discharge tube having electrodes of which the normal spaced condition is subject to displacement by external vibrations comprising a fixed element and an element bearing the tube, said elements having spaced

surfaces of substantial area adjacent each other and a substantial volume of sponge rubber fixedly held between said surfaces by securing means which is free from contact with one of said elements whereby a range of movement of said elements with respect to each other is permitted subject only to the restraint imposed by said sponge rubber.

In witness whereof, I hereunto subscribe my name this 22nd day of March, A. D. 1918.

WILLIAM T. BOOTH.

In witness whereof, I hereunto subscribe my name this 15th day of March, A. D., 1918.

WALTER A. BOYD.