Nov. 13, 1928. 1,691,177

C. W. BALKE

MEANS FOR OBTAINING VACUUMS

Filed Feb. 17, 1927

Fig. 1

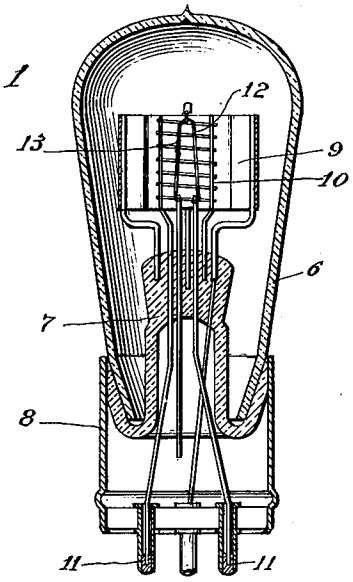


Fig. 2

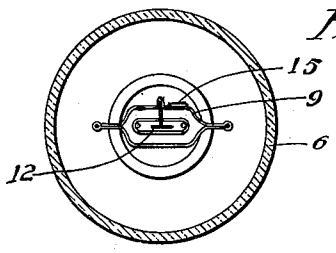


Fig. 4

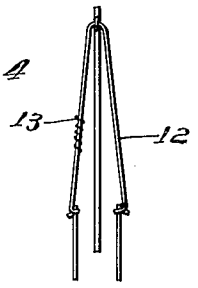


Fig. 3

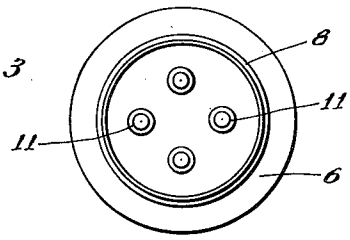


Fig. 6

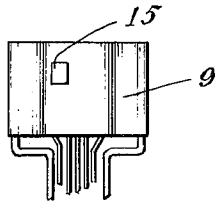
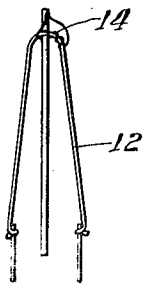


Fig. 5



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UNITED STATES PATENT OFFICE.

CLARENCE W. BALKE, OF HIGHLAND PARK, ILLINOIS, ASSIGNOR TO FANSTEEL PRODUCTS COMPANY, INC., OF NORTH CHICAGO, ILLINOIS, A CORPORATION OF NEW YORK.

MEANS FOR OBTAINING VACUUMS.

Application filed February 17, 1927. Serial No. 168,850.

My invention relates to means for eliminating the last traces of undesirable gases found in the ordinary vacuum tubes, such as are used for radio receivers and transmitters.

A certain amount of oxygen is always absorbed by glass. When a vacuum tube is sealed, the glass is heated so hot that some of this oxygen is liberated, which impairs the vacuum. This oxygen, together with any objectionable gases left in the tube after the mechanical exhaustion, is removed by a device which is known in the art as a getter.

The object of my invention is to make use of certain properties of columbium in a device of this character.

Other objects will appear from the following description, reference being had to the accompanying drawings, in which

Fig. 1 is a vertical section of a conventional vacuum tube.

Fig. 2 is a horizontal section thereof, taken on line 2—2 of Fig. 1, and showing one embodiment of my invention.

Fig. 3 is a bottom plan view of a tube shown in Fig. 1.

Fig. 4 is a detailed view of a filament showing another embodiment of my invention.

Fig. 5 is a view similar to Fig. 4, showing an embodiment of my invention similar to that shown in Fig. 4.

Fig. 6 is an elevation of the plate with a piece of columbium spot welded thereto.

When metallic columbium (sometimes called niobium) is heated to a dull red, it has the property of absorbing or occluding large quantities of gases. My invention employs this property of columbium to remove the last traces of objectionable gases from vacuum tubes, such as are used for radio sets.

Fig. 1 shows a vertical section of a conventional tube consisting of a glass bulb 6, a glass body 7, and the usual metallic or non-conducting mounting 8. A plate 9 and a grid 10 are suitably supported within the tube and are connected by conductors to the terminal posts 11. A filament 12 is similarly supported within the grid and is likewise connected to terminal posts 11.

Thus far the usual conventional construction of a vacuum tube has been described. My invention contemplates the use of metallic columbium as a getter for a vacuum in this tube. Getters are of two general types:

1. Continuous or permanent, and
2. Instantaneous or intermittent.

An embodiment of the continuous or permanent type is shown in Figure 4 wherein a helical coil 13 of columbium wire is wound around a portion of the filament. It is understood that, while columbium is preferred, an alloy of columbium and tantalum or other suitable metal may be used for this purpose, if desired. The size of the coil may be such that it will normally attain a temperature at which it is a dull red. so that it will absorb any amount of gas present in the tube after it has been sealed. The coil will last as long as the filament, and the tube will, therefore, be kept free from undesirable gas throughout its entire life and, although the coil is of very small dimensions, it is capable of absorbing a considerable quantity of gases and will, under ordinary circumstances, effectively maintain a vacuum of the desired degree.

In Fig. 5, I have shown a modification of the invention wherein the columbium coil serves as a support for the filament. In this construction the coil is preferably made in diameter considerably larger than the diameter of the filament wire so that the filament may be readily threaded through the coil. The action of the coil in this construction is practically the same as that of the coil shown in Fig. 4. It will be noted, however, that a part of the columbium coil in Fig. 5 is not in contact with the heated filament. This is an important feature when the filament gets above a red heat because when the portion in direct contact with the filament becomes so hot that it loses its absorbed gases, the adjacent portion of the columbium will be cool enough to reabsorb these gases.

In each of these modifications, at least a portion of the coil is in heat exchange relation with the filament and is heated, for the most part, by heat conducted from the filament, although the slight current which passes through the coil will also have a small heating effect. It will be noted that the columbium is not subjected to any great mechanical strains so that, even though it should

become brittle through absorption of great quantities of gases, its efficiency would not be impaired.

The instantaneous or intermittent embodiment of my invention is disclosed in Figs. 2 and 6. The elements of the tube, such as filament, grid, or plate, may be made of the columbium or columbium alloy. I prefer, however, to spot weld a small thin piece of columbium, about one-fourth inch square, to the plate. Now when the tube is sealed, I heat this plate by induced current by placing the bulb in a rapidly changing magnetic field. The heated columbium or columbium alloy will absorb the oxygen and other objectionable gases. If, after a period of use, the vacuum in the tube becomes impaired due to absorption of oxygen from the glass or from some other source, said vacuum may be re-established by again placing the bulb in a rapidly changing magnetic field whereby the getter is again heated to the required temperature.

While I have shown and described my invention with reference to specific embodiments, it will be apparent that its principles may be applied in a wide variety of constructions. In any case, it will be noted that the means for obtaining a vacuum is always present in the solid state and vaporization is not necessary. This avoids the objectionable features common to the use of magnesium, calcium, and aluminum for the purpose specified.

I do not restrict myself to the modifications shown.

What I claim and desire to secure by Letters Patent is:

1. The method of obtaining a vacuum which comprises heating metallic columbium in a partially exhausted tube.

2. The method of obtaining a vacuum which comprises mechanically exhausting gases from a tube, sealing metallic columbium within said tube, and heating said columbium to a dull red heat.

3. In a vacuum tube, a filament, and a coil of columbium wound around said filament in heat exchange relation thereto.

4. In a vacuum tube, a filament, and a columbium support for said filament wound around it in heat exchange relation thereto.

5. In a vacuum tube, a filament, a piece of columbium adjacent said filament so as to be heated thereby and to absorb gases present in the tube.

In witness whereof, I hereunto subscribe my name, this 10 day of February, 1927.

CLARENCE W. BALKE.