

[54] **PUNCTIFORM CATHODE, IN PARTICULAR SUITABLE FOR DETACHABLE ELECTRIC DISCHARGE TUBES**

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[58] Field of Search.....313/217, 311, 336, 341, 343

[56]

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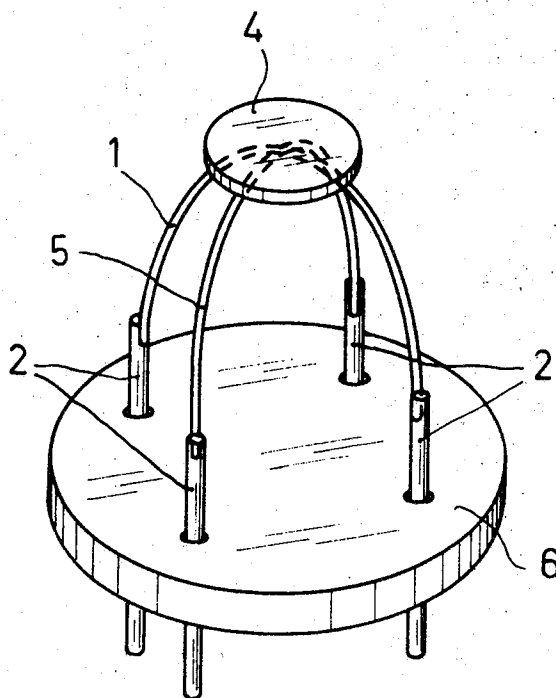
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[57]

ABSTRACT

A punctiform cathode for detachable tubes consisting of a tantalum plate which is secured to the tops of one or more V-shaped filaments.

3 Claims, 4 Drawing Figures



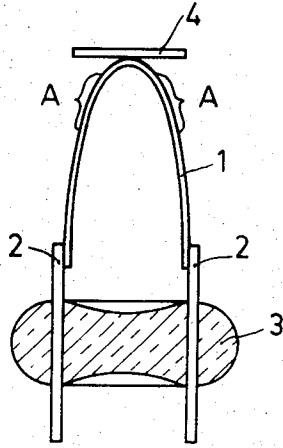


Fig.1

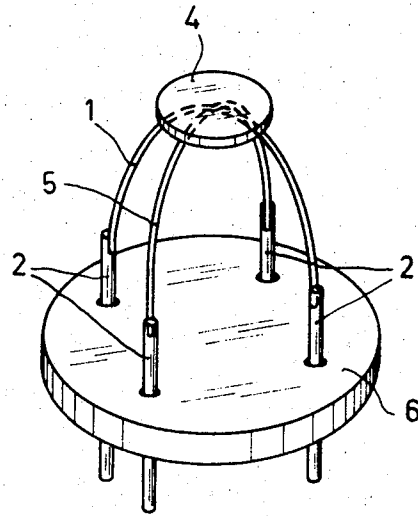


Fig.2

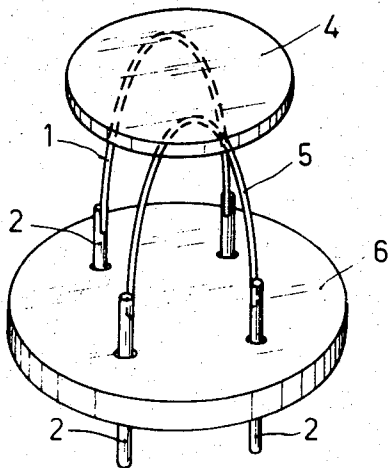


Fig.3

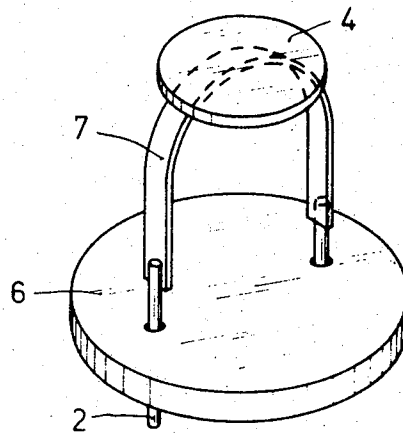


Fig.4

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PUNCTIFORM CATHODE, IN PARTICULAR SUITABLE FOR DETACHABLE ELECTRIC DISCHARGE TUBES

The invention relates to a punctiform cathode, particularly suitable for use in detachable electric discharge tubes, for example, electron diffraction tubes, electron microscopes and similar tubes, which have to be dismantled several times after use and in which the cathode, after having been in operation, is again contacted with air, or in tubes in which heat-sensitive parts are present and which therefore have to be evacuated without strong heating and can hence contain gas particles, for example, camera tubes, and the like.

In general, punctiform cathodes are used in the said tubes which consist of a hairpin-like or V-shaped bent filament in which the strongly bent part or the top serves as a cathode and is usually arranged close to or in a small aperture of a plate-shaped electrode.

In order to avoid a voltage drop in the part operating as cathode and hence to obtain a punctiform equipotential cathode it is known, for example, from British Pat. Specification No. 455,351, to weld on the top of a hairpin-like filament a plate operating as the cathode and to provide an emissive oxide layer on said plate.

However, such an oxide cathode is not suitable for the above-mentioned tubes, since the cathode, after the formation, may no longer contact air, since in that case the oxide layer is spoiled beyond repair. The same holds good for tungsten-thorium cathodes.

Therefore, only pure metal cathodes, such as tungsten cathodes, are to be considered for the said tubes. However, it is not possible to secure a plate of tungsten as a cathode on a hairpin-like tungsten wire, since the temperature of the filament must then be inadmissibly high to bring the plate at the emission temperature. The use as a cathode of the bent part of the hairpin-like filament as was done so far, has the additional drawback that due to the curvature of the filament no constant distance is obtained between the actual cathode and a following electrode.

The said drawbacks can be avoided in a cathode for electric discharge tubes, consisting of a metal plate which is secured to the bent part of the V-shaped filament if, according to the invention, the filament consists of tungsten and the plate consists of tantalum.

Since the emission temperature of tantalum is lower than that of tungsten, namely 1700° to 1800° C, the plate can be heated to the emission temperature by a tungsten filament without the filament having to be heated too strongly.

When a low heating energy is used, the filament must be very thin, however. It has been found that in many cases the temperature gradient along the filament strongly increases from the plate as a result of the com-

paratively poor heat conductivity through the tungsten filament to the plate, as a result of which the temperature of the filament at some distance from the plate can increase too high and the filament at that region fuses prematurely. It is found possible to strongly reduce this drawback by using several V-shaped filaments and connecting them with their tops to the tantalum plate. By suitable proportioning of the V-shaped filaments, the heating energy can remain the same. If desirable, the V-shaped bent heat conductor may be in the form of a band.

The invention will now be described with reference to the accompanying drawing, in which:

FIGS. 1, 2, 3 and 4 show various embodiments of cathodes according to the invention.

In FIG. 1, reference numeral 1 denotes a V-shaped tungsten filament which is secured to current supply pins 2. The pins 2 are sealed in a glass bead 3. On the top of the V-shaped filament 1 a tantalum plate 4 is welded or soldered. The plate 4 may be circular or rectangular and have a diameter or diagonal of, for example, 1 mm. The thickness of the plate 4 is, for example, 10 μ . The diameter of the filament 1 is, for example, 250/ μ .

In spite of the small dimensions of the plate 4, the thermal radiation turns out to be so large that upon using such a thin filament overheating of the tungsten wire 1 can occur at the places A, so that at that region the wire will soon fuse.

In order to avoid this a second V-shaped filament 5 is provided as is shown in FIG. 2, the top of which, together with that of the filament 1, is welded to the plate 4. By suitable proportioning it may be achieved that the two filaments 1 and 5 of FIG. 2 together absorb as much heating energy as the single wire 1 in FIG. 1.

Instead of at one point, the filaments 1 and 5 may also be secured to the plate 4 separately as is shown in FIG. 3. Furthermore, more than two filaments may be used.

Instead of two or more filaments, one or more band-shaped filaments 7 may also be used as is shown in FIG. 4. The supporting rods may be sealed in a glass or ceramic disc 6. Instead of separate current supply pins for each filament, two supply pins may be used, for example, and the filaments may be secured thereto, for example, by means of transverse rods.

What is claimed is:

1. A cathode for electric discharge tubes, comprising at least one V-shaped filament of tungsten and a plate consisting of tantalum secured to the bent part of each filament.

2. A cathode as claimed in claim 1, wherein the top of each filament is secured to the tantalum plate.

3. A cathode as claimed in claim 1 wherein at least one filament is in the form of a band.

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