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ELECTRODE SPACER

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Fig. 1.

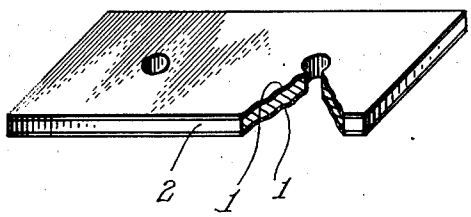


Fig. 3.

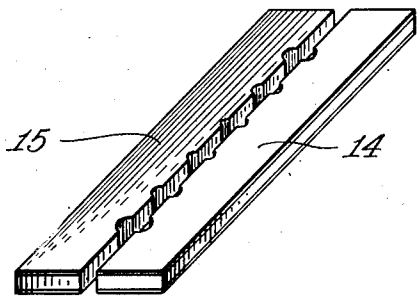
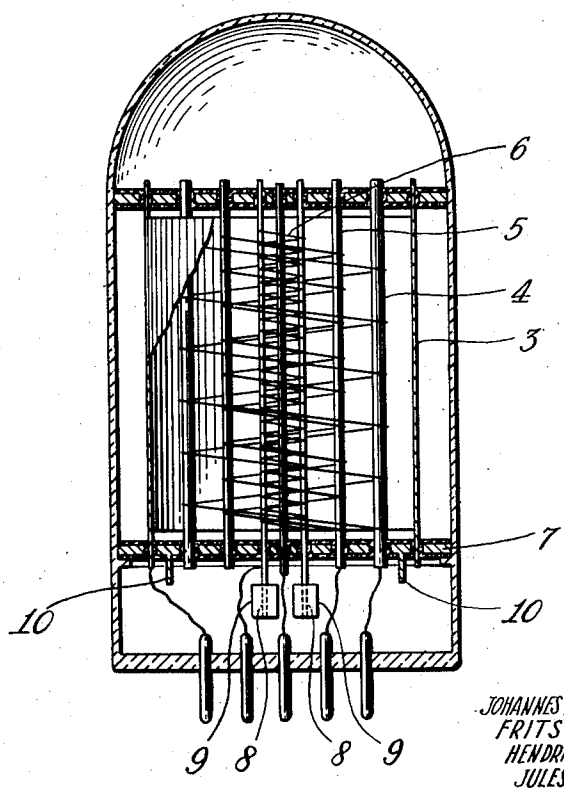


Fig. 2.



JOHANNES ANTONIUS MARIE VAN LIEMPT
FRITS PRAKKE
HENDRICUS JOHANNES LANDSBERGEN
JULES HENRIE MARIE VAN UDEN
INVENTORS

BY Fred M Vogel

AGENT

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ELECTRODE SPACER

Johannes Antonius Maria van Liempt, Frits Prakke, Hendricus Johannes Landsbergen, and Jules Henri Marie van Uden, Eindhoven, Netherlands, assignors, by mesne assignments, to Hartford National Bank and Trust Company, Hartford, Conn., as trustee

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6 Claims. (Cl. 250—27.5)

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This invention relates to an electric discharge tube comprising an electrode system in which the electrodes are maintained at the correct relative spacing by means of plate- or disc-shaped members. The invention also relates to members of this kind and to a method of manufacturing them.

For supporting electrodes and other metal components or discharge tubes and maintaining them at the correct relative spacing, generally for centering them, it is common to use a small mica plate which for example by stamping has formed in it a plurality of apertures through which the supporting members of the electrodes extend. Generally, such a plate is arranged at each end of the electrode system.

Although satisfactory centering of the electrodes is thus ensured, this construction has the disadvantage that at the areas at which the said plates are arranged there is insufficient electric screening between the various electrodes. In order to obviate this disadvantage it has been suggested before to provide supplementary screening means, for example in the form of small metal plates or metal layers arranged in close proximity to or on the mica. This construction, however, also entails disadvantages; thus, for example, supplementary members have to be secured in place and the construction of such tubes is thus rendered more involved; in addition the screening thereby provided is not quite satisfactory since these conducting members cannot be continued throughout the surface of the mica plates but, in order to avoid short-circuit, must end at a certain distance from the positioning members of the electrodes. Lastly, there has been the disadvantage that when driving occluded gases from the tube components by high-frequency currents during exhaust the metal plates or layers that assume a high temperature heat the mica to such a temperature that the mica loses its mechanical rigidity.

The invention provides a simple construction which ensures satisfactory centering and satisfactory screening at one time. For this purpose, the electrodes of an electric discharge tube according to the invention are maintained at the correct relative spacing by metal plates or discs which have formed in them apertures for centering the electrodes and other conducting component members and which are superficially coated with an insulating layer.

The use of centering members thus constructed ensures that satisfactory centering and satisfactory screening are simultaneously secured in a

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simple manner. Centering is effected in the same manner as with mica plates in that the stay or positioning members of the electrodes or these electrodes themselves are passed through apertures and thus, due to the fact that the plate is coated superficially, including the aperture walls, with an insulating layer, satisfactory insulation between the electrodes is obtained. On the other hand, the screening is also very complete due to the fact that the plates are conductive inside and only contain a very thin insulating layer on the outside. Such screening could not be achieved by means of the known constructions. The conductive part of the plate may be connected to a given potential, for example, by connection to one of the electrodes or component members. A further advantage consists in that these spacers may readily be formed into a given shape so that they can be used not only in the form of a small plate but also as a curved object or provided for example with projecting tags.

For constituting the spacers here described use may be made of various metals or metal combinations; thus, for example, use may be made of a small metal plate coated with any insulating layer. An example thereof is a tombac plate coated with an insulating enamel layer. In addition, use may be made of a small metal plate which is superficially oxidized and is thus provided with an insulating layer; in such cases aluminium or aluminium alloys may be chosen with advantage to constitute the metal since it is possible for aluminium to be quite readily coated with a dense oxide layer. Lastly, use may be made of small plates made of metal or metal alloy and coated with a further metal which is then oxidized. One example thereof is an iron or a nickel plate which is chromium-plated, the chromium layer being then superficially oxidized. In respect of the last-mentioned example it must be borne in mind that if in the opening part of the specification and in the claims reference is made in very general terms to a metal or a metal alloy which are superficially coated with an insulating layer these terms are to be understood to include a metal or metal alloy which is first coated with a further metal, as is illustrated in the above-mentioned example.

An insulating oxide layer may be applied by any of the well-known methods of oxidizing metals. In cases in which the insulation need not satisfy high requirements a chemical oxidation may suffice; if use is made of aluminium or aluminium alloys electrolytic oxidation will generally be retorted to, it being possible by a proper

choice of the material and oxidation conditions to ensure ample variation in layer thickness and insulating properties of the oxide layers obtained.

Plates according to the invention formed of oxidized metal may be very simply made by mass-production methods by adopting the following course. A long continuous strip, for example of aluminium, in which the desired apertures are formed and which may be provided with tags is passed through an oxidizing bath in such manner that on discharge from the bath the oxide layer formed has the desired insulating properties even in the apertures, the strip being then severed into individual plates. The cutting edge of a plate made in this manner, which edge results from the severing operation, has no insulating oxide layer and this is important. The insulating properties of the oxide layer naturally depend on the conditions of oxidation, chemical or electrolytic, on bath compositions, temperature, the intensity of current, if used, nature of the aluminium, duration of the oxidation and so forth. When the starting material used for an insulating plate for the electrodes of a wireless valve is aluminium or for example an aluminium-magnesium alloy, use may be made of an electrolytic oxidation with 7.6 amp./dm.^{2} at ordinary temperatures in an aqueous solution of 3% by weight of oxalic acid taking from 20 to 30 minutes. The layer thus obtained has a thickness of about 30μ, a high electric resistance and a low loss-factor.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawing, in which various forms of construction and possibilities of using a plate according to the invention are illustrated.

Fig. 1 is a schematic view of a right-angled plane insulating plate according to the invention which has formed in it two apertures for the passage of electrodes or other metal parts, 1 designating the insulating oxide layer and 2 the unchanged aluminium fundamental metal.

Fig. 2 shows a portion of the electrode system of an electric discharge tube, 3 designating the anode of the tube, 4, 5 and 6 the suppressor grid, screen grid and control grid respectively whilst the cathode is omitted as being not essential to an understanding of the invention in the present case. The electrodes are maintained at the correct relative spacing by a small plate 7 which is formed as shown in Fig. 1. It is apparent from Fig. 2 that both an insulating and a screening effect are thus obtained; thus, for example, the ends of the current-supply leads 8 of the control grid and the cooling fins 9 arranged thereon are fully screened from the parts of the anode that are arranged on the other side of the plate. Relative screening between the various parts of grids and anode that extend on the outside of the plate may be ensured by the plate 7 being provided with some few tags 10. Sufficient screening inside the electrode system between anode and control grid is obviously ensured by means of the screen grid 5.

The spacer of Fig. 3 comprises two parts 14 and 15 the opposite edges of which have formed in them registering apertures between which

the electrodes and so forth may be clamped in an insulated manner.

As set out, the plates hereinbefore described may be used with great advantage in electric discharge tubes where they have to perform various operations. It is, however, also possible for these plates to be used at other points in replacement of mica, for example in electric incandescent lamps to protect the pinch and the stem tube from heat radiated from the glower.

We claim:

1. An electric discharge tube comprising an envelope, electrodes within the envelope, and means maintaining a predetermined spacing between said electrodes comprising a metallic member within the envelope having surface portions coated with a superficial insulating layer.

2. An electric discharge tube comprising an envelope, electrodes within the envelope and means maintaining the relative spacing of the said electrodes comprising a metallic plate having integral superficially oxidized insulating surface portions.

3. An electric discharge tube comprising an envelope, electrodes within said envelope, and means maintaining the said electrodes in a substantially fixed space relationship comprising a disk consisting of a metal including aluminum and having oxidized insulating surface portions.

4. An electric discharge tube comprising an envelope, electrodes within said envelope having supporting members, means maintaining said members in fixed space relationship comprising a metallic disk having apertures in which said members are embraced, said disk having oxidized insulating surface portions including the walls of said apertures.

5. In the manufacture of an electric discharge tube, the method of fabricating a spacer plate, comprising the steps of forming a metal plate to a desired shape, and surface oxidizing the plate to coat it with an insulating surface layer, thereby to fabricate a spacer for insertion in an electric discharge tube.

6. In the manufacture of an electric discharge tube, the method of fabricating a spacer comprising the steps of aperturing a strip of metal, oxidizing said strip to coat it with an insulating surface layer, and severing the oxidized strip into individual plates which form spacer elements for an electric discharge tube.

JOHANNES ANTONIUS MARIA VAN LIEMPT.
FRITS PRAKKE.
HENDRICUS JOHANNES LANDSBERGEN.
JULES HENRI MARIE VAN UDEN.

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