Jan. 22, 1957 E. GABBRIELLI 2,778,485

VACUUM TUBE GETTER BODY MATERIAL

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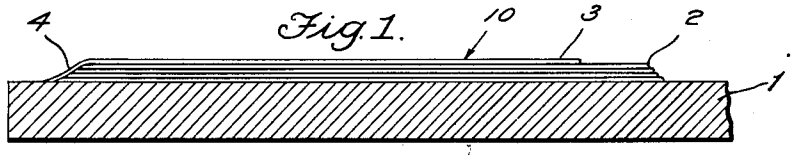


Fig. 1.

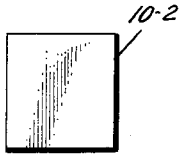


Fig. 2.

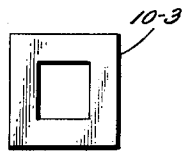


Fig. 3.

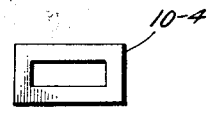


Fig. 4.

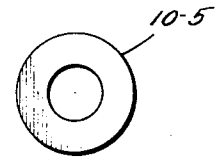


Fig. 5.

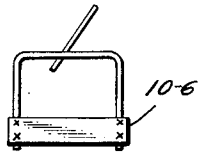


Fig. 6.

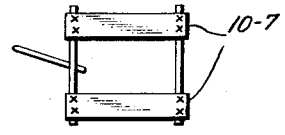


Fig. 7.



Fig. 8a.

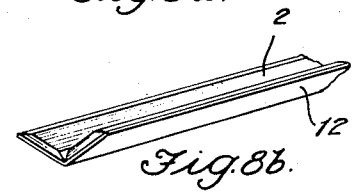


Fig. 8b.

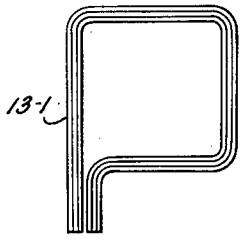


Fig. 9.

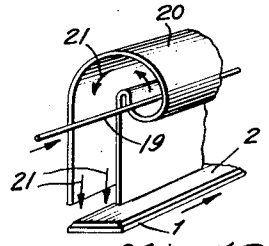


Fig. 12.

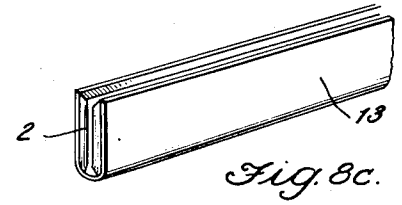


Fig. 8c.

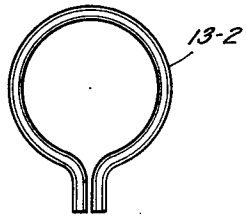


Fig. 10.

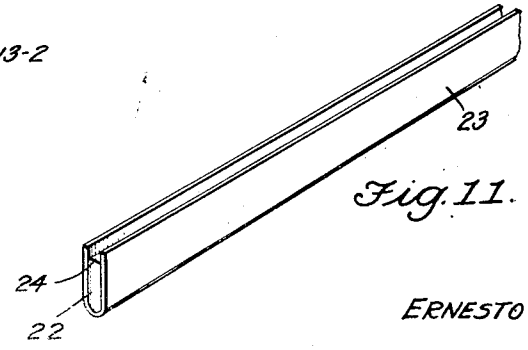


Fig. 11.

INVENTOR

ERNESTO GABBRIELLI

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VACUUM TUBE GETTER BODY MATERIAL

Ernesto Gabbrielli, Milan, Italy

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4 Claims. (Cl. 206—0.4)

As known, electronic tubes and particularly electric radio tubes require the use of chemical vacuum getters to attain the final degree of vacuum required for the operation of these devices. The chemical action by which the desired vacuum degree is obtained is obtained in the electronic tube itself at the moment when the vacuum getter is rendered active by the evaporation, within the selected part of the tube, of that metal or metal group possessing a determined chemical affinity with the gases and vapors that are successively removed in order to obtain the vacuum of the highest possible values. This chemical action is generally prolonged even to the entire life of the electronic tube.

As further known, the commonest alloys used for the fabrication of the vacuum getters are those of Ba—Mg, Ba—Mg—Al, Ba—Al, Ba—Ni, Ba—Sr—Al, etc.

It is an object of the present invention to obtain a novel method of fabricating the vacuum getters by which the mechanical fabrication difficulties of the former processes are eliminated, rendering thus possible the realization of a new family of vacuum getters offering, beside mechanical advantages also the possibility of providing a gamut of vacuum getters having a more diversified composition either with respect to the components or the proportions under which the latter are present in the said compounds.

Another object of the present invention is to simplify the difficulty of the fabrication process at present in use in order to provide a real advancement in the vacuum getter and electronic tube fabrication technique.

The method of the present invention is to adopt the process of the metallization under a vacuum or in an inert gas atmosphere to obtain upon the heater supports the deposition of one or more metals or active substances. By such a method it is possible to obtain compact or porous layers of various thicknesses perfectly adhering to the support surfaces and possessing a higher purity and degasification ability than is attainable by the usual systems. According to the method of the present invention the final deposit of a protective layer is effected by the same technique, operating under a high vacuum, inasmuch as the thus obtained deposits have a compact structure and even the smallest layer thicknesses provide highly efficient protective effects. This method provides for the obtention of active and protective layers by a continuous process upon coatings and shapes on prior art types of vacuum getters in the same layer deposition installation.

The method of the present invention for obtaining chemical vacuum getter elements permits the deposition of successive layers of different active elements in any desired proportion. It provides, by intercalated heatings of the supports themselves, for obtaining said deposits in the form of stable alloys, for obtaining various unstable and protected alloys, and of non-brittle structure deposits which are capable, therefore, of standing considerable mechanical working even when exposed to the air.

The fabrication process according to the method of the present invention presupposes the availability of the active elements as raw material, elements whose fabrication is not secret and is therefore possible by known systems, or that can, anyhow, be bought on the open market.

The method according to the present invention assures besides that every operation is developed under the same very high vacua that can be obtained only by using the vacuum getters themselves, and the obtainment of a finished product hermetically sealed under vacuum in the shipping containers or phials, thus eliminating all those manipulations in the air that finally make the quality of such products worse.

Besides, this method renders every type of automatic control of the thicknesses of the various active and protective deposits possible, as well as a self-regulation of the thicknesses. Its technique is already a known technique and any arrangement scheme lends itself to the realization of the method as applied to the fabrication of chemical vacuum getters. Generally, the particular trade tricks to be used will be those concerning the use of previously degased support metals, the obtention of determined shapes directly in the metallizing equipment after having deposited one or more active coatings and before or after the deposition of the protective coating according to the required shape. The cutting operations on covered and continuous covered and protected elements (for instance, bands to be cut into rectangular shapes) may be performed even outside of the depositing equipment according to the present process, inasmuch as the thinness of the active layers which is uncovered on the cut sections and the transfer of protective material over said cut sections by means of the cutting blade render the process of alteration in depth very slow, whereby the possibility of rapidly arranging the cut vacuum getters in the shipping containers under a vacuum provides for the utilizing of the vacuum getters which still have a long exposure time without being appreciably degraded. Where the cut is effected under the vacuum of the active layer deposit equipment and the resultant depositing of the protective layer after the cutting assures even the protection of the cut sections. All of the vacuum getters of the present invention are characterised by the fact that the deposition of the active elements is obtained by an evaporating and condensing process onto the selected portions of the support by heating the active elements themselves. The protection of the active elements from the attacks of the external agents can be effected by final external coatings of selected elements such as aluminium, copper, nickel, the active element magnesium itself whose alteration in the air is sufficiently slow, iron or anyway other metals or metalloids or compounds neither evaporating nor decomposing up to the normal evaporation temperatures of the desired active elements. The method of fabrication of the present invention also characterizes the vacuum getters deprived of a true and proper protective coating when the active elements are deposited with the technique of the metallization under vacuum or in an atmosphere of inert gases and remain adherent to the heating support also in the form of compounds or alloys stable against the external agents, obtained either by a successive heating of the support itself after the deposition of the active or alloy or combination elements, or by a deposition of the simultaneously obtained compounds onto the heated support surface.

Fig. 1 is a cross sectional view illustrating the layer structure of the device of the invention.

Figs. 2–7 are several modified forms of the shape of the getter body.

Figs. 8*a*, 8*b* and 8*c* illustrate a process of forming another modified form of the getter body.

Figs. 9 and 10 are views showing shapes to which the product of Fig. 8 may be further changed.

Fig. 11 shows still another modified form of getter containing body.

Fig. 12 illustrates a method of forming a product like that shown in Fig. 1.

Fig. 1 shows on a much enlarged scale the section of a heating element surface of a vacuum getter **10** obtained according to the method of the present invention. **1** is the heating support, **2** the active layer that can also be formed by the superposition of a plurality of element layers, **3** the external protective layer. Through ordinary artifices like screening, directional projection with vapor outline limitation, etc., it is possible to confine the deposit to definite portions of the support as seen on part **4** of Fig. 1. All of the forms **10–2**, **10–3**, **10–4**, **10–5**, **10–6**, and **10–7** shown in Figs. 2, 3, 4, 5, 6 and 7, respectively, can be obtained from supports having a completely covered plane surface. Generally only one face of the heating support is covered in order to permit a unidirectional projection of the active material into the electronic tube. Figs. 8*a*, 8*b*, 8*c* show the steps of starting with a plane band **11**, bending the band **11** coated with active layer **2** to U-shape with sides **12** and finally completing the bending to produce the final form **13**, the protective layer 3 being deposited before or after the final bending step. The shapes **13–1** and **13–2** of Figs. 9 and 10, respectively, or any other required shapes can be obtained from the product **13** of Fig. 8*c*. Fig. 11 shows a third type of shaped support **23** that may be filled with active materials **22** with an upper protective closure or layer **24** of other stabilizing elements. The deposition of active materials up to the filling of cavities or open channels upon shaped supports by a continuous process according to the method of the present invention can be obtained by causing the shape itself to slide below a narrow evaporating surface extending slightly into the cavity to be filled.

Fig. 12 shows a scheme of the disposition of a band-shaped element **1** under the evaporating element **20** in an installation for the deposition of active and protective layers arranged for a continuous process of surface coating. The vaporizing filament is shown at **19** and the direction of movement of the vapors is shown by arrows **21** in Fig. 12. The entire apparatus may be enclosed in a vacuum proof cover in known manner. The thickness of the band-shaped support that is generally of iron, can be very small.

The possibility afforded to cover the entire surface of a heating support permits, for instance, that a square shaped heater having 10 mm. sides may carry 17.5 mgs. of pure barium even with an active coating thickness of 0.05 mm. In current practice, 10 x 10 mm. is a normal size, while 17.5 mms. of Ba constitute a sufficient quantity for a high power vacuum getter usable in special large diameter tubes, such, for instance, as cathodic ray tubes for television apparatus. This demonstrates the possibility of very economically obtaining the most powerful vacuum getters with the smallest overall dimensions. From the smallest sized, band shaped, elements having for instance a width of 0.5 mm. and a thickness of 0.05 mm. with which elements of the type shown in Fig. 5 are formed, having outside overall dimensions of 3 x 3 mms., a 0.75 mg. Ba potentiality will be obtained, thus realizing an easy heating type, vacuum getter notwithstanding the reduced dimensions. Or one

of substantial power may be obtained for those types of tubes where it is possible to utilize the elements of larger dimensions. By the present process thin filament with outer getter coatings may be obtained, that may be utilized in the smallest types of tubes that can be made. The filaments may be in the form of small spirals which are readily heatable either by a direct or H. F. current. In special cases it is possible to obtain by the method of the present invention, covered active coatings over any structural part of a tube or electronic tube, as for instance the covering of a portion of the outer surface of a radio tube anode with a Ba—Ni or Ba—Al alloy having a stable composition and high activating temperatures will permit a normal degasification of the anode with a successive activation of the resulting vacuum getter. Elements of small size and maximum potentiality are obtainable by metallising with active elements alveolar structures providing large surfaces that, even if covered with small thickness active and protective coatings will be able to carry a substantial amount of active element.

All of the problems related to the construction of all types of vacuum getters, by the adoption of the fabrication method of the present invention are generally resolved pure physical problems and to the production of light and exact mechanical contrivances having extremely variable forms.

The lightness of the structures carrying the vacuum getter elements by said method eliminates the troubles of a mechanical sort. As an approximate example of what are the possibilities offered by the method of the present invention it will be sufficient to say that it has been possible to produce a Ba coating on the summit of a mercury thermometer capillary.

What I claim is:

1. A vacuum tube getter body comprising a strip of supporting material, at least one layer of getter material condensed on said strip from the vapor state, and a thin layer of protective metal condensed onto the exposed surface of said getter material from the vapor state.

2. The body as set forth in claim 1 in which the protective layer of metal is a metal selected from the group consisting of aluminum, copper, iron, nickel and magnesium, said last named metal having a vaporization temperature above that of the active metal.

3. The body as set forth in claim 1 in which the getter body comprises at least two layers of getter material.

4. The body as set forth in claim 3 in which the getter body comprises at least two layers of different getter metals which alloy with one another.

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