June 4, 1968 S. M. FROUWS 3,386,785

METHOD OF MANUFACTURING A GAS DISCHARGE TUBE

Filed April 12, 1966 2 Sheets-Sheet 1

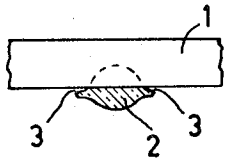

FIG.1

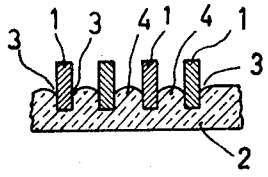

FIG. 2

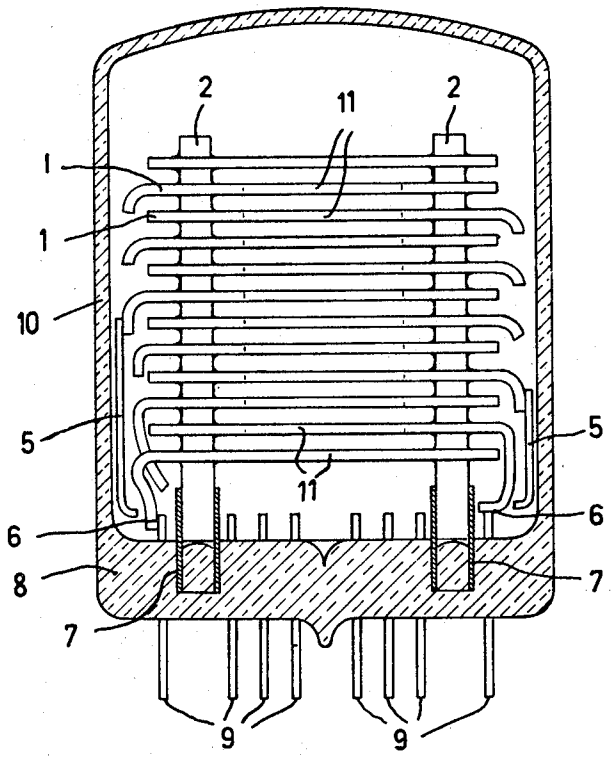

FIG.3

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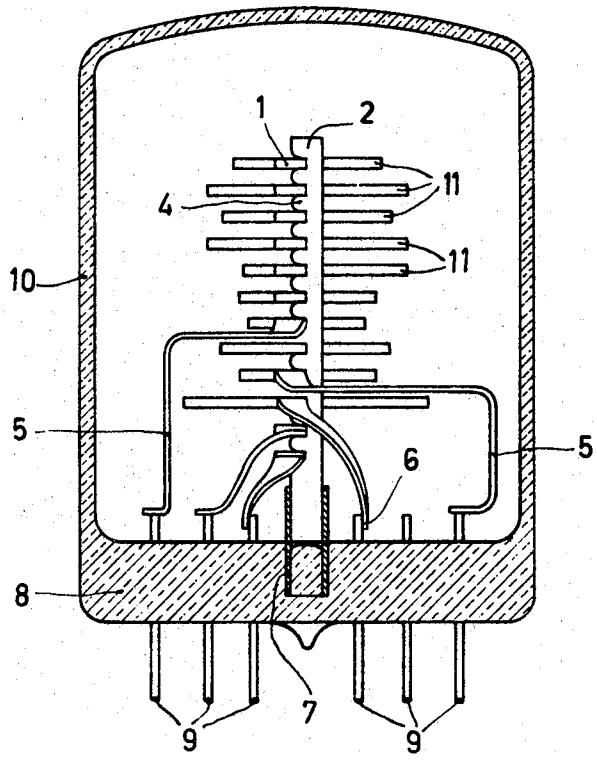

FIG. 4

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3,386,785

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METHOD OF MANUFACTURING A GAS DISCHARGE TUBE

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Claims priority, application Netherlands, Apr. 24, 1965, 65—5,268
4 Claims. (Cl. 316—4)

ABSTRACT OF THE DISCLOSURE

A character display gaseous discharge tube in which a plurality of character-shaped electrodes are arranged in a stack, each electrode being provided with a stay-rod, a cross-section of which is only partly embedded in a member of insulating material for supporting these electrodes which facilitates assembly thereof.

The invention relates to a method of manufacturing a gas discharge tube, particularly of mounting the electrodes of such a tube. The invention furthermore relates to a gas discharge tube particularly a character display tube manufactured by this method.

In gas discharge tubes having a large number of electrodes, these electrodes are, in general, provided with supporting members formed by ears of forks by means of which the electrodes are united into an electrode assembly by stacking with the interposition of spacer rings so as to be insulated from each other. This assembly must then be fixed to form a rigid unit by welding suitable members to the ends of, for example, stay rods on which the electrode supports are strung. These operations require much time and are therefore expensive.

It is a principal object of the invention to provide a simpler method of mounting electrodes of a gas discharge tube.

Further objects of the invention will appear as the specification progresses.

In accordance with the invention each electrode for a gas-discharge tube is provided with at least one stay rod. The stay rods of the various electrodes are clamped tight in coplanar arrangement in a jig and are pressed, at a place located between the end and the electrode, into a rod of insulating material which is in a soft state. This rod extends transversely of the longitudinal direction of the stay rods so that the stay rods sink down into the insulating soft material and are fixed therein after hardening of the insulating material without, however, being completely surrounded by the insulating material. The insulating rod may consist of a thermo-plastic substance which can be softened by heating, for example glass, certain minerals, synthetic resin, ceramic substances or a soft, hardenable synthetic resin.

With their ends the stay rods project from the insulating rod and may, if necessary, be bent over to be connected with other electrodes or with current supply conductors. Moreover, it appears that the formation of leakage paths by metal deposits is practically avoided, since the rods are not fused in the insulating material. By pressing them into the soft insulating material, the insulating surface comes into contact with the surface of the stay rods at an acute angle, so that a narrow gap, which is narrower than the free path of metal atoms in the gas, is formed around the contact area betwen the insulating material and the metal. Consequently no metal atoms can be deposited therein, since they do not perform a rectilinear movement in the gas. In this method the electrodes need no longer be stacked up, nor is it necessary to pass stay rods through narrow apertures.

The invention will be described more fully with reference to the drawing, in which

FIGS. 1 and 2 are sectional views of stay rods and an insulating rod, and

FIG. 3 is a front elevational view in section of a character display tube according to the invention;

FIG. 4 is a side elevation of the tube shown in FIG. 3.

The electrodes **11** are clamped tight with their stay rods **1** in a jig and at a place located between the stay rod end and the electrode, they are pressed in a glass rod **2** softened for example by heating. The soft glass is urged aside by the rod **1**, so that glass accumulations **3** and **4** are formed as is shown in FIGS. 1 and 2. These glass accumulations do not surround the stay rods **1**, but join the metal **1** at acute angles without wetting the metal, so that a gap is formed around the contact area of the glass **2** and the metal **1**, where practically no metal atoms have access. In spite of the small distance between the stay rods **1** a constant, satisfactory insulation is thus obtained. After the glass has cooled, the stay rods are fixed in the glass rod and the electrode assembly can then be mounted in a tube as shown in FIGS. 3 and 4. The glass tubes **2** are fixed for example by means of metal cylinders partly fused in a tube bottom **8**, after which the ends of the stay rods **1** are connected directly or indirectly to the contact pins **9**. For this purpose the ends of the rods **1** can be bent over and be connected, if desired, to a conductor **5**. In certain cases some ends can be directly connected to the current supply pins **9**.

Then a bulb **10** is fused to the tube bottom **8** and the tube is exhausted and, after the desired quantity of gas is introduced, it is sealed.

The characters **11** can be viewed from the top side of the bulb.

Although a definite embodiment is described, the invention may be applied to other tube structures, in which a great number of electrodes are to be united closely to each other so as to be insulated from each other, for example signal tubes, switching tubes, and so on. Accordingly, other modifications will be apparent to those skilled in this art without departing from the spirit and scope of the invention as defined in the appended claims.

What is claimed is:

1. A method of manufacturing a gas-discharge tube having electrodes each of which is provided with a stay-rod each having a side edge comprising the steps, clamping the stay-rods of the electrodes in coplanar arrangement in a jig, pressing the stay-rods at a place between the end thereof and the electrode with their side edges into

a member of insulating material in a soft state extending transversely to the longitudinal direction of the cross-section of the stay-rods whereby the stay-rods are partly embedded into the insulating material, hardening the insulating material, inserting the member with the electrodes secured thereto by the stay-rods into an envelope, and filling the envelope with an ionizable medium.

2. A method as claimed in claim 1, in which the insulating material is thermoplastic.

3. A method as claimed in claim 2, in which the insulating material is glass.

4. A method as claimed in claim 1, in which the insulating material is a hardenable synthetic resin.

References Cited

UNITED STATES PATENTS

2,769,939	11/1956	Williams	313—109.5 X
2,950,406	8/1960	Barnett et al.	313—81 X
2,991,388	7/1961	Wightman	313—188 X
3,317,981	5/1967	Dress	313—268 X

FOREIGN PATENTS

893,553	4/1962	Great Britain.

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