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New York, N.Y.
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 [33] **Netherlands**
 [31] **6816125**

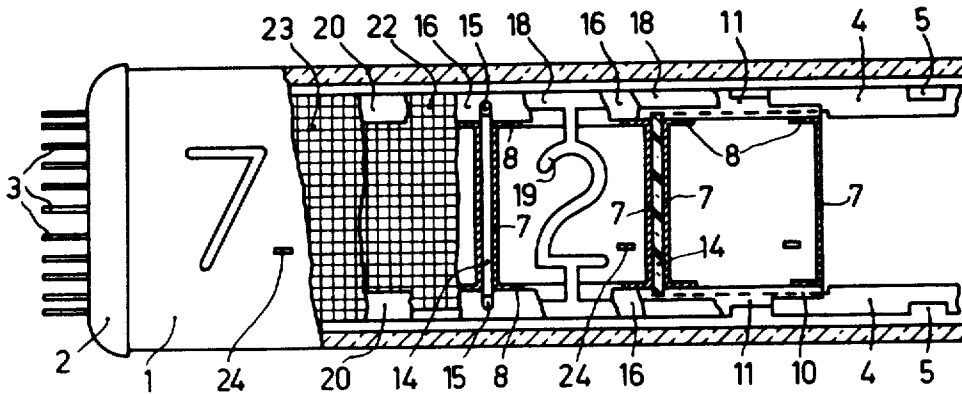
[51] Int. Cl. **H01J 61/66**
 [50] Field of Search..... **313/109.5;**
340/336

[56] **References Cited**
UNITED STATES PATENTS
 3,244,923 4/1966 Milliken 313/109.5
Primary Examiner—Raymond F. Hossfeld
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[54] **GAS DISCHARGE TUBE COMPRISING A NUMBER OF ELECTRODES WHICH ARE UNITED TO FORM A GROUP AND ARE IN THE FORM OF CHARACTERS**
5 Claims, 12 Drawing Figs.

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313/210

ABSTRACT: In a multiple character tube disturbing light phenomena are avoided by providing a double gauze electrode between the electrode stacks and the envelope and the corners of the U-shaped anodes are sealed by bent edges, insulating partitions engaging in recesses of the insulating strips situated between the digit strips.



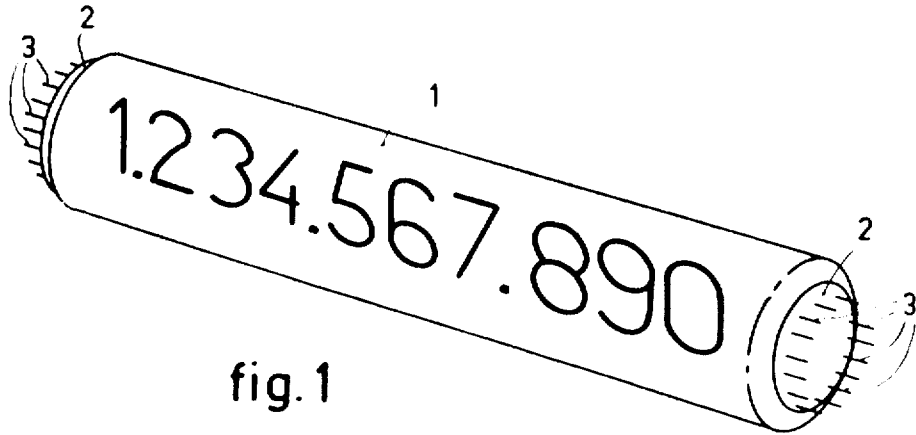


fig. 1

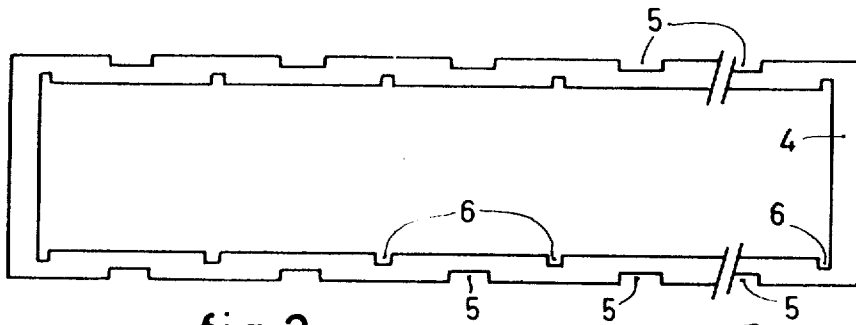


fig. 2

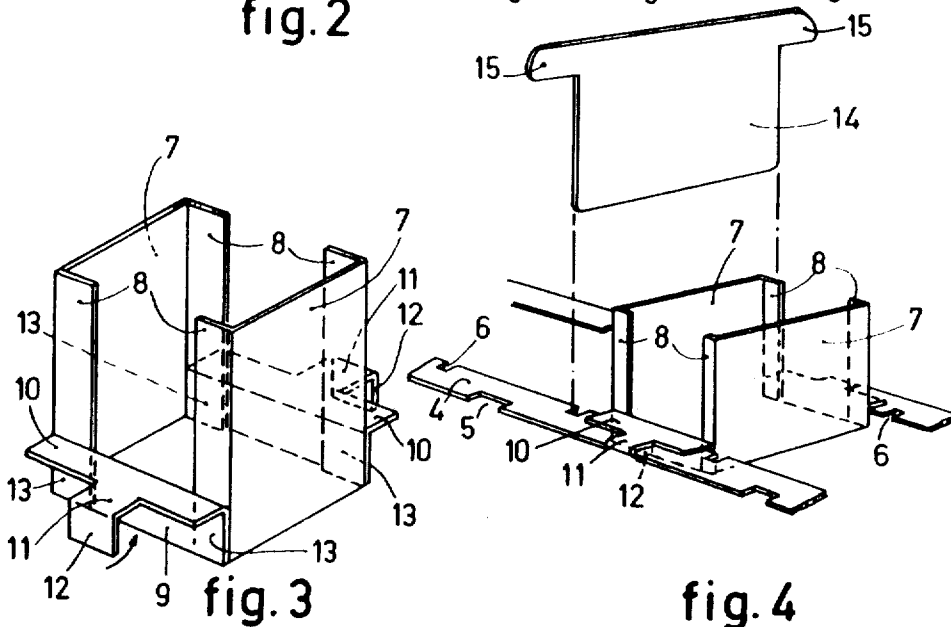


fig. 3

fig. 4

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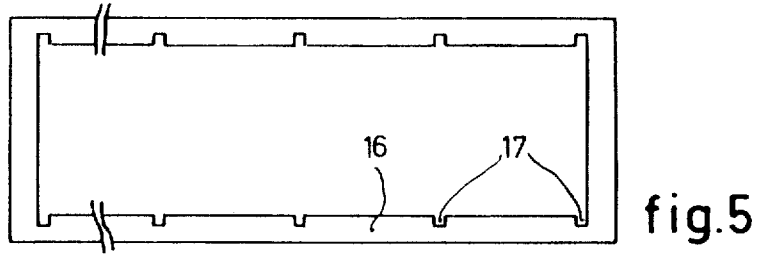


fig.5

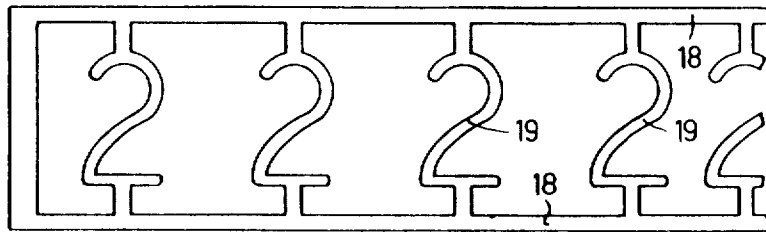


fig.6

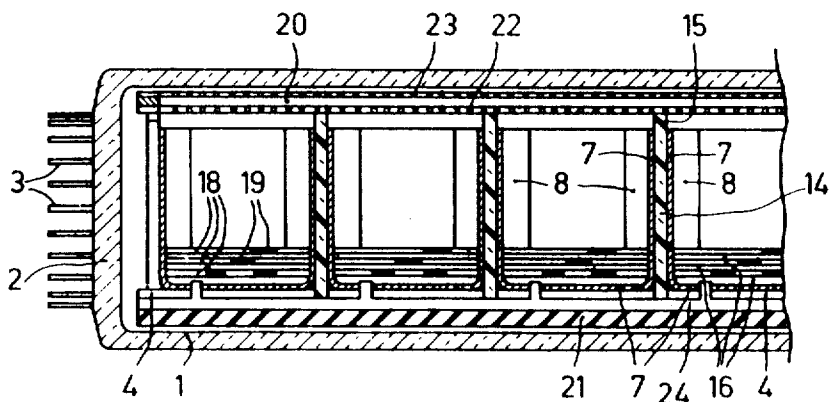


fig.7

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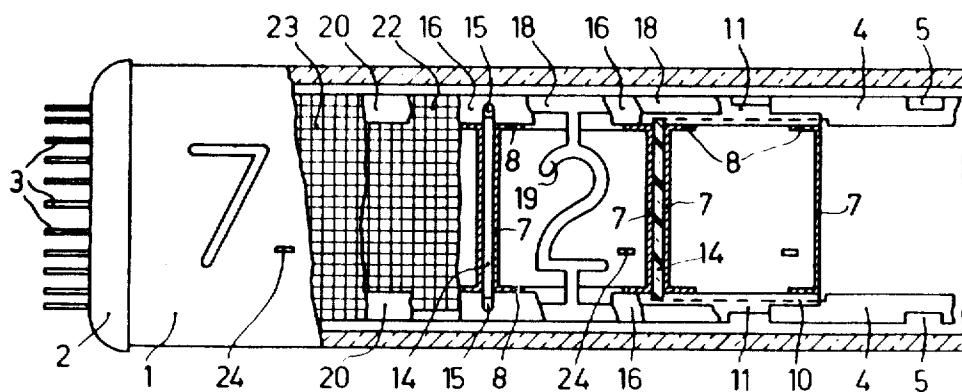


fig.8

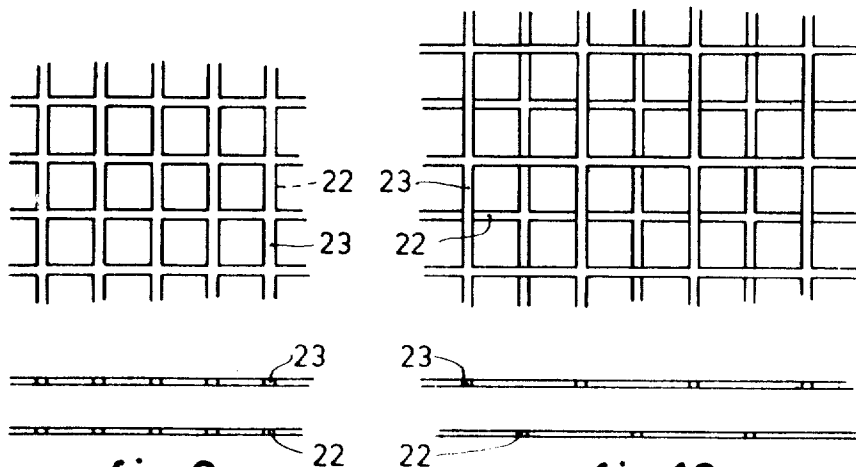


fig.9

fig.10

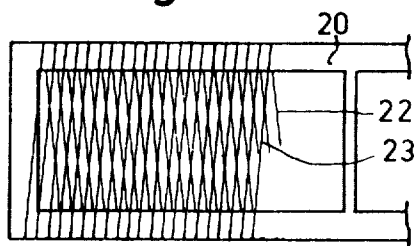


fig.11a

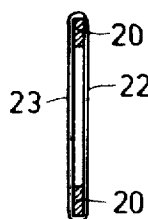


fig.11b

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GAS DISCHARGE TUBE COMPRISING A NUMBER OF ELECTRODES WHICH ARE UNITED TO FORM A GROUP AND ARE IN THE FORM OF CHARACTERS

The invention relates to a gas discharge tube comprising a number of electrodes which are united to form a group by stacking and are in the form of legible characters and are arranged opposite to an anode.

In known tubes having electrodes which are formed as legible characters and are united to form a group with the interposition of insulating plates, always one group with the remaining associated electrodes is accommodated in a separate envelope. For reproducing number or words, a number of such tubes is placed beside and/or over each other.

The drawback is that a large number of separate tubes have to be provided, so that the mutual distance of the characters which are produced by the tubes is comparatively large, which impedes the reading. Moreover, the use of a number of separate tubes is expensive.

The said drawbacks are strongly reduced by using a similar gas discharge tube as is described in application Ser. No. 776,471, filed Nov. 18, 1968, now U.S. Pat. No. 3,564,324 which comprises a number of equal electrode groups which are arranged beside each other in the same envelope, the corresponding electrodes of all the groups being situated in one plane and the corresponding characters of all the groups being connected together in the form of a strip, the electrodes situated in different planes being stacked one on the other with the interposition of correspondingly shaped strips consisting of an insulated material.

The assembly is slid into one envelope having an elongate cross section, which envelope may be provided at both ends with a pinch or a disk-shaped bottom portion through which the current supply wires for the various electrodes are passed in a vacuum-tight manner. It has been found that in such a tube as is described in the prior application, disturbing light effects may occur at given larger current strengths which are necessary for the lighting up of the characters in question, for example, when these are to be read readily in an illuminated room. For example, false light dots and other light phenomena may occur which adversely influence the reading.

It has been found that said disturbances can be avoided if in a gas discharge tube as described in the prior application, measures are taken according to the present invention to suppress the mutual influencing of the various electrode groups as much as possible.

It has been found that the false light dots are formed in that anodes which are situated beside each other can influence each other through the apertures of a gauze electrode which is common for all the groups when characters of adjacent groups light up, so that a light dot can be formed in one or more gauze apertures. According to the invention, this disturbance can be suppressed by providing two gauze electrodes at some distance over each other.

Other light phenomena have been found to occur at the edges of the anodes of the various groups. According to the invention this disturbance can be suppressed by providing labyrinth packings between the various groups by means of insulating plates which engage with their edges in gaps of the insulating strips situated between the electrode strips and by bending the edges of the U-shaped anodes in such manner that near the corners of the central part of the U two metal strips overlap each other. As a result of this the corners of the anodes are closed.

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

FIG. 1 shows a tube according to the invention,

FIG. 2 shows an insulating strip for securing the anodes.

FIGS. 3 and 4 show an anode,

FIG. 5 shows an insulating intermediate strip and

FIG. 6 shows a strip with a character 2, while,

FIG. 7 is a longitudinal cross-sectional view and

FIG. 8 is a partial longitudinal cross-sectional view at right angles to the view shown in FIG. 7, of a tube according to the invention,

FIG. 9 and 10 show two embodiments of gauze electrodes, and

FIGS. 11a and 11b are an elevation and a cross-sectional view, respectively, of still another embodiment of a gauze electrode according to the invention.

The tube shown in FIG. 1 comprises a cylindrical glass envelope 1 which is closed at either end by a bottom part 2. Each bottom part comprises a large number of current supply pins 3 which number depends upon the number of character groups in the tube. Instead of the 10 character groups of the tube as shown, this number may be chosen to be arbitrary.

Each group of characters is surrounded by an U-shaped anode 7 (FIG. 3), which anodes are supported by means of an insulating strip 4 (FIG. 2). As shown in FIG. 4, each upright edge of an anode 7 comprises bent sides 8, while the central portion is provided with upright edges 9 which are bent so that they bear on the mica strip 4 with a flat strip 10. The strip 10 comprises a lug 11 the portion 12 of which can be bent in the recess 5 of the insulating strip 4, so that said strip 4 is rigidly clamped. Since near the corners 13 of each anode two layers of metal overlap each other to in the corners, namely the ends of the bent edges 8 and 9, such a seal is obtained that no ions can travel along the corners to an adjacent anode.

As a result of this the light phenomenon which could occur near the lower edges of the anode is suppressed also because the insulating plates 14 which are situated between the upright sides 7 of two anodes engage in recesses 6 of the insulating strip 4.

When all the anodes 7 are mounted, the lugs 11 and the strips 10 are covered by a mica strip 16 which is provided with recesses 17 which correspond to the recesses 6 of strip 4. Digit strips 18, as is shown in FIG. 6 for the digit 2 are then stacked alternately with insulating strips 16, in which the digit characters 0-9 become situated in the U-shaped anodes 7 (FIGS. 7 and 8). After sliding the separating plates 14 between the anodes, the gauze electrode 22 is laid on the widened upper edges 15 of the plates 14. According to the invention, however, a second gauze electrode 23 is provided at some distance from the gauze electrode 22, which gauze electrodes are separated from each other by a spacing strip 20 which may be insulating or noninsulating.

In the lower side of the system an insulating plate 21 is provided to which a strip 24 comprising lugs, is secured, which lugs may serve as decimal characters as described in the prior patent application. However, this strip may also be provided on the upper side. The whole system may be clamped in a metal sheath having a U-shaped cross section (not shown), after which it is inserted into the envelope 1. The envelope may be provided on its inner side with a transparent conductive layer, for example, tin oxide, so as to avoid charging of the glass wall. Such a layer can in certain cases produce an effect similar to that of the upper gauze electrode so that this may be replaced by the conductive wall layer when the requirements imposed for the maximum current strength are less stringent. By using two gauze electrodes the travel of ions from one electrode group to the other is prevented. The wall layer and each of the gauze electrodes may be provided with separate current supply pins, so that they can be applied to different potentials.

The gauze electrodes are preferably made equal and arranged one behind the other in such manner that the wires of both electrodes lie in each other's shade. (FIG. 9). However, it is alternatively possible to use gauze having larger apertures and to provide said electrodes while shifted relative to each other as is shown in FIG. 10.

If desirable, a grid-shaped electrode wound around a conductive or insulating strip 20 may be used, as is shown in FIGS. 11a and 11b, so that the parts of the wire situated in the one plane constitute the electrode 22 and the parts of the wire situated in the other plane constitute the electrode 23. It will be necessary for said electrodes always to have the same potentials so that the strip 20 can consist of metal.

It has been found that the current for causing characters to light up can be varied within wide limits by using the invention without the said disturbing light effects occurring. In order to

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obtain an even better contrast, a filter may be provided on the glass of the wall of the tube, for example, a red filter, by including silver ions in the glass, as is used for example, for infrared rays.

What we claim is:

1. A gas discharge tube comprising an elongate envelope, a plurality of stacks of character-shaped electrodes united to form a group, an anode surrounding each stack, said electrode stacks being arranged beside each other in said envelope with corresponding electrodes of all the groups lying in one plane and the corresponding electrodes of all the groups being at the same time connected together in the form of a strip, the electrodes located in different planes being stacked one on the other with the interposition of correspondingly shaped strips of insulating material, and means to suppress the mutual influence of the stacks, said means comprising a plurality of spaced perforated electrodes between each stack and surrounding anode and the envelope.

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2. A gas discharge tube, as claimed in claim 1, wherein the means comprises two gauze electrodes which are common for all the groups and are situated at some distance behind each other.

5 3. A gas discharge tube as claimed in claim 2, wherein the anode associated with each group is U-shaped and comprises bent edges in such manner that in the corners of the U-shaped anodes parts of two edges overlap each other.

10 4. A gas discharge tube as claimed in claim 3, wherein the inner wall of the envelope is provided with a transparent conductive layer which can be connected to a given potential.

15 5. A gas discharge tube as claimed in claim 4, wherein insulating partitions which are provided between upright surfaces of adjacent anodes engage in recesses of the insulating strips and comprise a widened upper portion on which one of said gauze electrodes bears.

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