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(54) Image display device and picture tube.

(57) An image display device comprising means for emitting a row of electron beams and an electron optics for the row of electron beams, including an assembly of at least two electrodes, provided with contact planes, which are separated by insulating interfaces which are contiguous to the contact planes. Such an assembly is simple to manufacture, is mechanically stable and has an appropriate microphonic behaviour, i.e. it is less sensitive to microphonics.

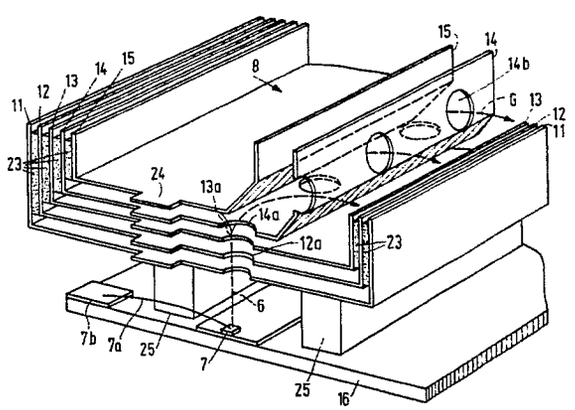

FIG.4

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Image display device and picture tube.

The invention relates to an image display device, comprising a picture tube, which includes means for emitting a row of electron beams, an electron optics for the electron beams and a display screen, the electronic optics including an assembly of at least two electrodes and the assembly having apertures for the passage of the electron beams.

The invention also relates to a picture tube suitable for use in such an image display device.

An image display device of the type defined in the opening paragraph is disclosed in the European Patent Application 0,288,094.

In the prior art image display device the electron optics contains electrodes which are stacked on and connected to conducting pins. In a given embodiment, an electron beam corresponds to a vertical column of the image. An image display device including such an electron optics is hardly suitable for mass production. The risks of rejects is high.

The invention has for its object to provide an image display device of the type defined in the opening paragraph, which is more suitable for mass production.

To that end, an image display device according to the invention, is characterized in that one of the electrodes has a first and a second contact plane, the other electrode has a third and a fourth contact plane and a first and a second interface, respectively, of an insulating material extends between the first and third contact planes and the second and fourth contact planes, the first interface being contiguous to the first and the third contact planes and the second interface being contiguous to the second and the fourth contact plane. The electrode assembly can thus be manufactured in a simple manner.

Further advantages are that the assembly is mechanically more stable and less sensitive to microphonics.

Preferably, the first and second contact planes extend in different planes. The assembly is thus even more stable and less sensitive to microphonics.

An embodiment of the image display device according to the invention, is characterized in that the first and the second electrode each have a plane provided with apertures for the passage of the electron beams, and two edges placed diagonally on the plane, the contact planes being constituted by these edges.

The interfaces extending between the contact planes and extending diagonally on the planes are not or hardly charged. Charging of the interfaces may cause aberrations in the electron beam paths.

Preferably the first and the second electrodes have a U-shaped profile. The electrodes are easy to stack and the chance that the electrodes are displaced with respect to each other during manufacture of the electron optics is small.

An embodiment of the image display device according to the invention, is characterized in that the electrodes are folded along fold lines.

It is possible to assemble an electrode suitable for the image display device of the invention from different component parts, for example by welding parts in the form of sheets together. It is simpler to produce a suitable electrode by means of folding along fold lines. The fold lines are preferably perforations.

An embodiment of the image display device according to the invention, is characterized in that the first and second interfaces interconnect the electrodes. A still further embodiment of the image display device according to the invention, is characterized in that the first and second interfaces are made of polyimide.

An embodiment of the image display device according to the invention, is characterized in that the first and second electrodes have aligning apertures.

The electrodes can be aligned in a simple manner by means of these aligning apertures.

Some embodiments of the invention will now be described by way of example with reference to an accompanying drawing, wherein

Fig. 1 is a cross-sectional view of a prior art image display device;

Figs. 2 and 3 are a perspective view and a cross- sectional view, respectively, of a detail of the electron optics of the prior art image display device;

Figs. 4 and 5 are a perspective view and a cross-sectional view, respectively, of a detail of an image display device according to the invention;

Fig. 6 shows a flat sheet from which a profiled electrode is foldable;

Fig. 7 shows a method of assembling an electron optics suitable for use in the image display device according to the invention;

Figs. 8a to 8g show several electrode assemblies suitable for use in an image display device according to the invention.

Fig. 1 shows in a cross-sectional view the prior art image display device. The image display device 1 has an envelope 2 having a face plate 3 which on the interior side is provided with a display screen 4. In addition, the image display device 1 includes a generating system 5 for generating a row of

electron beams 6, which include a plurality of emitting elements 7 and an electron optics 8. The electron optics 8 causes inter alia the electron beams 6 emitted by elements 7 to be accelerated. In this example, the electron beams emerge from the electron optics 8 such that they are parallel to the display screen 4. The electron beams 6 are subsequently deflected to the display screen 4 by means of deflection electrodes 9. In this example a shadow mask 10 is placed in front of the display screen 4.

Figs. 2 and 3 show in a perspective and a cross-sectional view, respectively, a portion of the electron optics 8. The electron optics 8 contains a number of electrodes 11 to 15, provided with apertures 11a, 12a, 13a and 14a and 14b, a base plate 16 and a number of conducting pins 17 to 20, which are connected to a number of conducting strips 17a to 20a, respectively. Emitting element 7 is connected to a conducting strip 7b via connecting line 7a. The pins and the electrodes are mechanically interconnected by glass connector 21 and electrically interconnected by conducting connectors 22.

An image display device provided with such an electron optics is hardly suitable for mass production. The electrodes must be well-aligned both along the electron beams and in a direction diagonal thereto. If one pin is bent or incorrectly placed, then it becomes impossible to position the electrodes accurately. Measures must be taken to prevent a conducting pin from contacting a "wrong" electrode. The glass must be heated to the flowing point to produce the glass connections. This is time-consuming: moreover, after cooling, thermal stresses may occur, which might inter alia result in breaking of a pin or in the dislocation of an electrode. The invention has for its object to provide an image display device which is more suitable for mass production.

Fig. 4 shows in a partly perspective view a detail of an image display device according to the invention.

The electrodes 11, 12, 13, 14 and 15 are profiled and have raised edges and a plane with apertures for the feedthrough of the electron beams 6. Interfaces 23 of an insulating material, polyimide in this example, extend between the raised edges and are contiguous to the raised edges. These polyimide layers provide electrical insulation of the electrodes. It is possible for the interface to consist of a layer of Al_2O_3 deposited on one of the relevant electrodes. The polyimide layer has an advantage over a layer of Al_2O_3 in that the electrodes may also be interconnected through the polyimide layer.

The electrodes 11 to 15 are provided with lugs 24. These lugs can be provided with electrical contacts in a simple manner.

The assembly of electrodes 11, 12, 13, 14 and 15 is easy to manufacture, forms a rigid whole, is easily provided with electrical connections and is less sensitive to microphonics. The electrode assembly is supported and insulated by means of supports 25.

Fig. 5 is a cross-sectional view of a further example of a detail of an image display device according to the invention.

This detail shows electrodes 26 to 33 and an element for the emission of an electron beam 7. The electrodes are separated by insulating interfaces 34. These insulating interfaces extend, as is shown in Fig. 4, between the raised edges of the electrodes, i.e. in a plane parallel to the electron beams. Charging of the insulating interfaces 34 is prevented thereby. The final electrode 33 is the anode. Electrode 32 is provided with rounded edges 35. This reduces the risk of electrical flashover.

Fig. 6 shows a flat sheet 36 from which a U-shaped electrode is foldable. The flat sheet is provided with a row of apertures 37 for the feedthrough of electron beams, aside of the row of apertures with two aligning apertures 38 and 39, and fold lines 40 and 41. The apertures 37, 38 and 39 and fold lines 40 and 41 may be obtained by means of etching, spark erosion , drilling, by means of a laser or any other suitable method. Fold lines 40 and 41 may be lines for which the thickness of the electrode is less than for the remaining electrodes. Preferably, the fold lines are perforations. A profiled electrode is foldable from such a flat sheet in a simple manner. An elongated die having a width approximately equal to the distance between the fold lines 40 and 41 pushes the flat sheet 36 onto a rubber cushion. The edges of the flat sheet are thereby folded along the fold lines 40 and 41 and a profiled electrode, in this example a U-shaped electrode, is formed.

Fig. 7 illustrates a method of assembling an electrode assembly of an electron optics suitable for an image display device according to the invention.

Electrodes 44 and 45 with aligning apertures 46 and 47 are placed on the base plate 42 which includes a pin 43. The electrodes 44 and 45 are spaced apart by a spacer 48. The electrodes 44 and 45 are interconnected by polyimide insulating layers 49 and 50. Thereafter the pin 43 and the spacer 48 are removed.

Figs. 8a to 8g are cross-sectional views of further examples of electrode assemblies suitable for an image display device according to the invention. As in the examples already shown, in all these examples the first electrode is provided with contacts planes 81 and 82, which in these examples

extend in different planes, the second electrode is provided with contact planes 83 and 84 and the contact planes 81 and 83 and the contact planes 82 and 84 are separated by insulating interfaces 85 and 86, respectively.

It will be obvious that for a person skilled in the art, many variations are possible within the scope of the invention.

Claims

1. An image display device comprising a picture tube, which includes means for emitting a row of electron beams, an electron optics for the electron beams and a display screen, the electron optics including an assembly of at least two electrodes and the assembly having apertures for the passage of the electron beams, characterized in that, one of the electrodes has a first and a second contact plane, the other electrode has a third and a fourth contact plane, and a first and a second interface, respectively, of an insulating material extends between the first and the third contact planes and the second and fourth contact planes, the first interface being contiguous to the first and the third contact planes and the second interface being contiguous to the second and the fourth contact plane.

2. An image display device as claimed in Claim 1, characterized in that the first and the second contact planes extend in different planes.

3. A picture display device as claimed in Claim 2, characterized in that the first and the second electrode each contain a plane provided with apertures for the passage of the electron beams, and have two edges which extend diagonally on this plane, these edges constituting the contact planes.

4. An image display device as claimed in Claim 3, characterized in that the first and second electrodes have a U-shaped profile.

5. An image display device as claimed in Claim 3 or 4, characterized in that the electrodes are folded along fold lines.

6. A picture display device as claimed in Claim 5, characterized in that the fold lines are perforations.

7. An image display device as claimed in Claim 1, 2, 3, 4, 5 or 6, characterized in that the first and second interfaces interconnect the electrodes.

8. An image display device as claimed in Claim 7, characterized in that the first and second interfaces are made of polyimide.

9. An image display device as claimed in any one of the preceding Claims, characterized in that the first and second electrodes are provided with aligning apertures.

10. A picture display tube suitable for use in an image display device as claimed in any one of the preceding Claims.

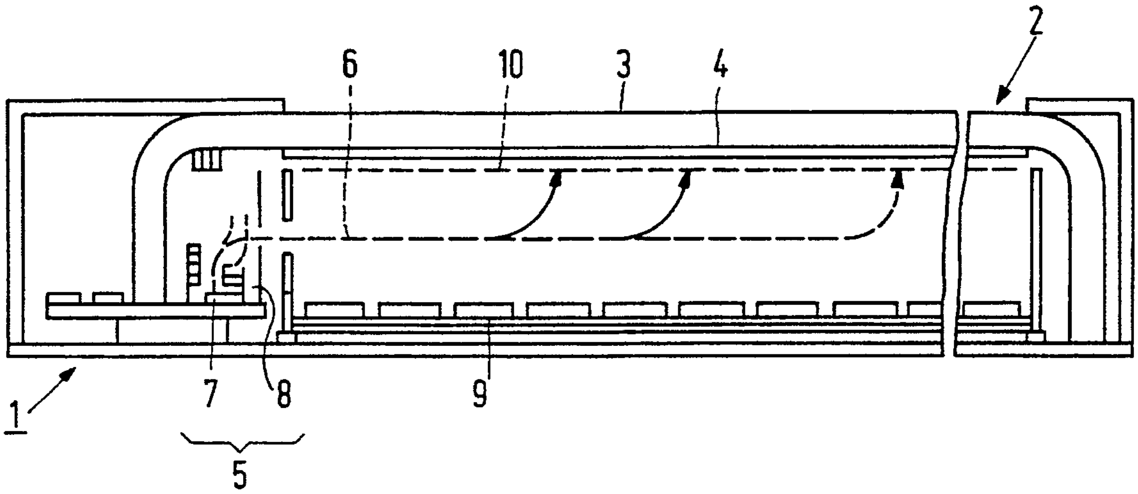
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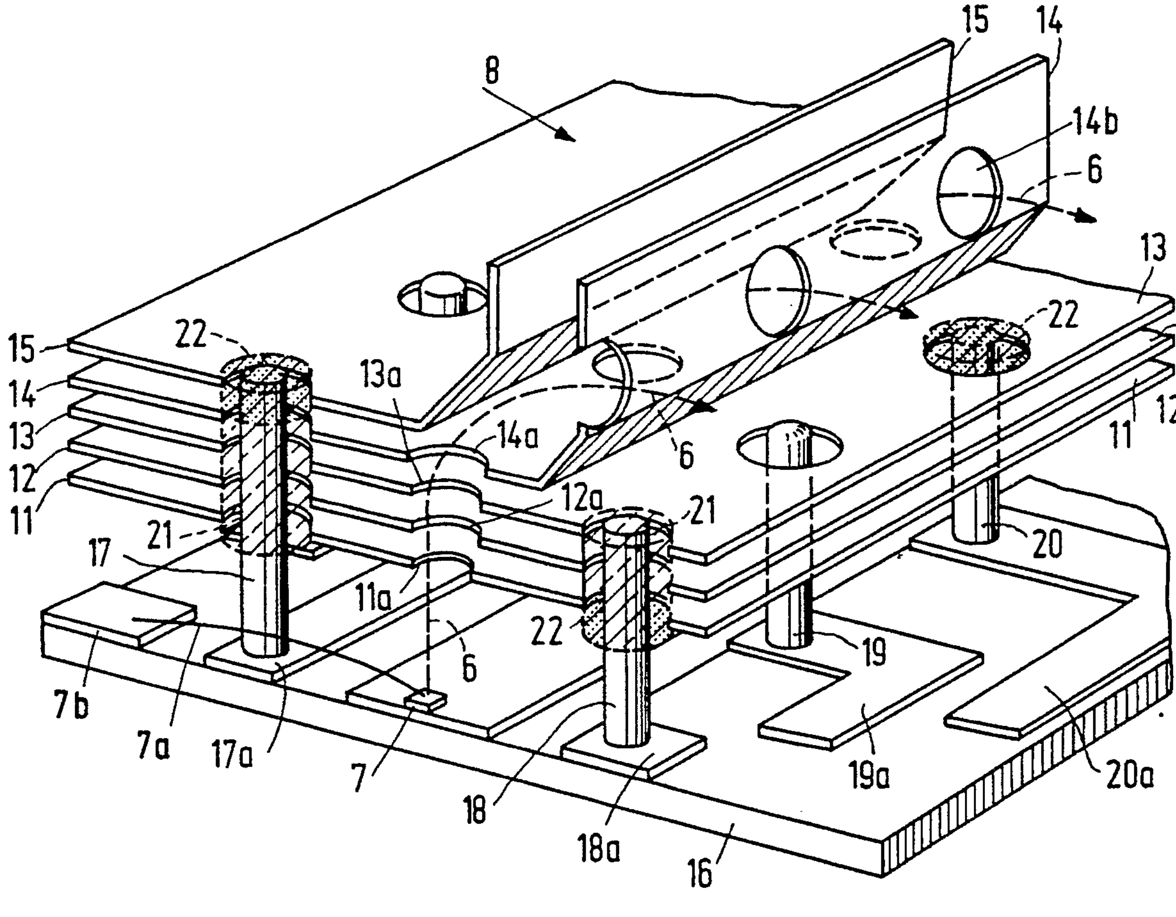
FIG.1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15
14
14b
6
13
22
15
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12
11
13a
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12a
11a
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18a
19a
20a
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FIG.2

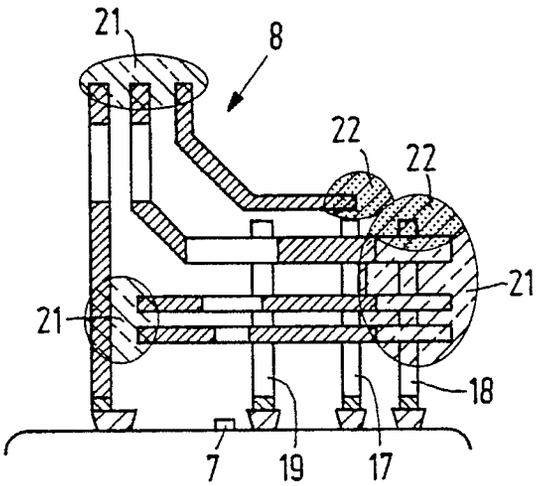
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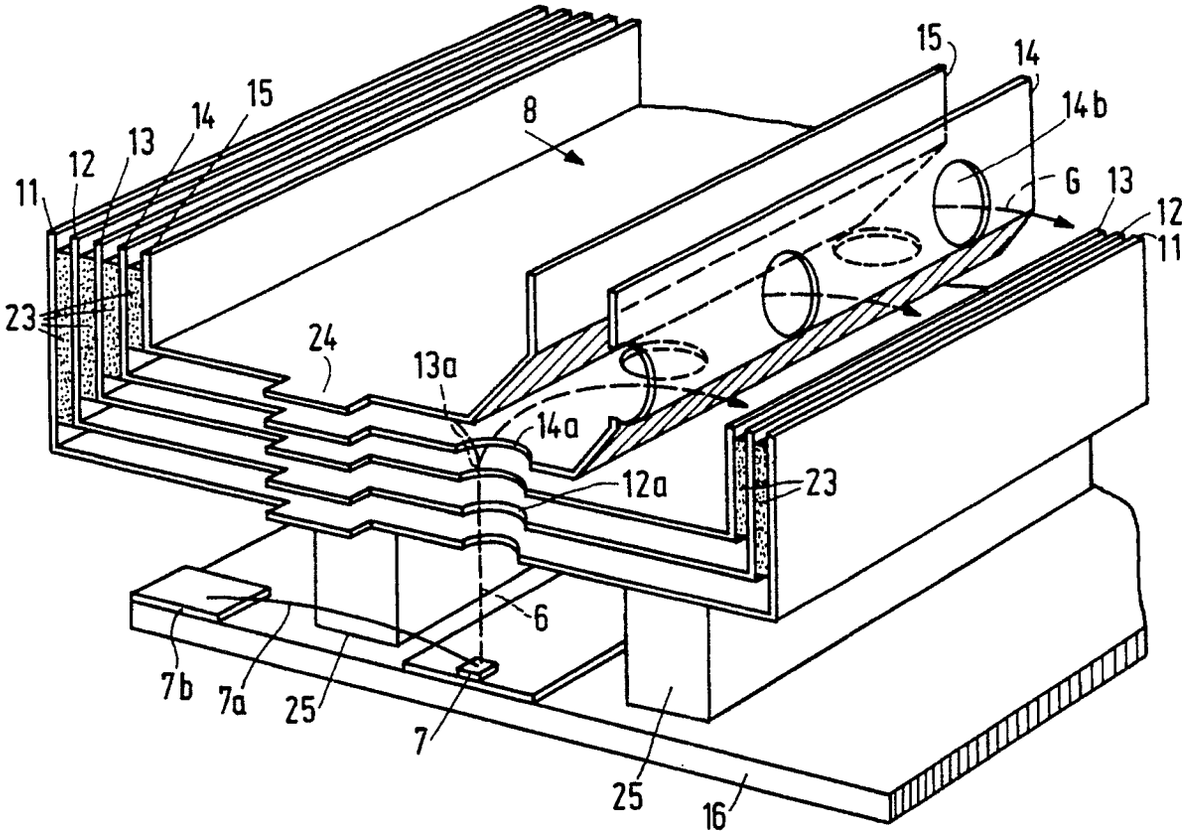
FIG.3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14b
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G
13
12
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11
23
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13a
14a
12a
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7b
7a
25
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25
16

FIG.4

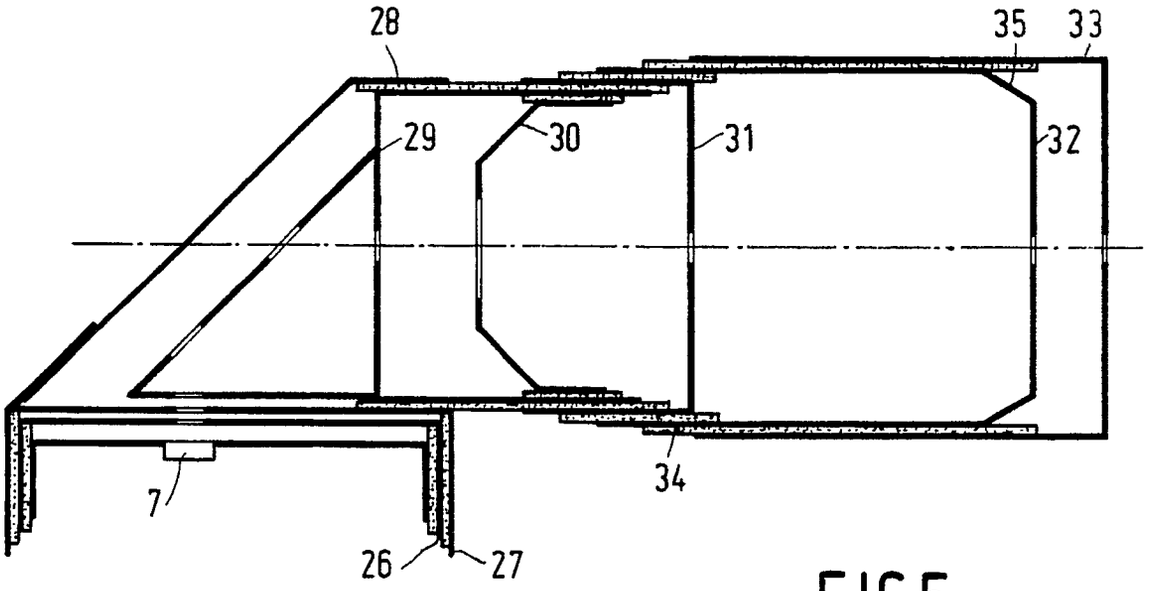

FIG.5

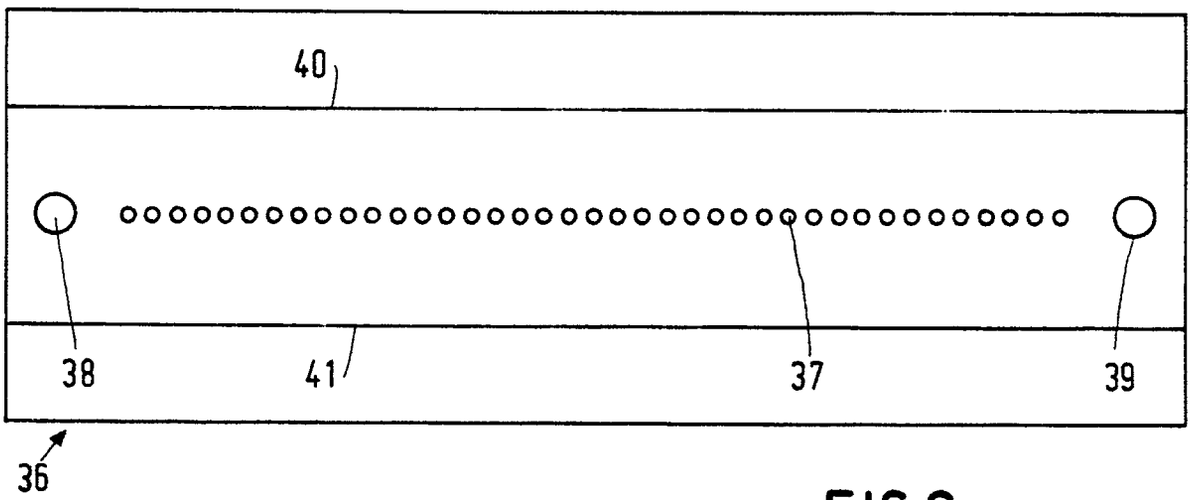

FIG.6

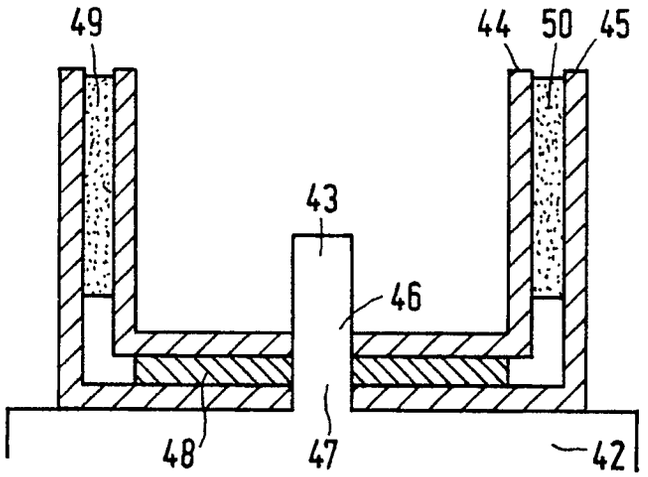

FIG.7

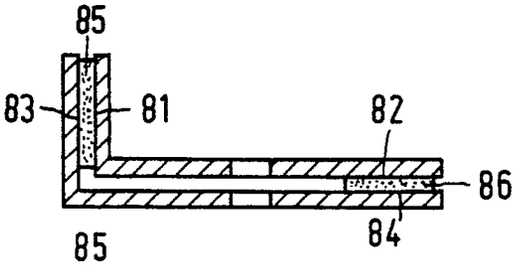

FIG.8a

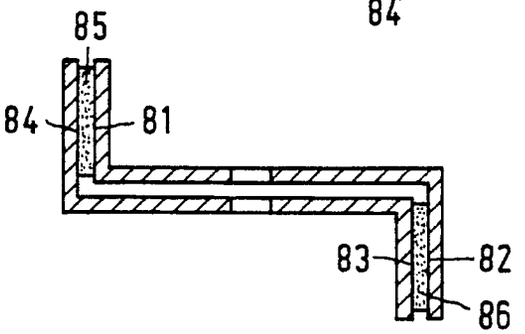

FIG.8b

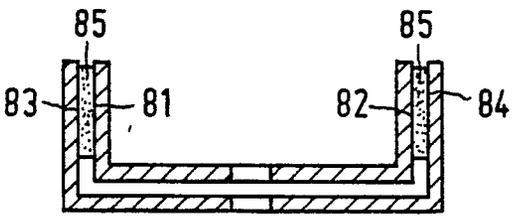

FIG.8c

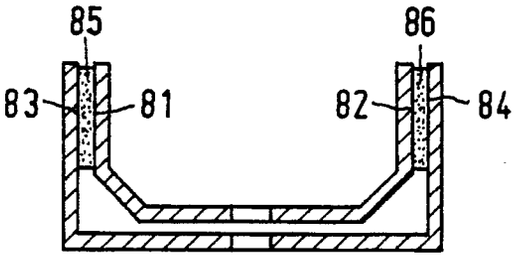

FIG.8d

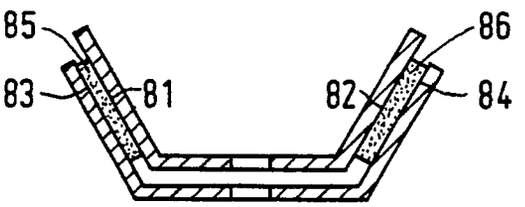

FIG.8e

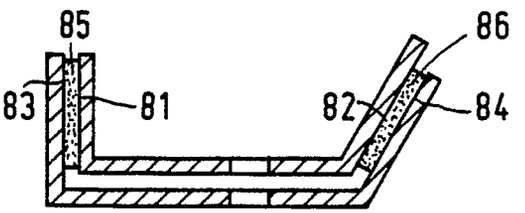

FIG.8f

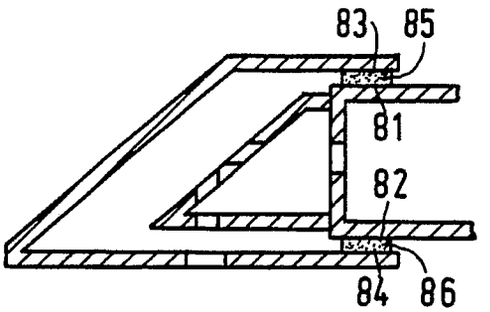

FIG.8g

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EUROPEAN SEARCH REPORT

Application Number

EP 90 20 0750

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
D,A	EP-A-0 288 094 (PHILIPS) * Page 2, lines 26-29; figure 1 *	1,3	H 01 J 29/82
A	FR-A-2 272 484 (ENCK) * Page 4, lines 21-27,33-39; page 5, lines 13-16; fig. *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H 01 J 31/00
H 01 J 29/00
H 01 J 43/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-06-1990	ROWLES K.E.G.

CATEGORY OF CITED DOCUMENTS

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