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(11) **EP 1 014 418 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.06.2000 Bulletin 2000/26

(51) Int. Cl.⁷: **H01J 29/92**

(21) Application number: **98830782.3**

(22) Date of filing: **23.12.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI
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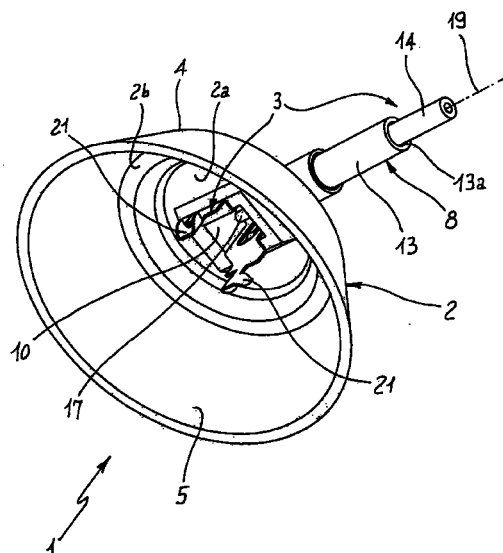
(54) **Electrical connection device for a cathode ray tube power supply and method manufacturing the same**

(57) It is provided an electrical connection device for cathode-tube power supply and a method of manufacturing the same in which a substantially suction-cup-shaped support body (2) is intended for being associated with an attachment surface (6) of the electric apparatus to be power driven.

The support body (2) comprises a deformable element (4) having at least one bell-shaped portion (5) and a stiffening element (8) associated with the bell-shaped portion (5) of the deformable element (4) at the upper part thereof and intended for receiving electrical connection means (3) into engagement, for power supplying the electric apparatus.

Combination of a rigid element (8) and a deformable element (4) to form the support body (2) enables a rigid base for anchoring to the support body to be obtained for associating the electrical connection means (3), and at the same time enables a reliable holding of the bell-shaped portion defining the suction cup to be achieved.

FIG. 1



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Description

[0001] The present invention relates to an electrical connection device, in particular for cathode tube power supply, and to a method of manufacturing the same.

[0002] More specifically, the device in accordance with the present invention is intended for anchoring and connecting high-voltage electric terminals to cathode tubes incorporated into electric apparatuses such as monitors or television sets, for example.

[0003] It is known that, in order to achieve a correct acceleration of the electrons within cathode tubes of monitors and television sets the latter are required to receive an appropriate supply voltage.

[0004] Problems linked with electric high-voltage connections are substantially due to the fact that in the presence of moisture and dust, the high voltage tends to generate currents and/or arcs on the cathode tube surface that are capable of damaging the electric apparatus itself.

[0005] In order to obviate the above drawbacks it is therefore necessary to carry out an appropriate insulation of the electrical connection terminals.

[0006] At all events insulation is indispensable also due to the fact that the electrostatic charges generated on devices such as monitors and television sets are capable of drawing a great amount of dust and dirt thereto.

[0007] In order to obtain the desired insulation, electrical connection devices are available on the market that are arranged to power high-voltage cathode-ray tubes.

[0008] These devices substantially consist of a body of silicone material substantially having the shape of a suction cup and provided at the upper part thereof with a hollow tubular portion arranged for fitting a suitably insulated electric wire carrying high voltage.

[0009] The hollow tubular portion has an insertion opening for receiving the electric cable and an exit opening turned internally of the cavity defined by the suction cup under engagement conditions so that live terminals are at the inside of the cavity.

[0010] The device further has a metal fork positioned at the exit opening which is electrically connected with a conductor by welding and is mechanically connected by clipping of a head portion thereof to the insulating sheath of the conductor itself.

[0011] The elastic fork is further fitted into a rest housing formed in the silicone support body at the exit opening of the tubular portion.

[0012] The metal fork itself has two opposite projecting teeth intended for being engaged in a corresponding undercut provided on the surface of the cathode tube. The connection carried out by means of the teeth is both a mechanical anchoring and an electrical connection.

[0013] Under operating conditions, power passes through the conductor and is then transmitted to the

fork-shaped element and subsequently to the cathode tube.

[0014] The deformable element of silicone material, on the one hand offers an electrical insulation of the uncovered metal portions and, on the other hand, due to the sealing action exerted by the suction cup, prevents moisture or dust from penetrating into the region where the electric contact is established between the device and the cathode tube.

[0015] The process for manufacturing the devices of known type involves a first step in which the deformable silicone element is made in the form of a suction cup by moulding.

[0016] Subsequently a metal fork is rigidly engaged with the cable and the electrical connection is carried out by a welding operation between the metal wire inside the cable and the fork.

[0017] The assembly is then covered with a connecting small tube. The cable with the clip and small tube is fitted into the suction cup through a hole until it comes out from the opposite side. The connecting end portion thus made is then introduced into the housing formed in the silicone material of the suction cup.

[0018] However, the known technique briefly described above has many drawbacks.

[0019] First of all it is to note that the absence of a sufficiently rigid portion for anchoring of the electric terminals reduces reliability of the connection between the silicone material body and the electrical connection elements.

[0020] The geometric precision in coupling the parts substantially depends on the manual skill of the assembling operator.

[0021] In addition, forces generated inside the device when the latter is associated with the cathode tube, i.e. the elastic deformation force of the suction cup and the pulling force exerted by the metal fork clipped to the cathode tube itself, are discharged onto the silicone material which will be subjected to deformation and will become damaged in time.

[0022] Other drawbacks are then connected with the presence of a welding, which affects the good quality of the electrical connection sometimes to a great extent.

[0023] As regards the adopted procedure, it is then to note that the assembling process is rather complicated, difficult and of low productivity.

[0024] In particular, the steps of clipping the metal fork, the welding step and the final step of inserting the electric terminal into the silicone housing can be hardly made automatic and therefore are to be made manually, so that qualified staff is required and the production speeds are greatly reduced.

[0025] Finally, the device once assembled is of difficult disassembling and therefore the material-recycling operations when the operating life of the device is over, are very problematic.

[0026] It is therefore an object of the present inven-

tion to substantially obviate the above drawbacks.

[0027] First of all it is an important object of the invention to provide an electrical connection device in which the parts intended for electrical connection are engaged in the suction cup element in a reliable, geometrically precise and durable-in-time manner.

[0028] It is a further object of the invention to improve resistance of the device to the atmospheric elements.

[0029] It is another object of the invention to improve the electrical connection by eliminating the need for a welding operation.

[0030] A still further object of the invention is to create a modular device which can be easily assembled and disassembled so as to ensure easy recycling of the materials.

[0031] It is then fundamental that the manufacturing process of the invention should be automated, which will greatly reduce the production times.

[0032] The foregoing and further objects that will become more apparent during the following description are substantially achieved by an electrical connection device, in particular for cathode-tube power supply and by a method of manufacturing the same in accordance with the appended claims.

[0033] Further features and advantages will be best understood from the detailed description of a preferred non-exclusive embodiment of a connection device in accordance with the invention. Such a description will be taken hereinafter by way of non-limiting example with reference to the accompanying drawings, in which:

- Fig. 1 is a perspective bottom view of an electrical connection device in accordance with the present invention;
- Fig. 2 is a side view of a stiffening element being part of the device in Fig. 1;
- Fig. 3 is a section taken along a vertical plane of a device in accordance with the invention associated with an electric apparatus to be power supplied;
- Fig. 4 is a section taken along a vertical plane turned through 90° relative to the one shown in Fig. 3, of the device in accordance with the invention; and
- Fig. 5 is a perspective view of a clip being part of the device in Fig. 1.

[0034] With reference to the drawings an electrical connection device, in particular for cathode-tube power supply, has been generally identified by reference numeral 1.

[0035] The electrical connection device of the invention is preferably used for establishing high-voltage power supply connections with monitors and/or television sets.

[0036] In particular the device is arranged to be associated with a surface of attachment of a cathode tube to be power supplied in such a manner that an

electric insulation of the uncovered portions of the electrical connections is ensured, as well as the absence in time of dust, dirt and moisture at the connection region.

[0037] The device is made up of a support body 2 of insulating, in particular thermoplastic, material with which electrical connection means 3 capable of power supplying the electric apparatus with which the device is connected, is operatively associated.

[0038] As viewed from Figs. 1, 3 and 4, the support body 2, substantially in the form of a suction cup, comprises a deformable element 4 which has at least one bell-shaped portion 5.

[0039] The bell-shaped portion 5 substantially has a frustoconical conformation under undeformed conditions, whereas when the device is associated with the electric apparatus to be power supplied, it is deformed and its lower surface 5a is brought into contact with the attachment surface 6 of the cathode tube (see Fig. 3, in particular).

[0040] In this configuration the device 1 and attachment surface 6 define a cavity 7 substantially insulated from the surrounding atmosphere.

[0041] The deformable element 4 is preferably made of silicone material having the necessary deformability and insulation features.

[0042] On top of the bell-shaped portion 5, at the region of smaller radial bulkiness of same, the support body 2 has a stiffening element 8 preferably made of plastic material (thermoplastic material, in particular).

[0043] This second element is much stiffer than the silicone material, which makes the support body 2 more rigid at the upper region 2a thereof.

[0044] The stiffening element 8, seen in side view in Fig. 2, consists of a first portion 8a of a disk-shaped conformation which is substantially buried in the deformable element 4.

[0045] This portion 8a has a plurality of through windows 9 spaced apart the same distance from each other at the peripheral region thereof, which windows are such made that they promote gripping of the stiffening element 8 on the deformable element 4.

[0046] The stiffening element 8 also has an anchoring portion 10 defined at the lower part thereof and turned towards the lower surface 2b of the support body 2.

[0047] The anchoring portion 10 is intended for receiving a clip 11 (shown in Fig. 5) in engagement therewith, which clip is part of the electrical connection means 3.

[0048] In more detail, the anchoring portion 10 is defined by a fitting housing capable of receiving, by snap-fitting for example, or also by interference fit, an attachment head 12 of clip 11 the shape of which at least partly matches the shape of the fitting housing.

[0049] It is at all events apparent that the mutual connection between the stiffening element 8 and clip 11 can be obtained in the same manner, should the clip be provided with a fitting housing and should the anchoring

portion 10 be defined by an attachment head insertable into said housing.

[0050] The stiffening element 8 is then provided with a hollow tubular portion 13 arranged to receive a cable 14 of the electrical connection means 3.

[0051] The hollow portion 13 has an insertion opening 13a at the outside of the cavity 7 defined by the support body 2 and attachment surface 6 and an exit opening 13b opening into the cavity 7 itself.

[0052] In particular, the exit opening 13b of the hollow tubular portion 13 is placed close to an inner wall 10a of the fitting housing 10 of the anchoring portion 8.

[0053] The electrical connection means 3 in engagement at least with the stiffening element 8 is made up of said clip 11 and cable 14.

[0054] Practically, cable 14 is connected, at one end thereof, with power supply means and transfers high voltage from said means carrying it to clip 11. Said clip, under engagement conditions with the apparatus to be power supplied, transfers current to the apparatus circuits.

[0055] Clip 11, of metal material, is provided with an attachment head 12 having at least one tab 15 projecting from its overall dimensions and intended for snap-fitting in a respective recess 22 formed in the fitting housing 10 of the stiffening element 8.

[0056] Preferably two tabs 15 are present and they are disposed on opposite surfaces 12a, 12b of the attachment head 12, as shown in Fig. 3.

[0057] The attachment head 12 then comprises an insertion slit 16 on another side surface 12c thereof for receiving, by interference fit, a metal wire 17 carrying voltage of cable 14.

[0058] The insertion slit 16, when clip 11 is in engagement with the stiffening element 8, is at the inside of the fitting housing 10. In particular, slit 16 appears at the exit opening 13b of the hollow tubular portion 13.

[0059] In order to ensure a mechanical engagement between clip 11 and cable 14, the insertion slit 16 is delimited by at least one tab 18 which is elastically deformable along the insertion direction 19 of cable 14.

[0060] It is to note that in the embodiment shown in Fig. 5 two of said tabs 18 are present and they are both deformable towards the inside of the clip head 12.

[0061] Clip 11 itself then has a locking portion 20 that, when the attachment head 12 is in engagement with the fitting housing 10, is at the outside of the fitting housing itself.

[0062] The locking portion 20 is arranged to be engaged in an undercut 23 of the attachment surface 6 for ensuring both a mechanical connection and an electrical connection with the apparatus to be power supplied (Fig. 3).

[0063] In more detail, the locking portion 20 consists of two opposite teeth 21 defined by a thin plate bent towards the outside of clip 11.

[0064] The two teeth are snap-fitted into an appro-

priate recess of the attachment surface, so that they abut against respective portions of the recess itself preventing separation of the connection device from the cathode tube.

[0065] It is finally to note that thickness of the stiffening portion 8, above all close to clip 11, is adapted to ensure a correct insulation of the external environment from voltage passing through the electrical connection means 3.

[0066] From an operating point of view, assembling of the above described device is as follows.

[0067] First of all a stiffening element 8 preferably made by moulding is arranged. The deformable element 4 is subsequently associated with the stiffening element 8 generally by overmoulding techniques.

[0068] The process further comprises a step in which, starting from a thin metal sheet, a blank of the electric clip 11 is made by die cutting; the same blank is subsequently bent following preestablished folding lines so as to obtain the clip in its three-dimensional shape.

[0069] Then said clip is snap fitted into the fitting housing 10 until tabs 15 interfere with the respective recesses 22. Cable 14 having the metal wire 17 at least partly projecting from an end thereof, is inserted into the hollow tubular portion 13 of the stiffening element 8 until said wire 17 passes through slit 16 having opening sizes slightly smaller than the diameter of wire 17.

[0070] The insertion direction 19, which is substantially coincident with the axis of the hollow portion 13 causes an elastic deformation of tabs 18 defining slit 16 towards the inside of the attachment head 12.

[0071] The occurred deformation enables the force of tabs 18 on the metal wire 17 under static conditions to be increased. On the other hand, due to the geometric conformation of the coupling, the same force on wire 17 is increased if an attempt should be made to slip the wire off.

[0072] At this point, the portion of the hollow tubular element 13 at the entry opening 13a is heated in order to cause adhesion of said portion to cable 14.

[0073] In this way a tight seal of the device against the atmospheric elements is obtained at the cable, as well as an improved mechanical coupling between the device and the stiffening element.

[0074] It is apparent that the engagement steps for snap-fitting of clip 11 and connection of cable 14 must be carried out in succession in order to ensure a correct electrical connection.

[0075] The invention achieves important advantages.

[0076] First of all it is to note that the presence of a stiffening element 8 with which clip 11 and cable 14 are associated ensures the geometric precision of the connection and a better resistance of the device to stresses.

[0077] In addition, the lower cost of the material forming the stiffening element as compared with the silicone material greatly reduces expenses for manufac-

turing the device.

[0078] Due to the absence of welding between the parts forming the electrical connection means, reliability of the connection is greatly improved because said connection is ensured by a mechanical operation of inserting the cable into the tubular portion. In addition, the presence of the stiff element enables snap-fitting of the clip directly on the support body.

[0079] Combination of the two last-mentioned technical features also ensures an easy assembling of the parts that can be carried out in a completely automatic manner, and at the same time a ready disassembling capable of greatly promoting the material recycling operations.

Claims

1. An electrical connection device, in particular for cathode-tube power supply, comprising:
 - a support body (2) intended for being associated with an attachment surface (6) of an electric apparatus to be power supplied; and
 - electrical connection means (3) operatively associated with the support body (2) for power supplying said apparatus, characterized in that the support body (2) comprises a deformable element (4) having at least one bell-shaped portion (5) and a stiffening element (8) associated with the bell-shaped portion (5), preferably at the upper part thereof, and intended for receiving said electrical connection means (3) into engagement.
2. A connection device as claimed in claim 1, characterized in that the support body (2) substantially is in the form of a suction cup, under engagement conditions of the device with the electric apparatus the support body (2) having a lower surface (2a) intended for coming into at least partial contact with the attachment surface (6) to define a cavity (7) substantially insulated from the external environment.
3. A connection device as claimed in claim 2, characterized in that the connection means (3) comprises a cable (14) and a clip (11) electrically connected with the cable (14), and in that the stiffening element (8) has an anchoring portion (10) turned towards the lower surface (2b) of the support body (2) to receive said clip (11) into engagement.
4. A connection device as claimed in claim 3, characterized in that the anchoring portion (10) is defined by a fitting housing for receiving an attachment head (12) of the clip (11) into engagement, preferably by snap-fitting, the shape of said head matching the shape of the fitting housing (10) at least partly.
5. A connection device as claimed in claim 4, characterized in that the attachment head (12) has at least one projecting tab (15) intended for being inserted into a respective recess (22) formed in the fitting housing (10) of the stiffening element (8).
6. A connection device as claimed in claim 1, characterized in that the clip (11) comprises an insertion slit (16) for receiving the cable (14) by interference fit.
7. A connection device as claimed in claim 6, characterized in that the insertion slit (16) is formed on a surface (12c) of the attachment head (12) at the inside of the fitting housing (10) under engagement conditions between the clip (11) and the stiffening element (8).
8. A connection device as claimed in claim 6, characterized in that the insertion slit (16) is delimited by at least one tab (18) which is elastically deformable along an insertion direction (19) of the cable (14).
9. A connection device as claimed in claim 1, characterized in that the clip (11) comprises a locking portion (20) to be engaged in an undercut (21) of the attachment surface (6) to establish a mechanical and electrical connection with the apparatus to be power supplied.
10. A connection device as claimed in claim 3, characterized in that the stiffening element (8) has a hollow tubular portion (13) intended for receiving the cable (14), said hollow tubular portion (13) having an insertion opening (13a) external to the cavity (7) defined by the support body (2) and attachment surface (6) and an exit opening (13b) opening into said cavity (7).
11. A connection device as claimed in claim 10, characterized in that, under engagement conditions between the clip and stiffening element, the insertion slit (16) appears at the exit opening (13b) of the hollow tubular portion (13), the insertion direction (19) of the cable (14) being substantially coincident with an axis of the hollow tubular portion (13).
12. A connection device as claimed in claim 10, characterized in that the tubular portion (13) is sealingly coupled with the cable (14).
13. A connection device as claimed in claim 1, characterized in that the stiffening element (8) has a portion (8a) buried in the deformable element (4), said portion (8a) comprising a plurality of through windows (9) to promote gripping of the stiffening element (8) itself on the deformable element (4).

14. A connection device as claimed in claim 1, characterized in that the stiffening element (8) is made of a plastic, preferably thermosetting, material and in that the deformable element (4) is made of a silicone material. 5
15. A method of manufacturing an electrical connection device, in particular for power supplying cathode tubes, preferably as claimed in claim 1, characterized in that it comprises the following steps: 10
- arranging a stiffening element (8);
 - associating a deformable element (4) having at least one bell-shaped portion (5) with the stiffening element (8) to define a support body (12) intended for being associated with an attachment surface (6) of an electrical apparatus to be power supplied; 15
 - associating the electrical connection means (3) with at least the stiffening element (8). 20
16. A method as claimed in claim 15, characterized in that the step of associating the connection means (3) comprises the sub-steps of engaging, preferably by snap fitting, a clip (18) being part of the electrical connection means (3) into the stiffening element (8), and carrying out engagement of a cable (14) with the clip (11) through an insertion slit (16) present thereon. 25
17. A method as claimed in claim 16, characterized in that the two sub-steps of engaging a clip by fitting and engaging a cable with the clip are successive in time. 30
18. A method as claimed in claim 16, characterized in that the step of associating the electrical connection means (3) comprises a further sub-step of inserting the cable (14) into a hollow tubular portion (13) of the stiffening element (8) and the subsequent sub-step of sealingly engaging the hollow tubular portion (13) with the cable (14) by heating. 35
19. A method as claimed in claim 15, characterized in that the step of associating a deformable element (4) with the stiffening element (8) to define the support body (2) is obtained by overmoulding of the deformable element, preferably of silicone material, on the stiffening element, preferably of plastic material. 40
20. A method as claimed in claim 15, characterized in that it further comprises the steps of: 45
- making a blank of the clip (11) by die cutting of a sheet preferably made of metal material, and 50
 - bending said blank according to preestablished folding lines to obtain said clip (11). 55

FIG. 1

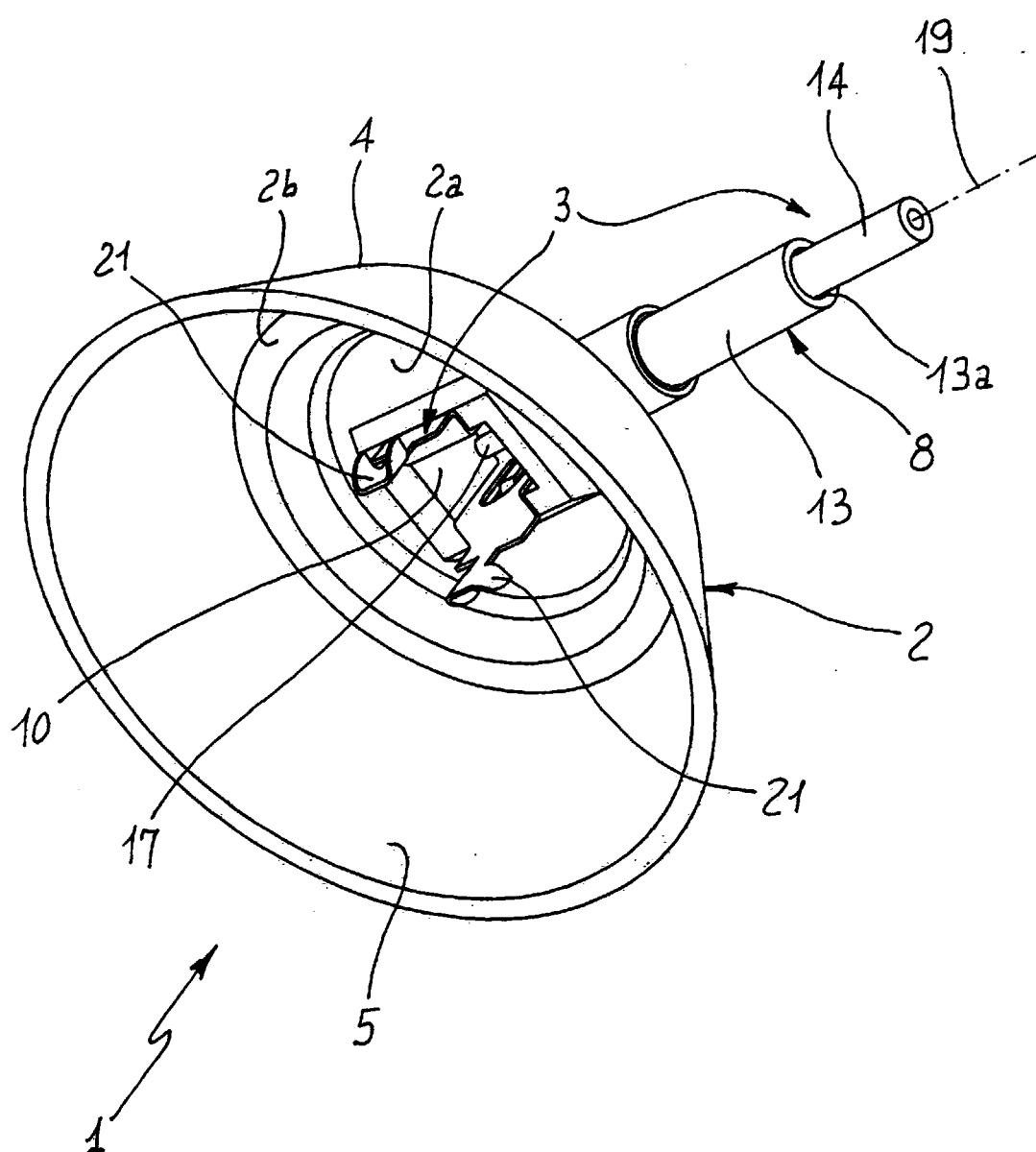


FIG. 5

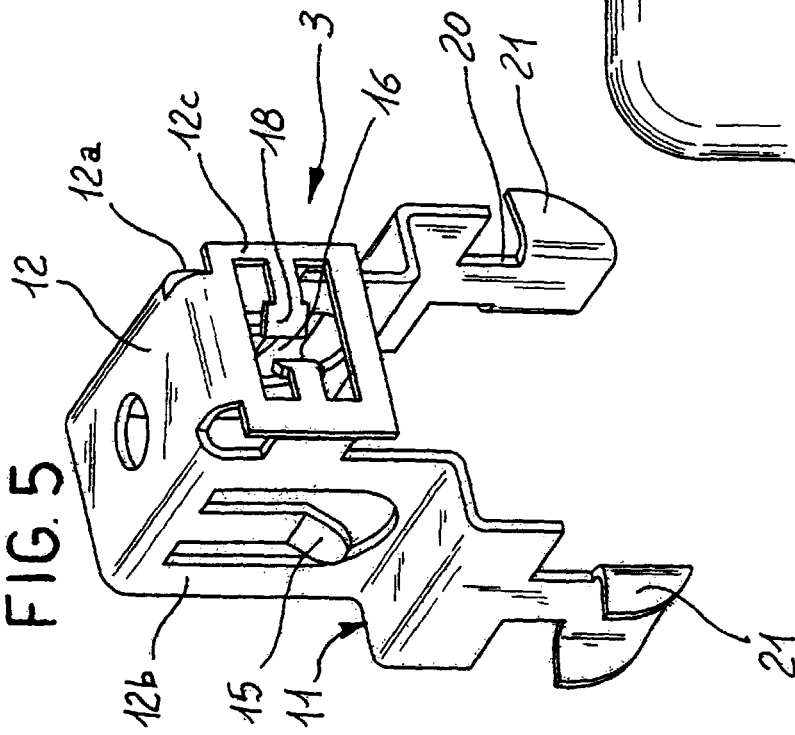
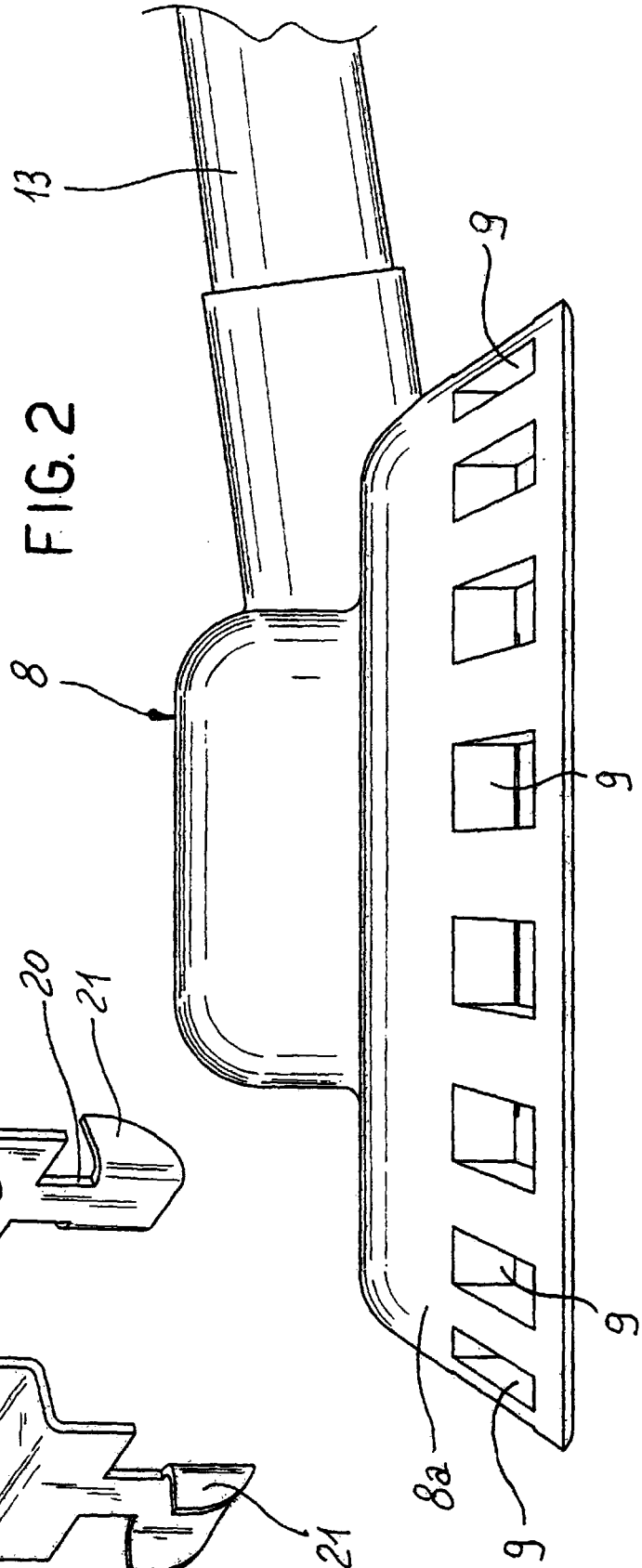
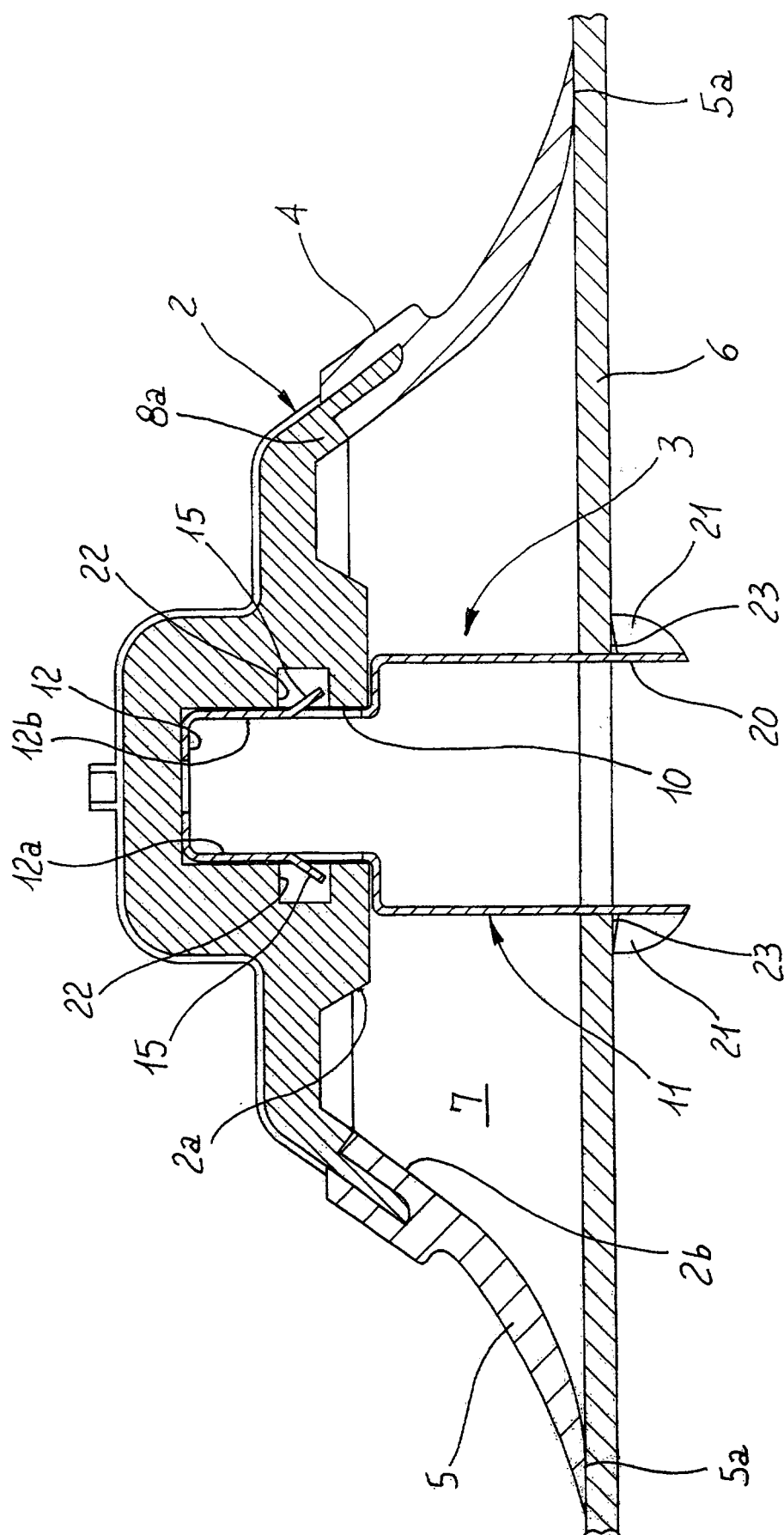


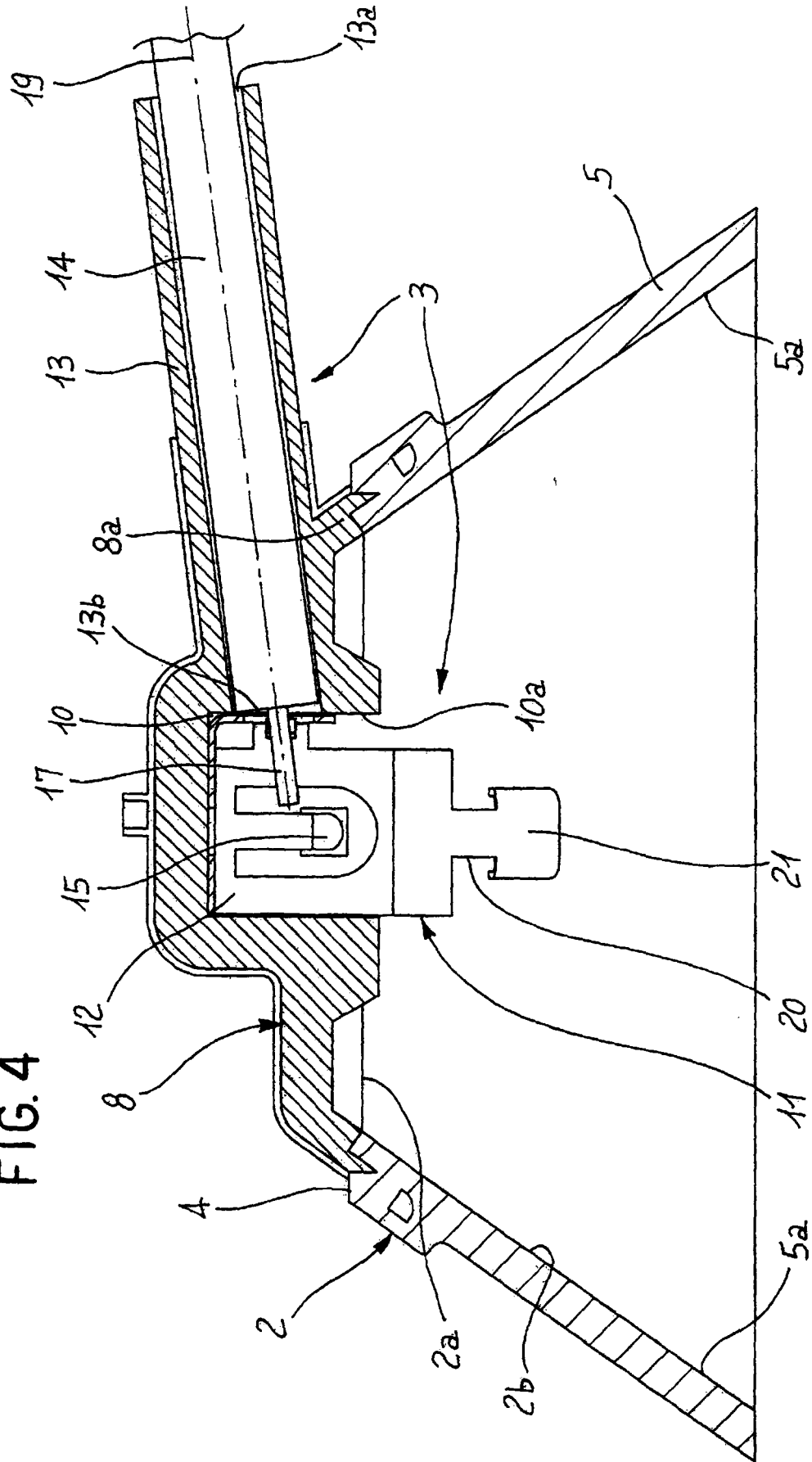
FIG. 2





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FIG. 4





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EUROPEAN SEARCH REPORT

Application Number
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A	W0 87 07087 A (THOLE THOMAS V) 19 November 1987 * page 23, line 11 - line 16 * -----	14, 19	TECHNICAL FIELDS SEARCHED (Int.Cl.6) H01J H01R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 May 1999	Examiner Colvin, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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