(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 153 090**
**A1**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **85300806.8**

(22) Date of filing: **07.02.85**

(51) Int. Cl.⁴: **H 05 B 3/00**

(30) Priority: **21.02.84 GB 8404549**

(43) Date of publication of application: **28.08.85**
***Bulletin 85/35***

(84) Designated Contracting States: **DE FR IT**

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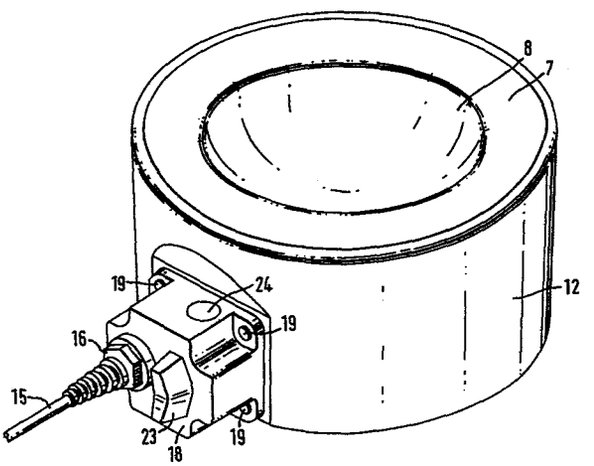
## (54) An electric heating apparatus.

(57) An electrical heating apparatus comprises a pre-formed body (1), made of a thermally insulating material and defining a cavity (2) for receiving a heater (7), which comprises a spirally wound heating element encased in knitted yarn. A coating (12) of plastics material is moulded onto the outside of the body (1), using a vacuum-forming method, thereby retaining the heater (7) in place in the cavity (2). Supply wires are lead from the heater (7) via a conncection box (18) to a cable (15). The connection box (18) has an aperture (24) through which an upright post can be fitted, the heating apparatus being attachable to the post by way of a screw connected to head (23).




EP 0 153 090 A1

AN ELECTRIC HEATING APPARATUS

According to the present invention, there is provided an electric heating apparatus comprising a pre-formed body of thermally insulating material defining a cavity for receiving a vessel whose contents are to be heated, and an electrical heater lining the cavity, there being a coating of plastics material which has been moulded on to the outside of the body.

The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1a) is a cross-section through a pre-formed body;

Figure 1b) is a view in the direction of arrow A in Figure 1a);

Figure 1c) is a view from underneath of the body;

Figure 2a) is a side view of a reinforcing plate;

Figure 2b is a view in the direction of arrow B in Figure 2a);

Figure 3a) is a cross-section through an alternative form of pre-formed body;

Figure 3b) is a view in the direction of arrow D in Figure 3a);

Figure 3c) is a view from above of the alternative form of body;

Figure 4a) is a front view of a junction box of the apparatus;

Figure 4b) is a rear view of the box;

Figure 4c) is a section on C-C in Figure 4b);

Figure 5 is a perspective view of the apparatus;

Figure 6 is a view from above of the apparatus;

Figure 7 is a side view of the apparatus;

Figure 8 is a cross-section along line E-E of Figure 6;

Figure 9 is an end view of the apparatus;

Figure 10 is a cross-section taken through an alternative embodiment of the present invention, which incorporates an earth screen;

Figures 11a) to 11c) are a partial side view, end view and cross-section of a further embodiment of the present invention, being provided with the earth screen and having a plug;

Figure 11d) is a part view with sleeve removed showing wire attached to terminal before soldering;

Figure 12 is a wiring diagram for another embodiment of the present invention, similar to that shown in Figure 10 but being provided with two heating elements; and

Figure 13 is a wiring diagram for yet another embodiment of the present invention, having no earth screen, but having two heating elements and a plug.

There will now be described a method of assembly of an example of an electric heating apparatus according to the present invention. First, there is provided a moulded, pre-formed body 1 of thermally insulating material, more particularly a pre-formed body made by moulding amorphous alumino silicate ceramic fibres. With particular reference to Figures 1a), 1b) and 1c), the body 1 has a hemispherical cavity 2 whose radius depends on the size of vessel to be heated by the apparatus - for example the radius could be in the range from about 30 to about 120 mm for heating laboratory flasks. The body 1 is formed with a cavity 4 and two passageways 5 and 6 between the cavity 2 and

the cavity 4.

Figures 3a), 3b) and 3c) show an alternative configuration for the body 1, items which correspond with items in Figures 1a), 1b) and 1c) having been given the same reference numbers as in these figures.

A bowl-shaped heater 7 (Figures 5 and 8) comprising a conventional spirally wound heating element encased in a knitted yarn (that is yarn which has been woven then overlocked) is received in the cavity 2 as a lining thereof, the yarn having an outwardly extending annular portion 8 which receives a reinforcing ring 9. As shown in Figure 8, the supply wires 25, 26 of the heating element of the heater 7 are inserted through respective ones of passageways 5 and 6 and tucked into cavity 4. Then a generally L-shaped reinforcing plate 10 (see Figures 2a) and 2b)) is placed on to the flat surface 11 around cavity 4 and a polypropylene coating 12 is moulded by vacuum-forming over the bottom, sides and at least part of the top of the body 1. The coating 12 may be, for example, PVC or any other suitable plastics material and serves to retain the heater 7, and give protection and reinforcement to the body 1, which is somewhat friable in nature . The result is a simple method of retaining a heater in the cavity of a body of thermally insulating material and at the same time giving protection and reinforcement to the latter. As an alternative, the vacuum-forming may be done, without the heater present, to coat the body 1, the heater then being glued into the cavity 2 using a glue such as sodium silicate or hot melt· adhesive.

The coating material is cleared from the large hole 13 and the small holes 14 in the plate 10 and the supply wires 25, 26 for the heating element are pulled through the hole 13.

Then, the supply wires of the heating element are connected to a supply cable 15 via a cable clamp 16

received in an opening 17 of a box 18 of plastics material (see Figures 4a), 4b), 4c) and 5) and the box 18 is secured to the coated body 1 by way of pop-rivets 19 passing through holes 20 in the box 18 and respective ones of the holes 14 in the plate 10. The pop rivets are sunk below the surface of the box 18. The box 18 is also provided with an inner recess 21 into which is received a nut for securing the box 18, there passing through the box 18 via an opening 22 and the nut a screw-threaded bolt which on the outside carries a knob 23 - see Figures 5 and 9. In a preferred embodiment, as an alternative to the bolt, the plastics material of the box 18 may be tapped direct. As shown in Figures 5 and 6, a vertical through-hole 24 is provided on the box 18, and this may be used to receive an upright post slid through it and against which the box 18 may be clamped by screwing in the bolt via the knob 23 in a position in which the apparatus is level. In this way the heater may be secured using a standard laboratory clamp at any convenient height above a work bench. Alternatively, the upright post may be used as an additional support for the apparatus.

If desired, feet 27 may be fixed to the underside of the body 1 after the coating material has been applied or, before coating, suitable members may be attached to the underside of the body for example by pinning, whereupon feet will be provided by the material coated over these members. The latter technique may also be used to provide shorter, anti-topple projections 28 between feet applied after coating. .Such a pin 29 is shown in Figure 8.

Incidentally, as will be appreciated from Figure 1c), the passageways 5 and 6 are offset, both of them being shown in Figure 1a) to show the directions in which they run.

The embodiment of the present invention which has

been described with reference to Figures 1 to 9 has two supply wires 25, 26: live and neutral. There is shown in Figure 10 an embodiment of the present invention similar to that which has been described, but incorporating an earth screen 30, which comprises a bowl shaped expanded metal component which sits inside the heater 7. This enables an earth wire 31 to be provided in addition to the wires 25, 26. The wires 25, 26 and 31 are connected to conventionally marked wires at connectors 32, 33 and 34 respectively, the conventionally marked wires being passed through cables 15. The earth screen 30 is held in place by an overturned annular portion of the knitted yarn of the heater 7, and the "lip" of the vacuum-formed coating.

A further embodiment of the present invention is shown in Figures 11a to 11d in which, in place of the cable clamp 16 and cable 15, a conventional plug 35 is provided. The plug has a casing 36 which is attached to the box 18 by means of screws 37. Each of the wires 25, 26 and 31 are connected to a respective terminal 38, 39, 40 as shown in Figure 11d. While the embodiment shown in Figures 11a to 11d is provided with the earth screen 30, it will be appreciated that the earth screen 30 and corresponding earth wire 31 may be omitted, in which case a two terminal plug will be provided.

In the embodiments described above, the heater 7 has a single heating element, or a plurality of heating elements connected in series. However, for the large heaters which are to carry high voltage, this series arrangement is not necessary. In these cases, the arrangement shown in Figure 12 (where the earth screen 30 is present, and which is provided with the cable 15) or Figure 13 (where there is no earth screen, and a two terminal plug is provided) may be adopted. According to this arrangement two heating

elements 7' and 7'' are connected in parallel and can b controlled so that one only of or both the elements may be connected to the power supply according to the volume of the contents in the vessel to be heated.

The bracket 10 (shown in Figure 2a) can be provided with a piece of "Kapton" tape to give additional insulation to avoid the possibility of a circuit through the pop rivets 19 should a live wire touch the bracket 10.

CLAIMS

1. An electric heating apparatus comprising a pre-formed body of thermally insulating material defining a cavity for receiving a vessel whose contents are to be heated, and an electrical heater lining the cavity, there being a coating of plastics material which has been moulded onto the outside of the body.

2. An electric heating apparatus as claimed in claim 1, in which the heater comprises a spirally wound heating element encased in a yarn.

3. An electrical heating apparatus as claimed in claim 1, in which the heater comprises first and second spirally wound heating elements encased in a yarn, the first and second heating elements being connected in parallel.

4. An electrical heating apparatus as claimed in any preceding claim, further comprising an electrically conductive screen lining the cavity, to provide an earth connection.

5. An electrical heating apparatus as claimed in any preceding claim, which is provided with a mounting means comprising a housing fixed to the pre-formed body and having an aperture therethrough and means for securing the housing with respect to the upright.

FIG.1a.

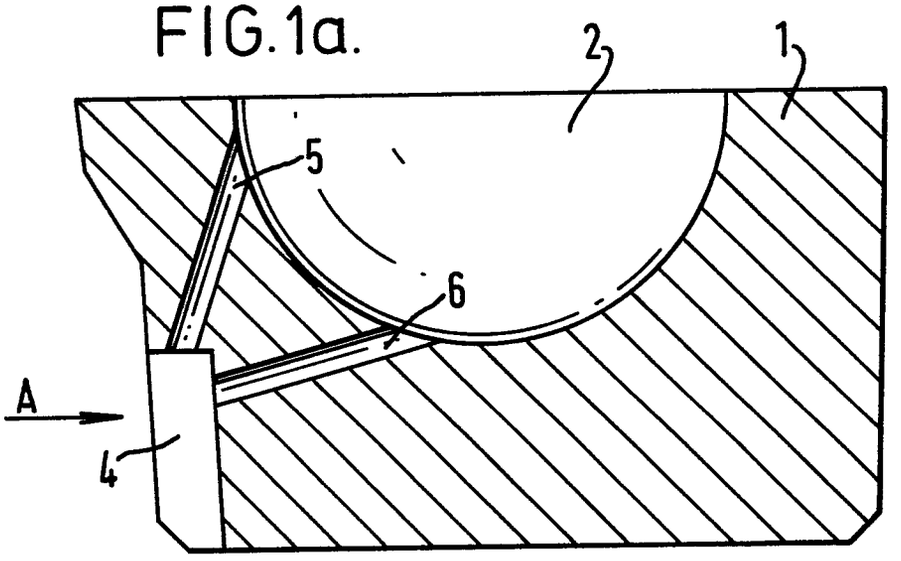



FIG.1b.

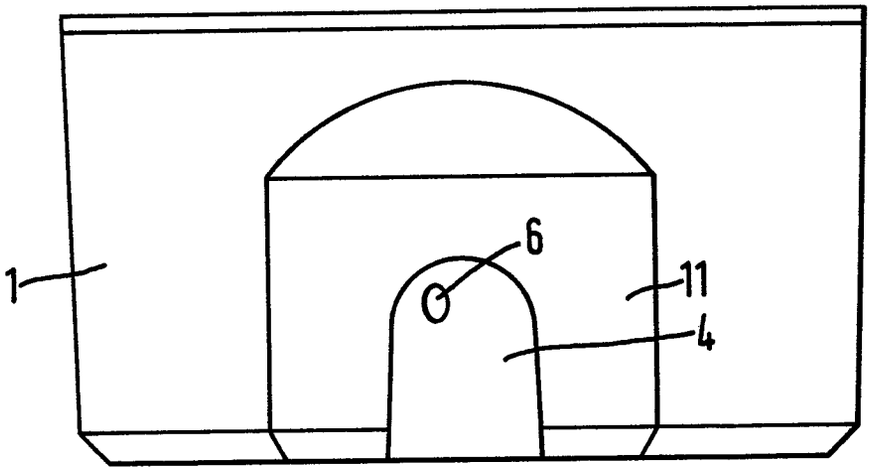


FIG.1c.

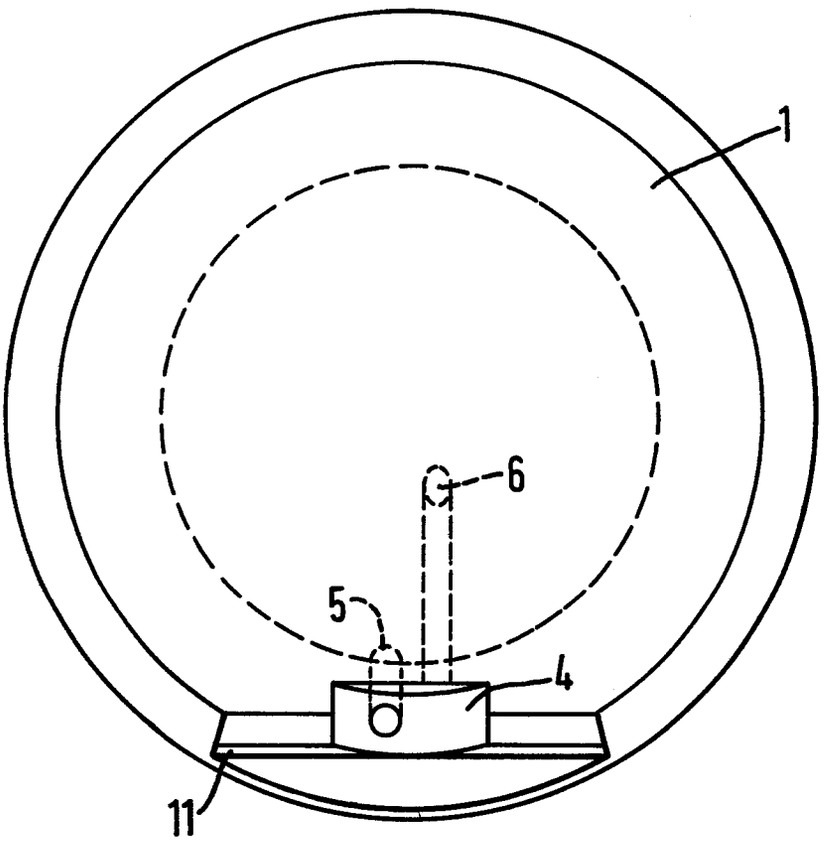



FIG. 2a.

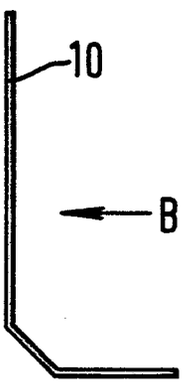



FIG.2b.

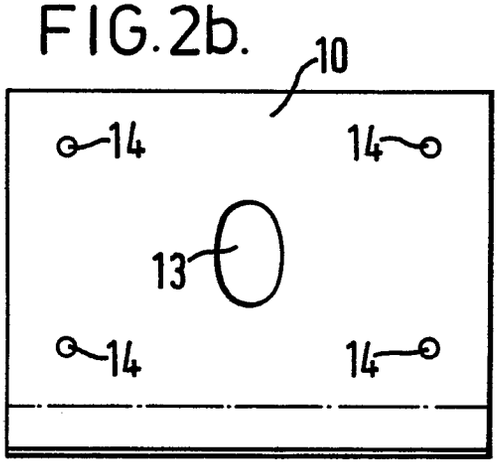


FIG.3a.

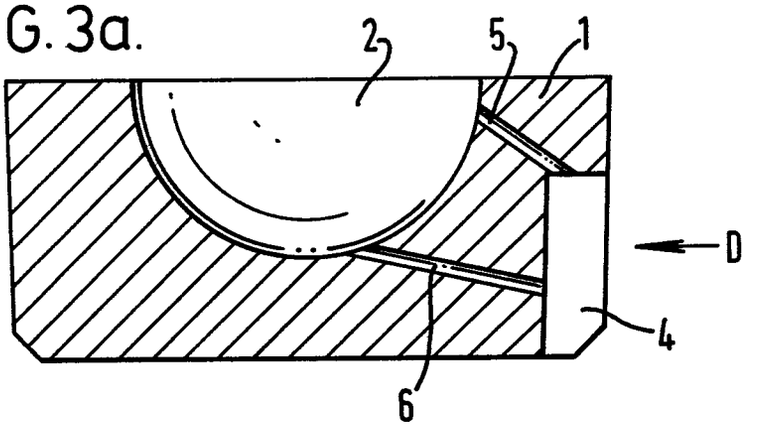



FIG.3b.

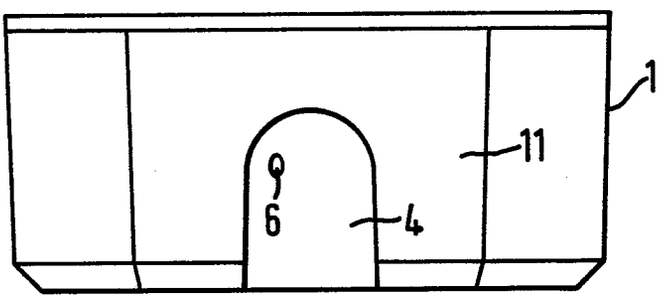



FIG.3c.

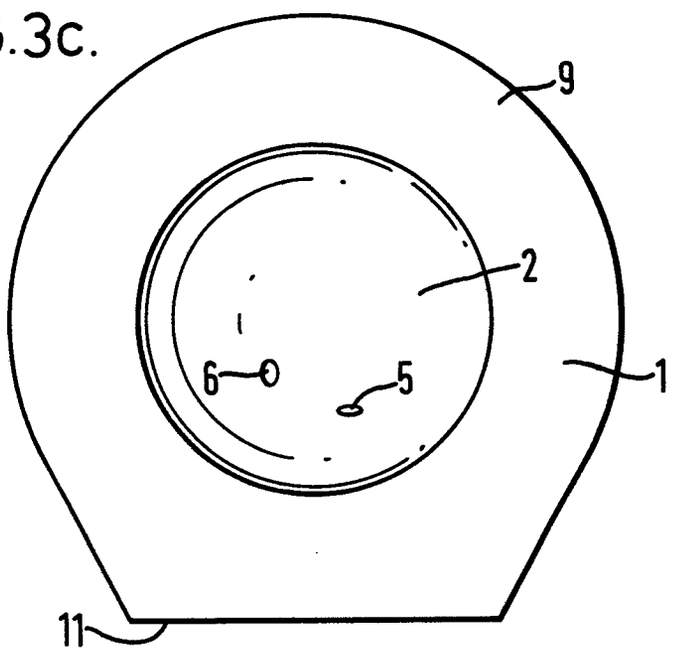


FIG. 4a.

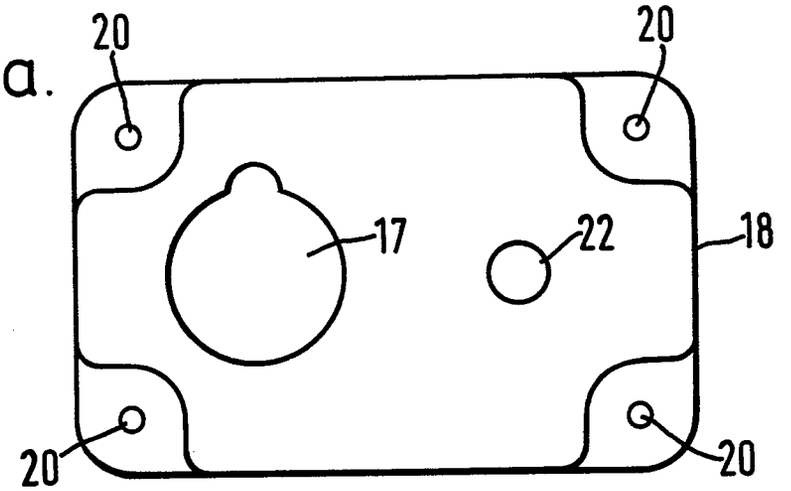



FIG. 4b.

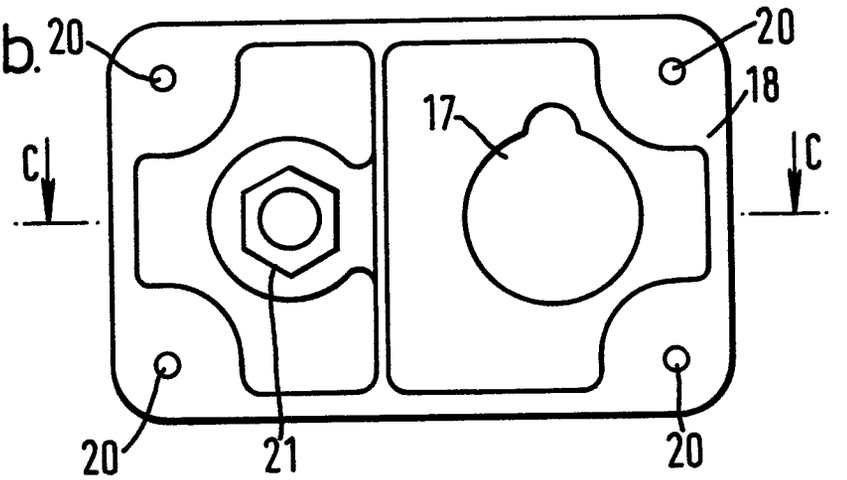
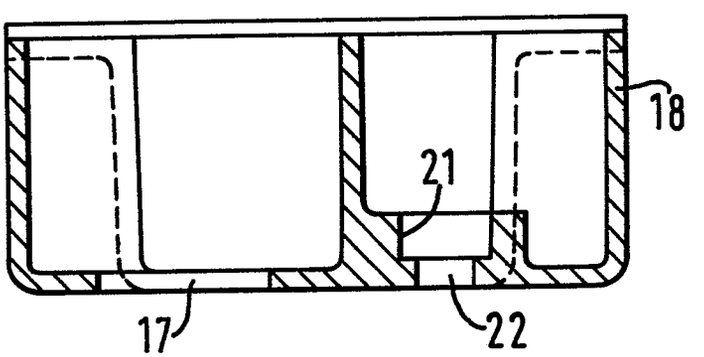



FIG. 4c



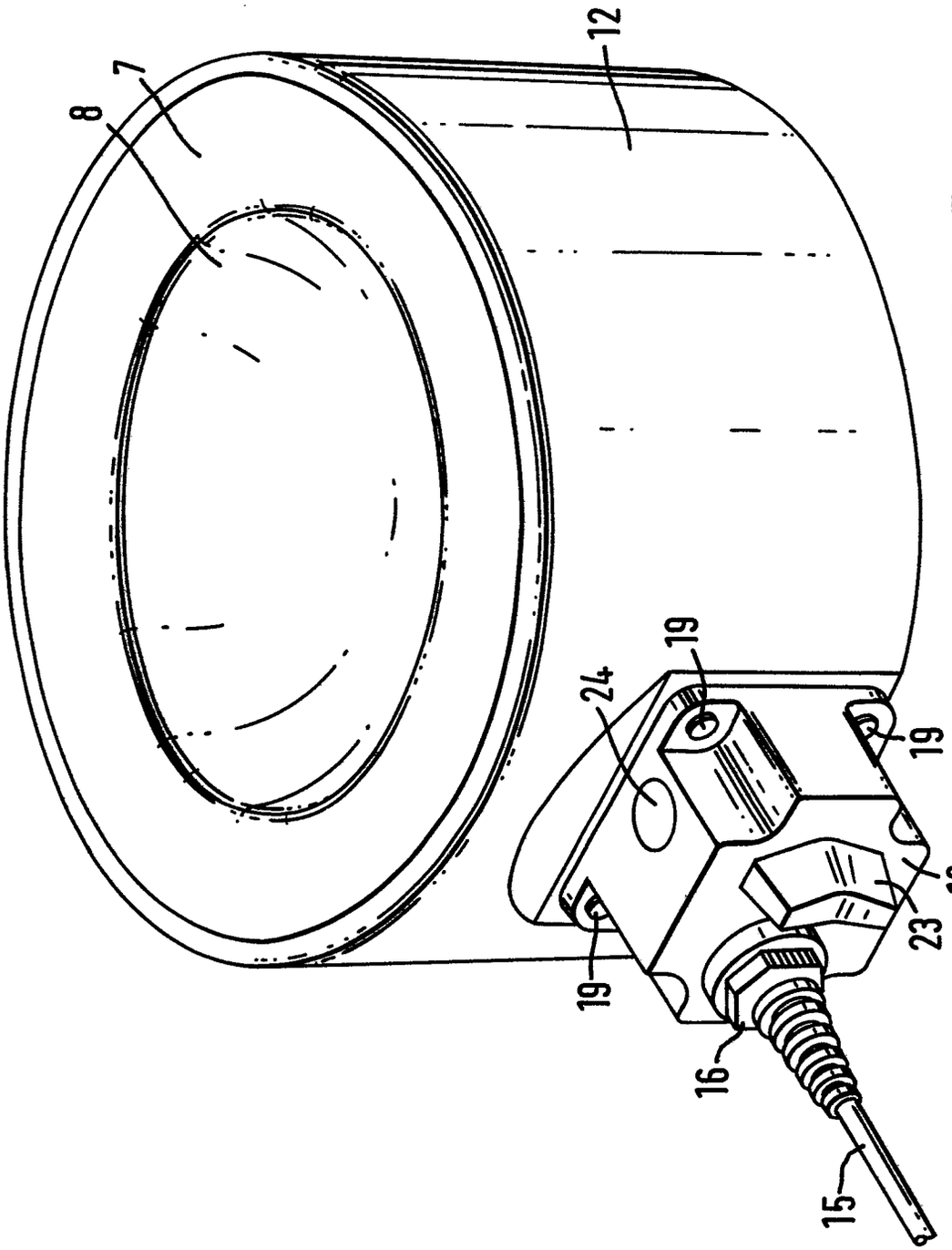



FIG.5

FIG. 6.

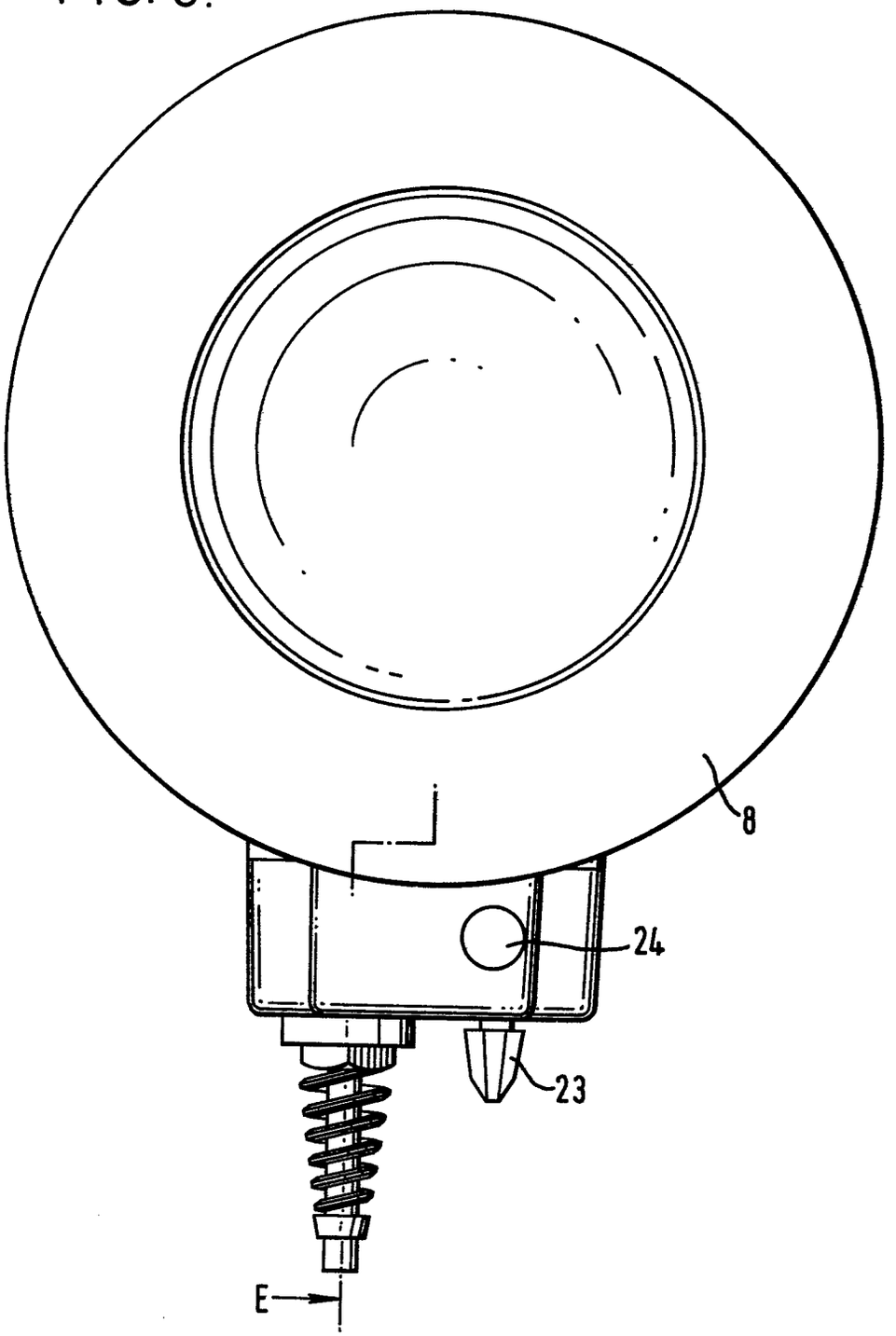
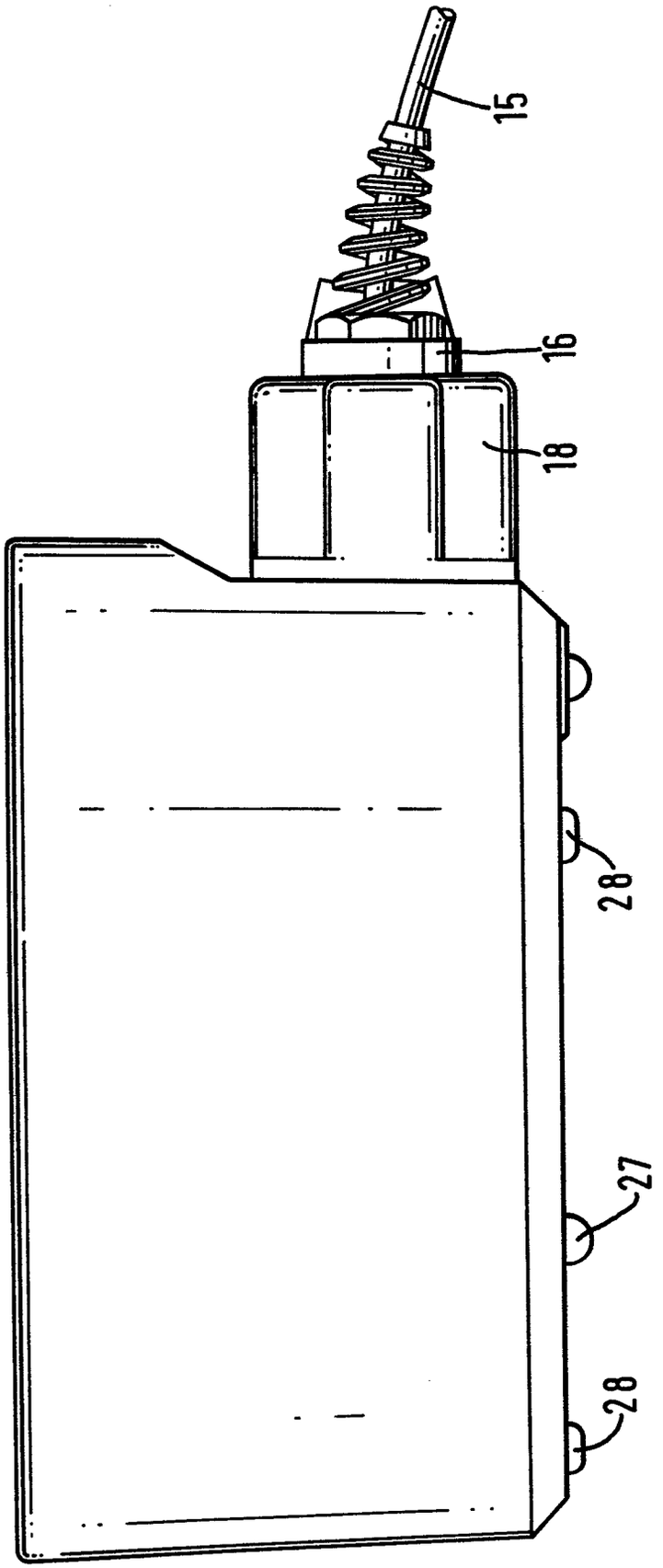


FIG. 7.



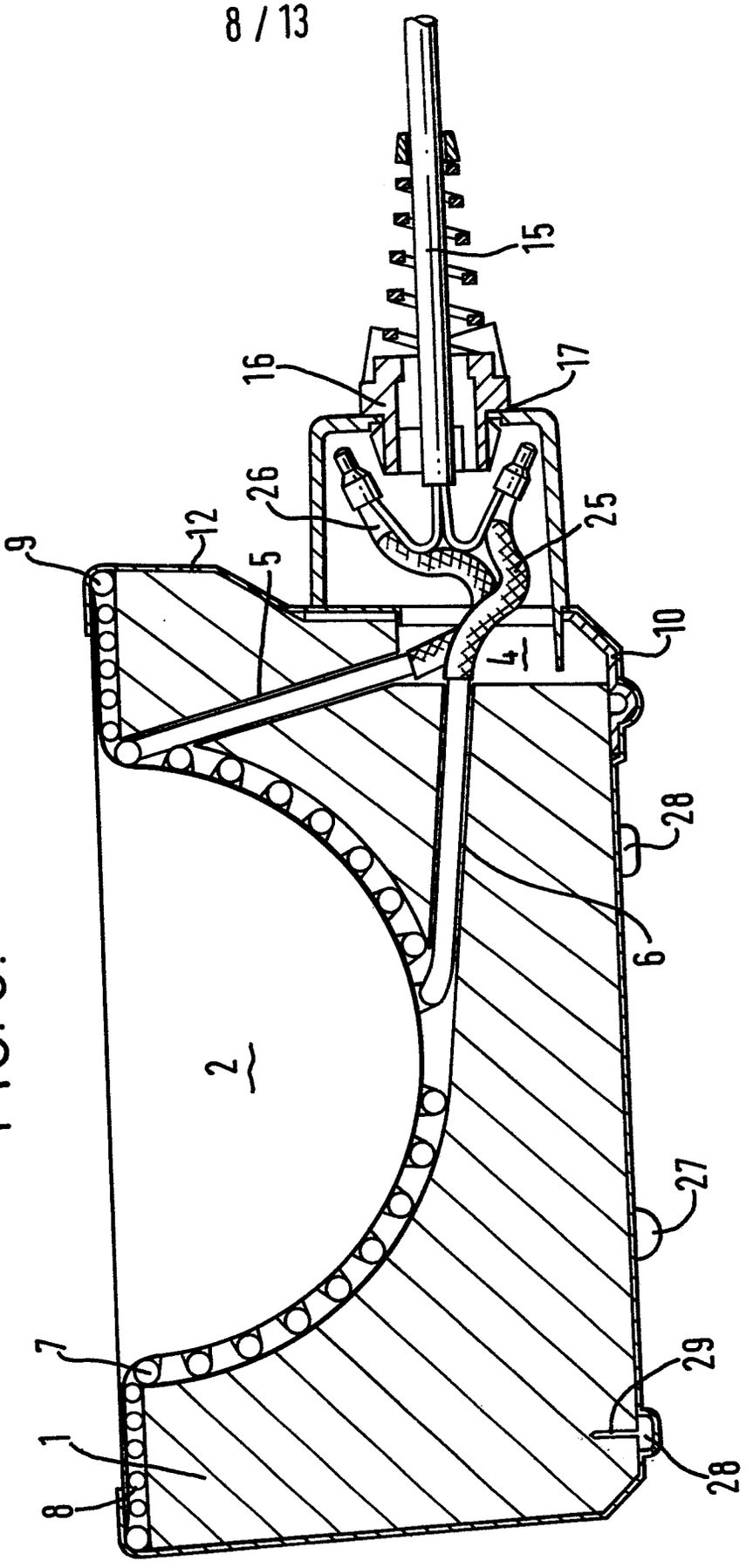



FIG. 8.

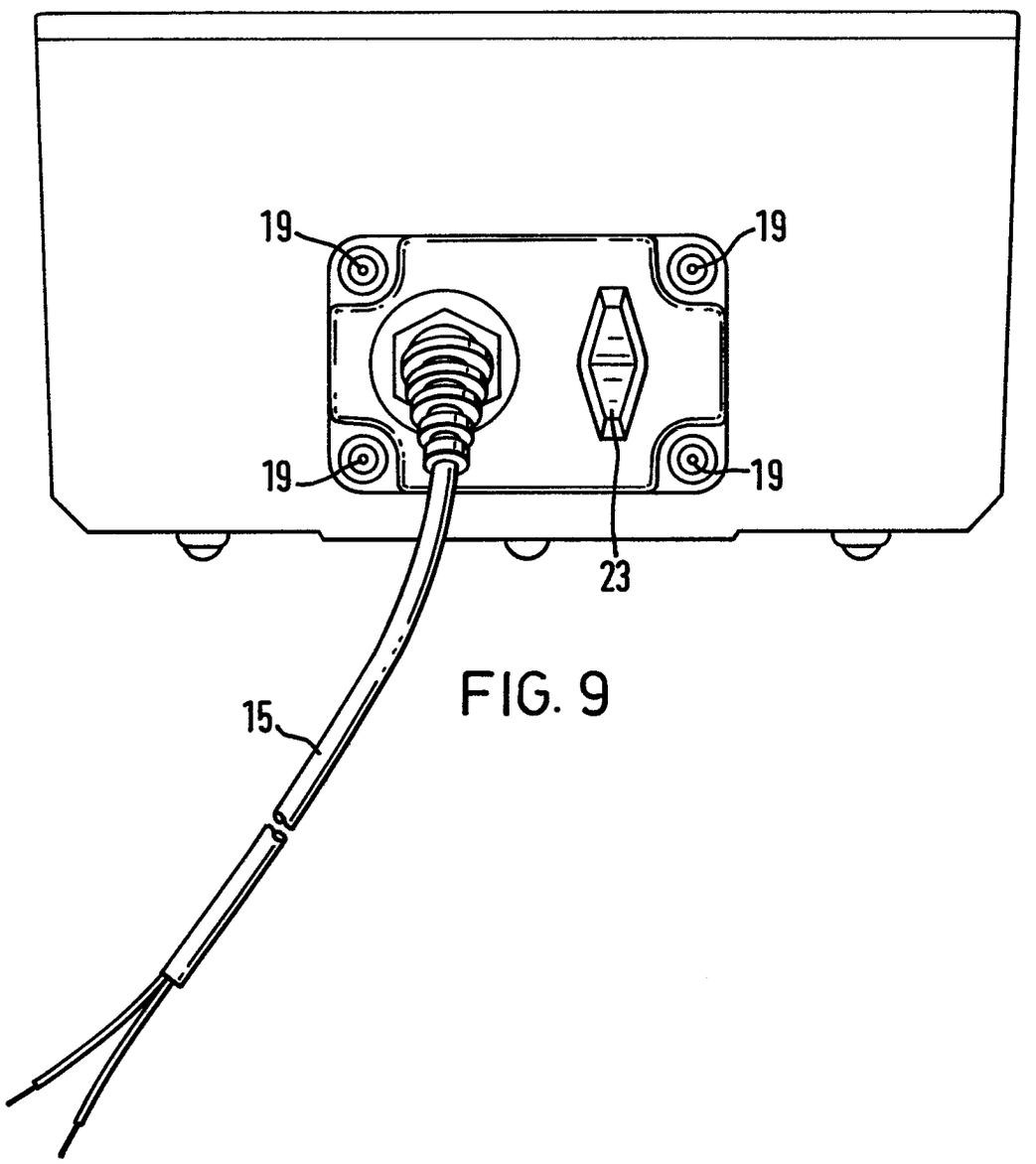



FIG. 9

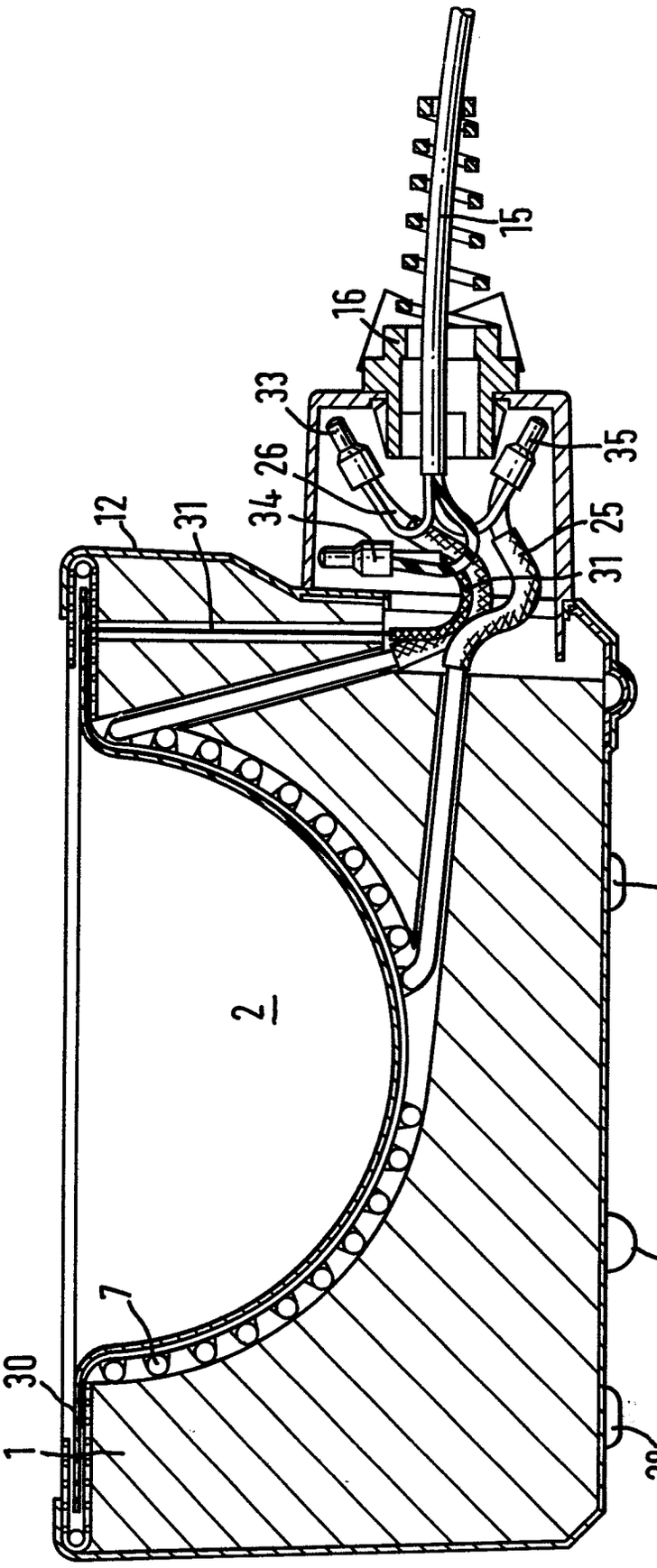



FIG.10

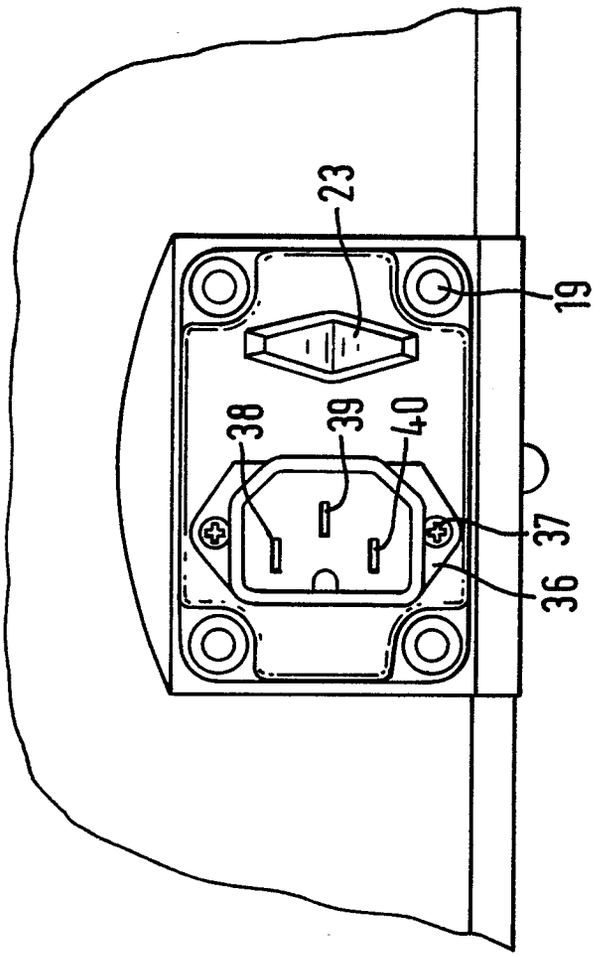



FIG. 11b

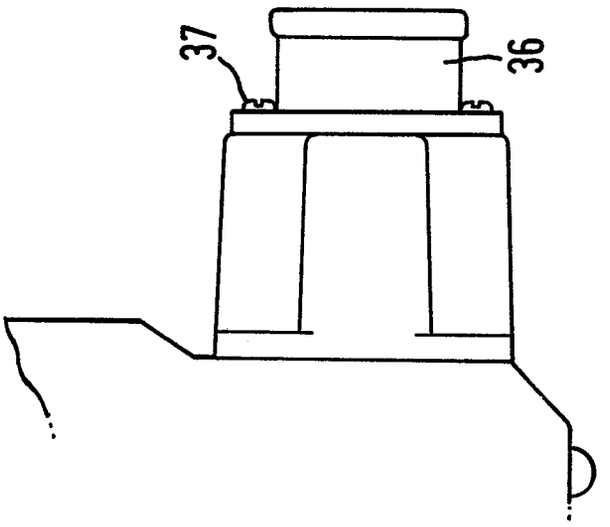



FIG. 11a

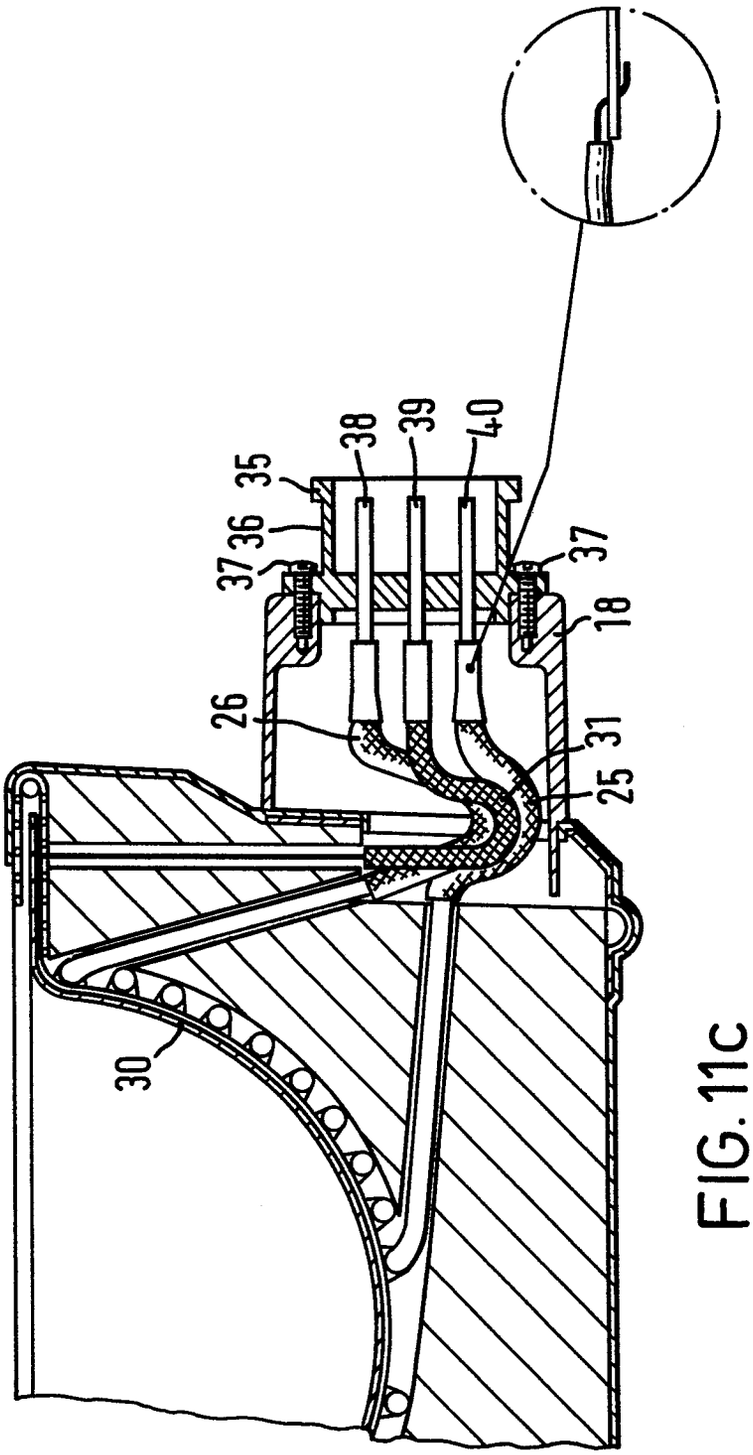



FIG.11d

FIG.11c

FIG. 12.

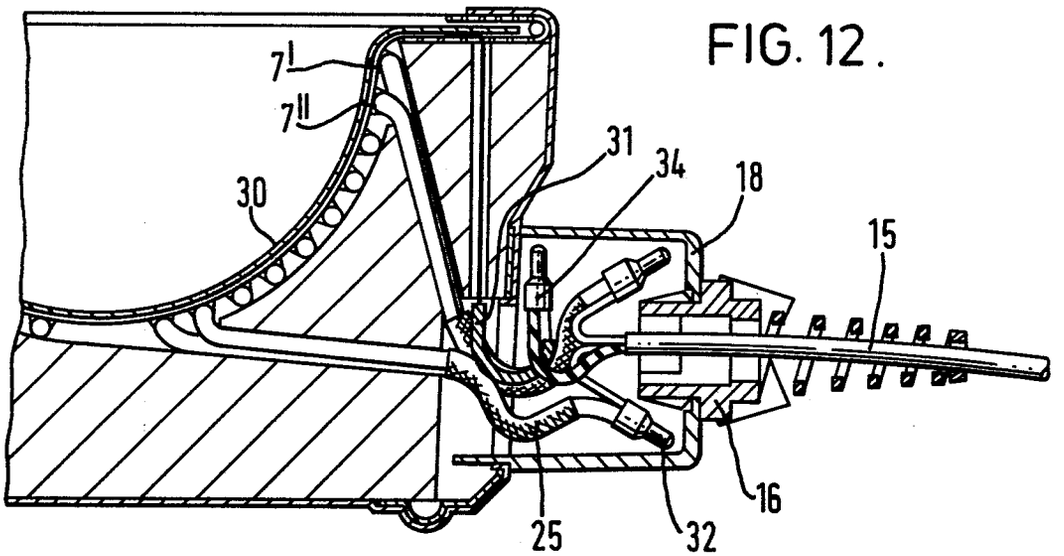
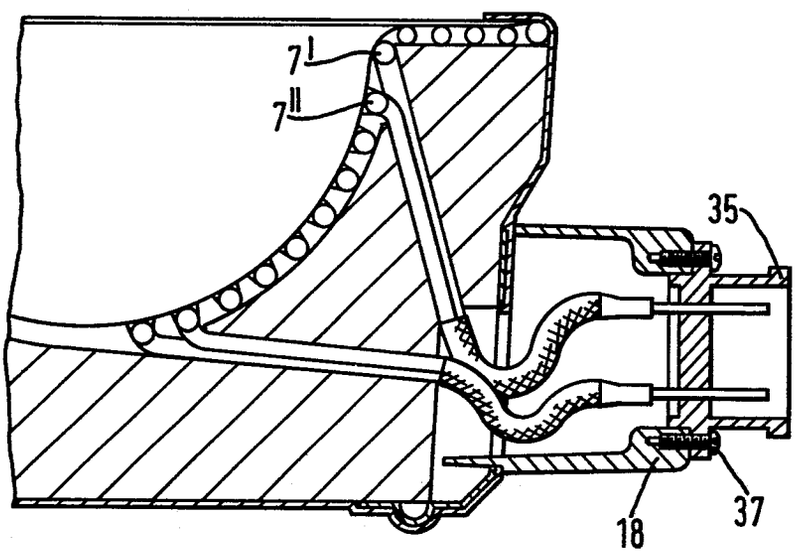



FIG. 13.



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# EUROPEAN SEARCH REPORT

0153090
Application number

EP 85 30 0806

## 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.4) |
|---|---|---|---|
| A | DE-A-2 445 889 (HERAEUS WITTMANN GmbH) * Page 1, lines 1-5; page 3, lines 26-29; page 4; page 5, lines 1-6; page 6, lines 19-23; figure 1 * | 1-3,5 | H 05 B 3/00 |
| A | EP-A-0 091 217 (ELECTROTHERMAL ENGINEERING) * Page 1, lines 1-3, 17-23; page 2, lines 23-37; page 3, lines 1-20; figure 1 * | 1,4,5 | |
| A | DE-A-3 006 679 (WITEG-GLASGERÄTE HELMUT ANTLINGER KG) * Page 4, lines 1-11; page 10, lines 18-20; page 11; page 12, lines 1-5; figure 1 * | 1,2,5 | TECHNICAL FIELDS SEARCHED (Int. Cl.4) |
| A | US-A-2 419 848 (GLEN H. MOREY) * Column 1, lines 1-10, 43-55; column 2, lines 1-25, 53-55; column 4, lines 2-35; column 5, lines 10-18; figure 2 * | 1,5 | H 05 B 3/00<br>B 01 L 7/00 |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 10-05-1985 | PIERRON P.A. |

CATEGORY OF CITED DOCUMENTS

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