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(54) **Hand-held electrical appliances.**

(57) A Hand-Held Electrical Appliance, specifically an electrical hair dryer has a housing, insulated power supply conductors, heating element, motor and fan, switches and controls, and the necessary internal wiring and thermal and electrical insulation. The appliance has switch means which is sealed against water entry and has an actuator requiring continuous manual pressure to hold the switch in closed position. When the pressure is released, for example if the appliance is dropped, the switch means is open thereby avoiding risk of electric shock if for example the appliance, when connected to the supply, is immersed in water.

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HAND-HELD ELECTRICAL APPLIANCES

The present invention relates to hand-held electric appliances, for example electric hair dryers. In particular the invention relates to a hand-held electrical appliance (called "of the kind described") including a supply side for connection to electric mains, operating means including electrical conductors accessible to ambient atmosphere in normal working of the appliance, and a manually operated switch means to connect the supply side to the operating means.

The basic elements of a hand-held electric hair dryer consists of a housing, insulated power supply conductors, heating element, motor and fan, automatically reset thermal limiters, switches and controls, and the necessary internal wiring and thermal and electrical insulation.

Usual types of hand-held hair dryers include styler, roller brush, pistol. In addition, some hand-held hair dryers are designed to include a dual voltage switch for travelling use.

There is a risk of electric shock and electrocution if a plugged-in hair dryer is immersed in water, even if the appliance is switched off. The

present invention has for its object a hand-held appliance of the kind described which provides improved electrical safety in this regard.

With this object in view the invention provides an appliance of the kind described wherein the manually operated switch means is sealed on the supply side so that no mains-energized conductor is accessible to ambient air, and the switch means has means requiring continuous manual pressure to hold the switch in closed position whereby release of manual pressure opens the switch means and thereby immediately disconnects electric power from the supply side to the operating means. As a result release of manual pressure, for example if the appliance is dropped, opens the switch means. Immersion of the appliance in water then gives rise to no danger since the only part of the appliance connected to the supply is sealed against access by water.

The invention further includes an actuator requiring continuous pressure in one direction to hold the switch means closed and being movable in a direction at right angles to control different appliance functions. The actuator is preferably a one-piece plastics member which by reason of its construction incorporates spring action to prevent actuation of the switch means in the absence of manual pressure.

Other features of the invention will be apparent from the following description of one preferred embodiment of the invention given by way of example with reference to the accompanying drawings.

Figure 1 is a side elevation of a hand-held hair dryer incorporating the invention;

Figure 2 is a section of the hair dryer taken on a central plane; Figure 3 is a partial sectional view corresponding to that Figure 2 but showing parts in different positions;

Figure 4 is a transverse sectional view of the handle taken on the section line z-z in Figure 3;

Figure 5 is an elevation of an actuator forming part of the hair dryer;

Figure 6 is a section of the actuator taken on the line a-a in Figure 5;

Figure 7 is a transverse section of the actuator on the line b-b in Figure 5;

Figure 8 is a partial sectional view of a second form of hair dryer;

Figure 9 is a partial sectional view of a third form of hair dryer;

Figure 10 is a section of the Figure 9 hair dryer on the line X-X in Figure 9; and

Figure 11 is a swap elevation of the switch and adjacent casing in the Figure 9 hair dryer.

Referring to the drawings, the hair dryer shown comprises a housing indicated generally by the reference numeral 10 (Figure 1) which is formed in two parts, 11, 12, meeting on the line 13 and secured together by screws not shown. The housing is made of plastics material and comprises a body 15 with the handle 16. The body is apertured at one end to provide inlet openings 18 and has an outlet 19 at the other end. The inlet openings and outlet are protected by grilles 20, 21. The handle 16 contains a main switch 24 (to be described), the actuator 25 for which projects through a slot 26 in the housing portion 12 for manual actuation. Electrical power is supplied to the switch through a cord 27 which enters the end 28 of the handle 16 through a resilient bushing member 29.

The main switch designated generally 24 consists of two momentary switches, or micro-switches 35, held side by side, each connected to one of the mains conductors of the cord 27, the pair thus providing a double pole switch. Each switch 35 has a projecting push button 36 and a resilient arm 37 which overlies it. Pressure on the arm depresses the push button to close the switch. The resilient arms of the two switches 35

are connected for movement together by a plastics strip 38 so that the switches make and break simultaneously.

The two switches 35, with actuating arms 37 and push buttons 36 are contained within an enclosure designated generally 40 which is totally sealed against water penetration. The enclosure comprises a main body member 42 of generally cylindrical form but with an opening 43 through which the push buttons and arms can project. The body member 42 may be of polycarbonate. The switches 35 are secured within this body member 42 with the aid of spacer members 44a and 44b (Figure 4) and have input tabs 45 soldered to the mains conductors 46 and output tabs 47 soldered to output conductors 48. The body member 42 has at one end a deep flange 50 providing a recess receiving a resilient end seal member 51 e.g. of silicone rubber through which the leads 48 pass. This seal member 51 is compressed by an end cap 52 which is screwed on to the flange 50 with the aid of mating threads 53.

The body member 42 provides a shoulder 55 about the flange 50. One end 56 of a resilient sealing sleeve 57 e.g. of silicone rubber or neoprene is stretched over the shoulder 55 in contact with the flange 50, the end cap 52, when screwed down upon the end seal 51 also compresses the end 56 of the sealing

sleeve against the shoulder 55 on the body member 42, thereby effecting a seal at this area.

The other end 60 of body member 42 is cylindrical and the corresponding end 62 of the sealing sleeve 57 is stretched around it. A retainer cap 63 has an external flange 64 and this is screwed on to the body member 42 with the aid of threads 65 so that the flange 64 compresses the end 62 of the sealing sleeve on to the end of the body member 42 to effect a seal over this area. The spacer members 44a, 44b are retained between the inner end of the cap 63 and the inner end wall of the body member 42. The retainer cap 63 has also a longitudinal flange 68 at its end forming a recess 69 receiving an end seal member 71 through which the cord 27 passes to the interior of the enclosure. An end cap 72 is screwed down on to the flanges 68 with the aid of threads 73 to compress the seal member 71 about the cord 27. A silicone sealant is used on each of the end seal members 51, 71, as an additional sealing precaution. The sealant is used around the cord 27 where it passes through the seal member 71, and around leads 48 where they pass through seal member 51. Sealant is also placed in the openings of end caps 52, 72 around the respective leads as shown at 74, 75.

It will be appreciated that because of the end seals 51 and 71, and the sealing sleeve 57 the switches

35 are completely sealed against the ingress of water. The enclosure 40 is located in the handle 16 by means of internal projections 80 and others not shown, when the parts 11, 12 of the housing are secured together.

The leads 48 are connected to a further switching arrangement designated generally 90 providing connections to a motor 91 (not shown in detail but of commutator type) driving fan 92, and the heater 93. The switching arrangement 90 provides in known manner three different motor speed and heat combinations.

The switch actuator 25 (shown in detail in Figures 5, 6 and 7) is a one-piece plastics moulding, for example of polycarbonate. The actuator has a generally semi-cylindrical main body 100 and a lever portion 101 which when unstressed fairs with the semi-cylindrical shape but is connected to the main body only by means of neck 102. The lever portion 101 is separated from the main body 100, apart from the neck 102, by a slit 103 extending around its periphery. The lever portion includes a serrated raised grip area 104, and markings 0, 1, 2, 3 are shown at 105. The main body 100 has an extension 107 at one end, and rigidifying flanges 108. The lever portion has on its underside an actuator flange 109 rigidified by webs 109a and an open box 110, for the purposes to be described.

Returning to Figures 2, 3 and 4 of the drawings, it will be seen that in the Figure 2 position of the switch actuator 25 the raised grip portion 104 is at the lower end of the slot 26 in the housing portion 12 with the body 100 of the actuator within this housing portion. The lower edges 112 of main body 100 of the actuator 25 contact guides 114 formed as projections on the inside of housing member 11. The actuator body 100 is an easy fit within the housing portion 12, and the raised grip portion 104 is an easy fit within the slot 26. The switch actuator 25 is thus trapped for movement longitudinally of the slot by manual manipulation of the grip area 104. The actuator flange 109 contacts the sealing sleeve 57, but since it is out of register with the spring arms 37 of the switches 35, depression of the lever portion 101 could have no effect on the switches. Also the webs 109a prevent any substantial inward movement of the lever portion 101. This is the "off" position of the switch and corresponds to the mark 0 on the markings 105.

It will be seen that the box 110 on the actuator encloses a slider 116 controlling the switching arrangement 90. The movement of the actuator along its length causes a corresponding movement of slider 116.

Figure 3 shows the actuator in a position corresponding to mark 3 of the markings 105. It will be

seen that the actuator flange 109 is now able to move the switch arms 37, by pressure applied through the sealing sleeve 57. As the actuator 25 is shown in Figures 3 and 4, the lever portion 101 is pressed inwards of the main body 100 against the restoring force due to the resilient neck 102, so that the switch arms 37 depress the push buttons 36 and bring the switches 35 to the closed position.

If the lever portion 101 of the actuator 25 is released, it will spring outwardly due to the resilient neck 102 and release the switch arms 37 thereby opening the switches 35. The only part of the hair dryer which remains live is the conductors 46 of the cord 27 and the input side of switches 35. However, these conductors and switches are completely sealed so that no danger arises from the immersion of the hair dryer.

The arrangement described is believed to comply with the requirements of safety specification of UL 859 for U.S., or CSA standard C22.2 No. 36 1979 for Canada, or, for the U.K., BS3456; Part 3; Section 3.13 1979.

Various modifications may be made in the apparatus described within the scope of the invention for example by replacing the two single pole single throw switches 35 by a double pole single throw switch.

The invention described will be applicable to a hair dryer of any type. It will also be applicable to other appliances where similar requirements arise, such for example as a hand-held stab mixer, i.e. a mixer for food or liquid to be inserted and held by hand in a mixing bowl.

The invention includes also a hand-held appliance where the main switch is actuated separately from other switching, as shown in the second form of hair dryer, illustrated in Figure 8. Parts similar to those of the first hair dryer are given the same reference numbers and will need no further description.

The switch actuator 25 in the Figure 8 hair dryer is arranged for longitudal movement in a slot 26, but is situated on the forward side of the handle 16. The switch actuator 25 does not control secondary switching, only the micro-switches 35 which form the on-off switch for the whole appliance.

Heater control is effected by a separate rocker switch 200 in the rear of the handle 16, supplied from the micro-switches through output lead 48.

A further constructional difference, as compared with the first hair dryer lies in way in which the sealing sleeve 57 is secured at the end of the enclosure 40 where the cord 27 enters. The body member 42 has an external longitudinal flange 202 forming a

recess 204 in which the end seal member 71 is received. An end cap 206 has a radial flange 208 and screws down on the flange 202 so as both to clamp the end of the sealing sleeve 57 against the end of the body 42 and to compress the end seal member 71 around the cord 27.

In the third form of hair dryer, illustrated in Figures 9, 10 and 11, once again parts similar to those previously described are given the same reference numbers and will need no further description.

In this third hair dryer, the pair of micro-switches previously described are replaced by a single double pole rocker switch of the type with a stable centre off position and momentary switch functions on either side of centre: the switch is designated 300. The switch actuator 25 is similar to that originally described, in sliding in slot 26 and having a grip portion 104 and actuator flange 109. It does not however have a box 110. The actuator 25 has three longitudinal positions illustrated in Figure 11, "1", "off", and "2". "1" and "2" are different function combinations of motor and heater. In both longitudinal positions "1" and "2" the hair dryer will only be actuated if the finger grip portion 104 is depressed to bring the actuator flange 109 into contact with the sleeve 57 above the corresponding one of the rocker projections 302, 304. Release of the actuator 25

ensures that the rocker switch 300 returns to its normal "off" position.

The construction of the switch enclosure 40 is similar to that described with reference to Figure 8, except that (as seen in Figure 10) the body member 42 is divided into two elements 306, 308 mating on a longitudinal plane extending through the handle 10 at right angles to the plane of the paper in Figure 9, and shown at 310 in Figure 10. This enables the spacers 44a, 44b in Figure 4 to be replaced by projections 312, 314 integral with element 306.

Switches for the apparatus described can be obtained from Marquardt GmbH, D-7201 Rietheim-Weilheim, West Germany.

Where the mains plugs are oriented, so that the live line can be ascertained, a single pole switch in the live line can be substituted for the double pole switches described.

Where the appliance requires only on-off switching a simple switch of push-button type momentary contact switch, or equivalent leaf type switch, will suffice, where continuous push is required to maintain switch contact.

To avoid accidental pressure on the switch actuator, this can be disposed in a recessed area of the handle.

C L A I M S:

1. A hand-held electrical appliance including a supply side for connection to electric mains, operating means including electric conductors accessible to ambient atmosphere in normal working of the appliance, and a manually operated switch means to connect the supply side to the operating means, wherein the switch means is sealed on the supply side so that no mains-energized conductor thereof is accessible to ambient air, and the switch means has means requiring continuous manual pressure to hold the switch means in closed position, whereby release of manual pressure opens the switch means and thereby immediately disconnects electric power from the supply side to the operating means.

2. An appliance as claimed in Claim 1, wherein the means requiring continuous manual pressure is an actuator requiring said continuous pressure in one direction to hold the switch means closed and being movable in a second direction at right angles between open and closed position.

3. An appliance as claimed in Claim 2, wherein the actuator is movable between open position and at least two closed positions for different appliance functions.

4. An appliance as claimed in Claim 1 or Claim 2, wherein the switch means has a movable control element and is enclosed in a water tight enclosure including a flexible sheath portion over the control element, and the actuator is outside the enclosure having a part to bear upon the control element through the sheath portion, the actuator part being out of register with the control element in its open position and in register with the control element in a closed position.

5. An appliance as claimed in any of Claims 1 to 3, wherein the actuator is a one-piece resilient plastics member which by reason of its construction incorporates spring action to open the switch means in the absence of manual pressure.

6. An appliance as claimed in Claim 5, wherein the actuator has a rigid body guided for longitudinal movement and a lever portion movable by manual pressure in a transverse direction, the lever portion being joined to the body at a neck allowing movement of the lever portion relative to the body and providing a restoring force.

7. An appliance as claimed in Claim 6, having a handle, wherein the body is guided for longitudinal movement by the handle with the lever portion projecting through a slot in the handle.

8. An appliance as claimed in Claim 7, including a subsidiary switching arrangement, the actuator body having a portion connecting with the subsidiary switching arrangement.

9. A hand-held electrical appliance as claimed in Claim 1, including switch gear, separate from said switch means but supplied therefrom, for control of appliance functions.

10. An appliance as claimed in Claim 2, wherein the switch means includes a rocker switch with stable central "off" position and momentary switch function to either side of the "off" position, the rocker switch being wholly enclosed and operable by manual pressure in the said one direction on the actuator when the actuator is in either one of two positions in said second direction.

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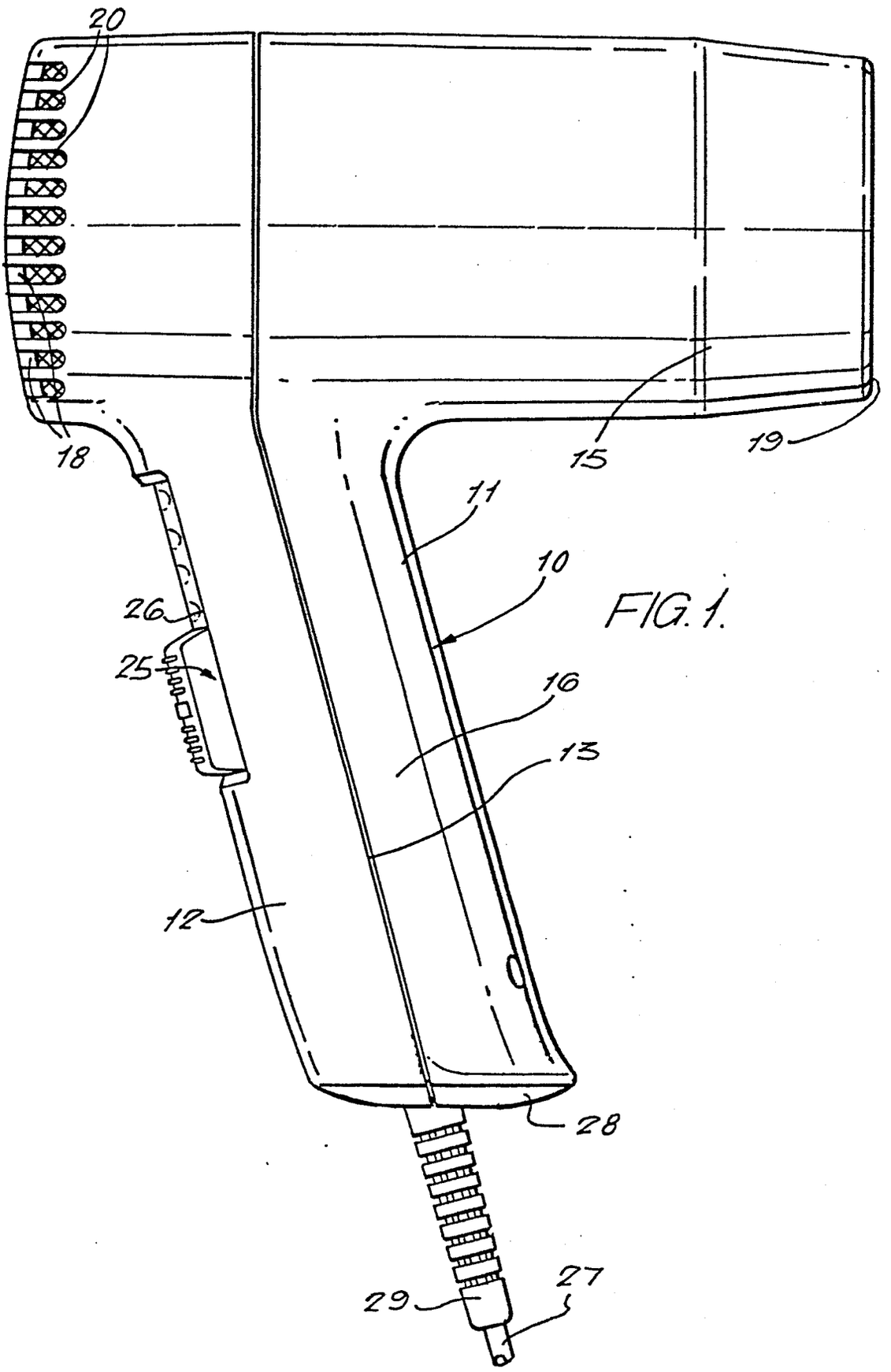

FIG. 1.

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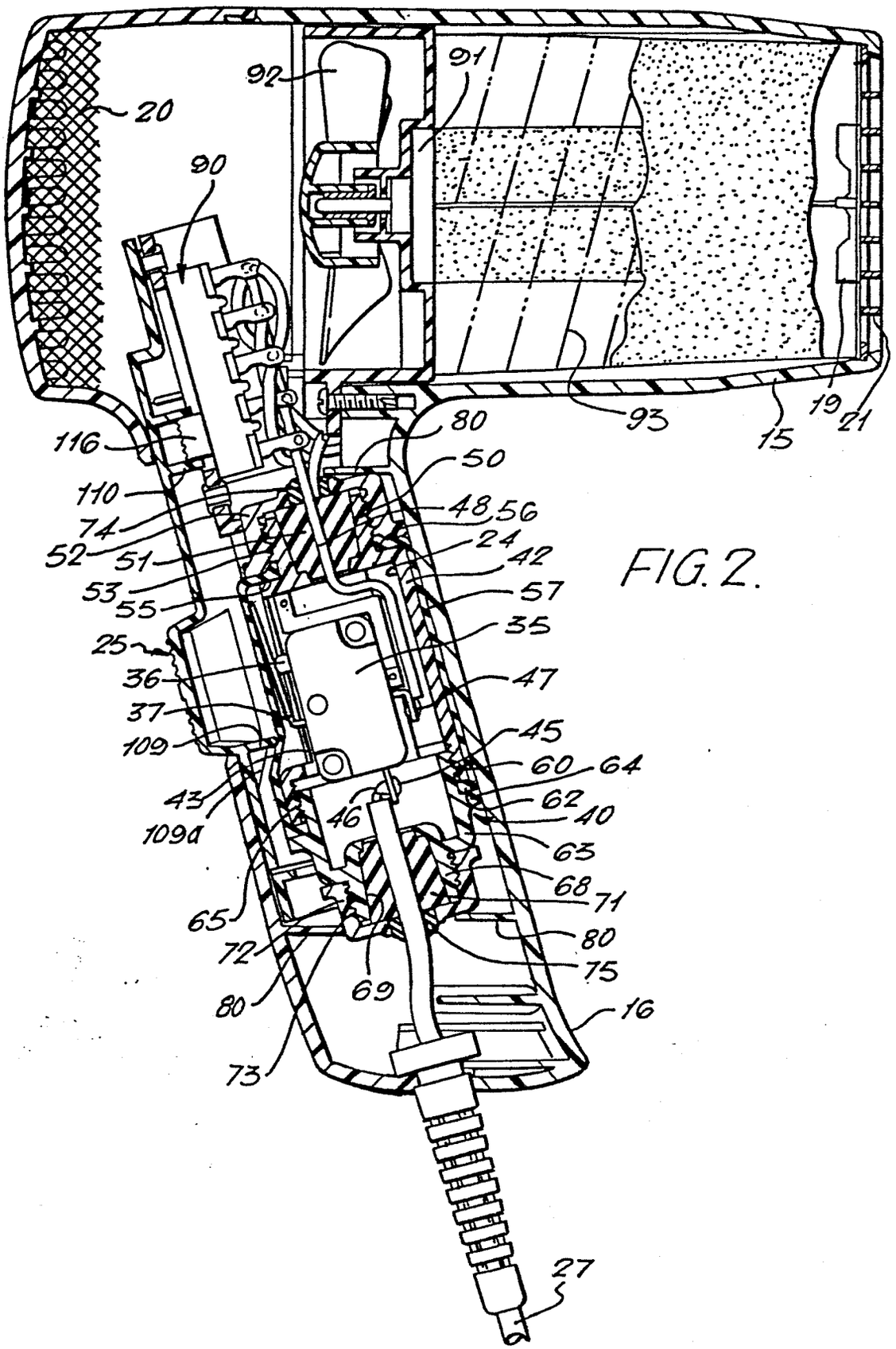
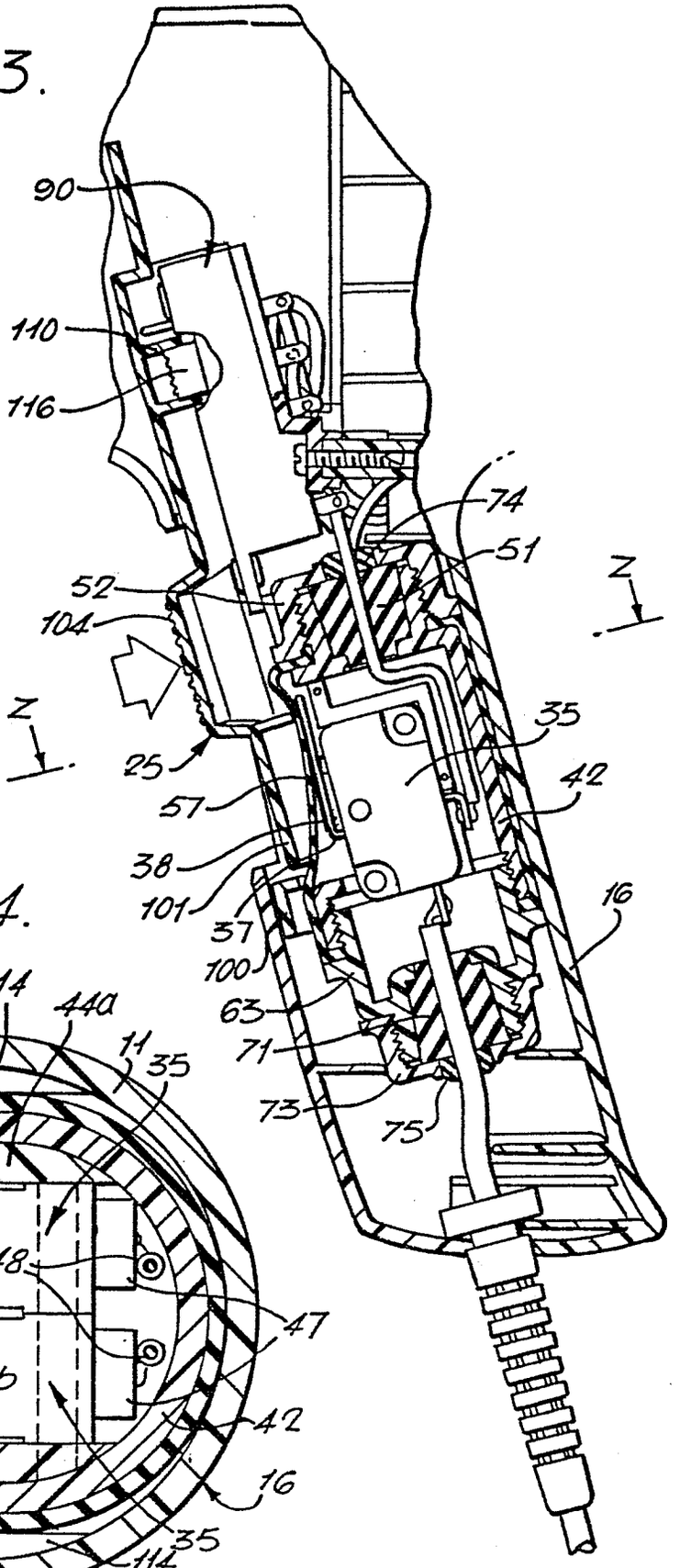


FIG. 2.

FIG. 3.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74
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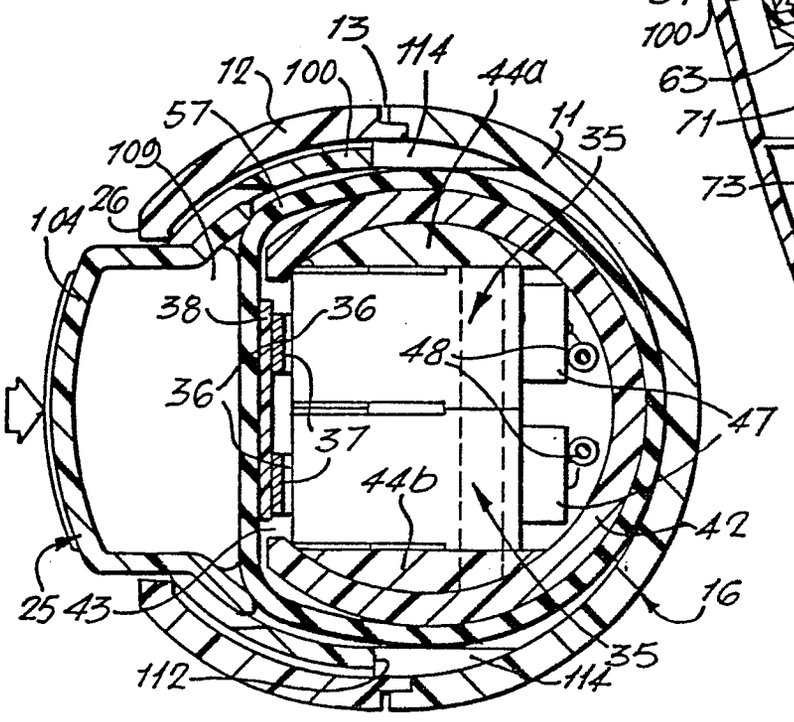
16

FIG. 4.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44a
12
100
57
11
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104
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44b
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16
112
114
35

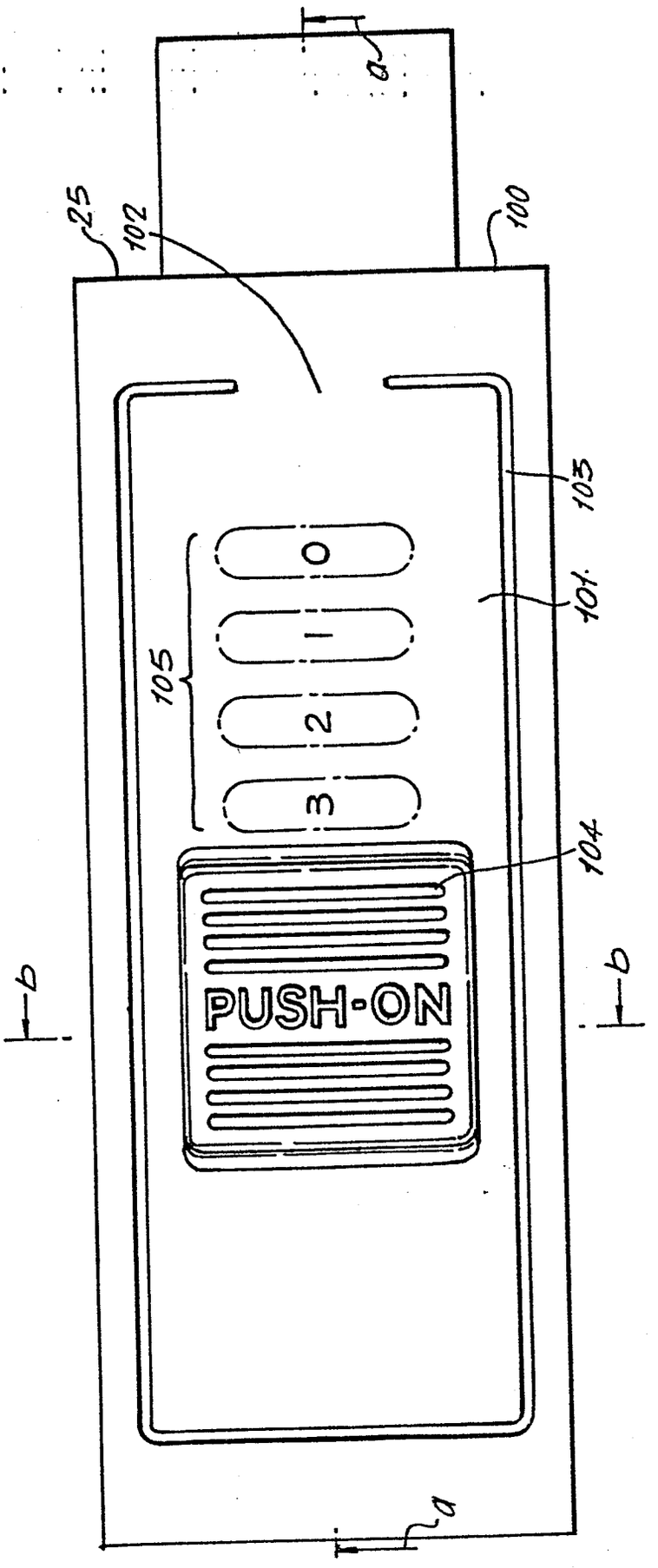

FIG. 5.

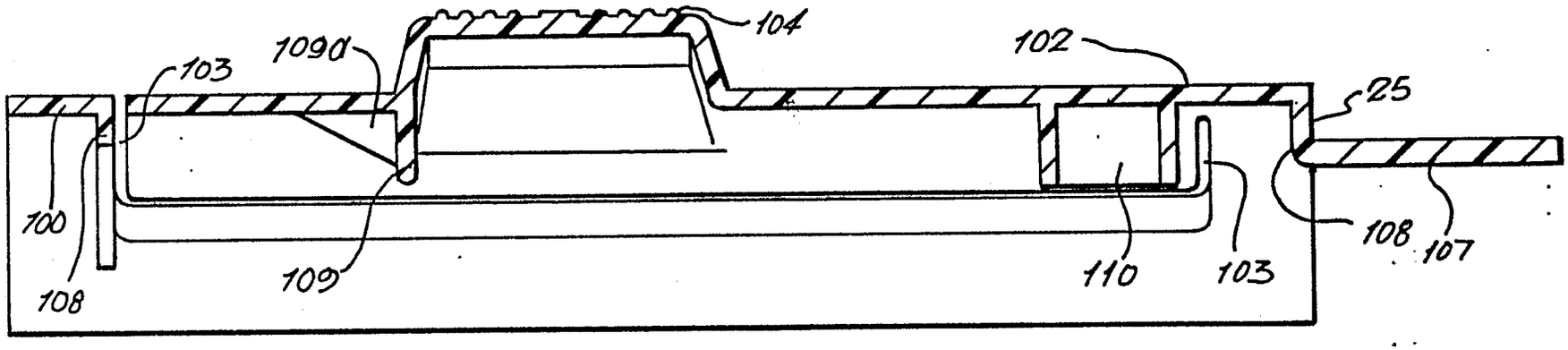

FIG. 6.

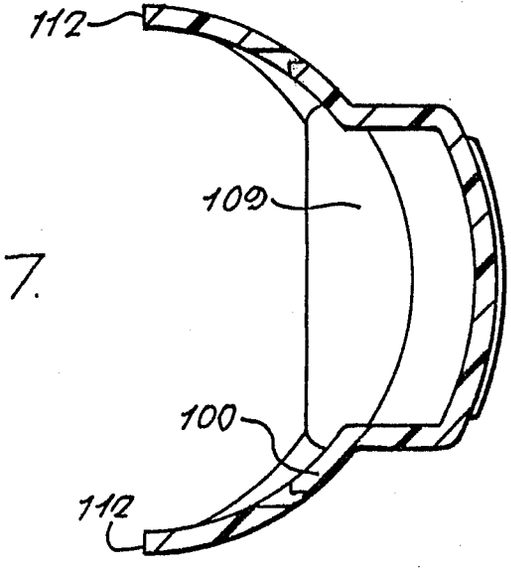

FIG. 7.

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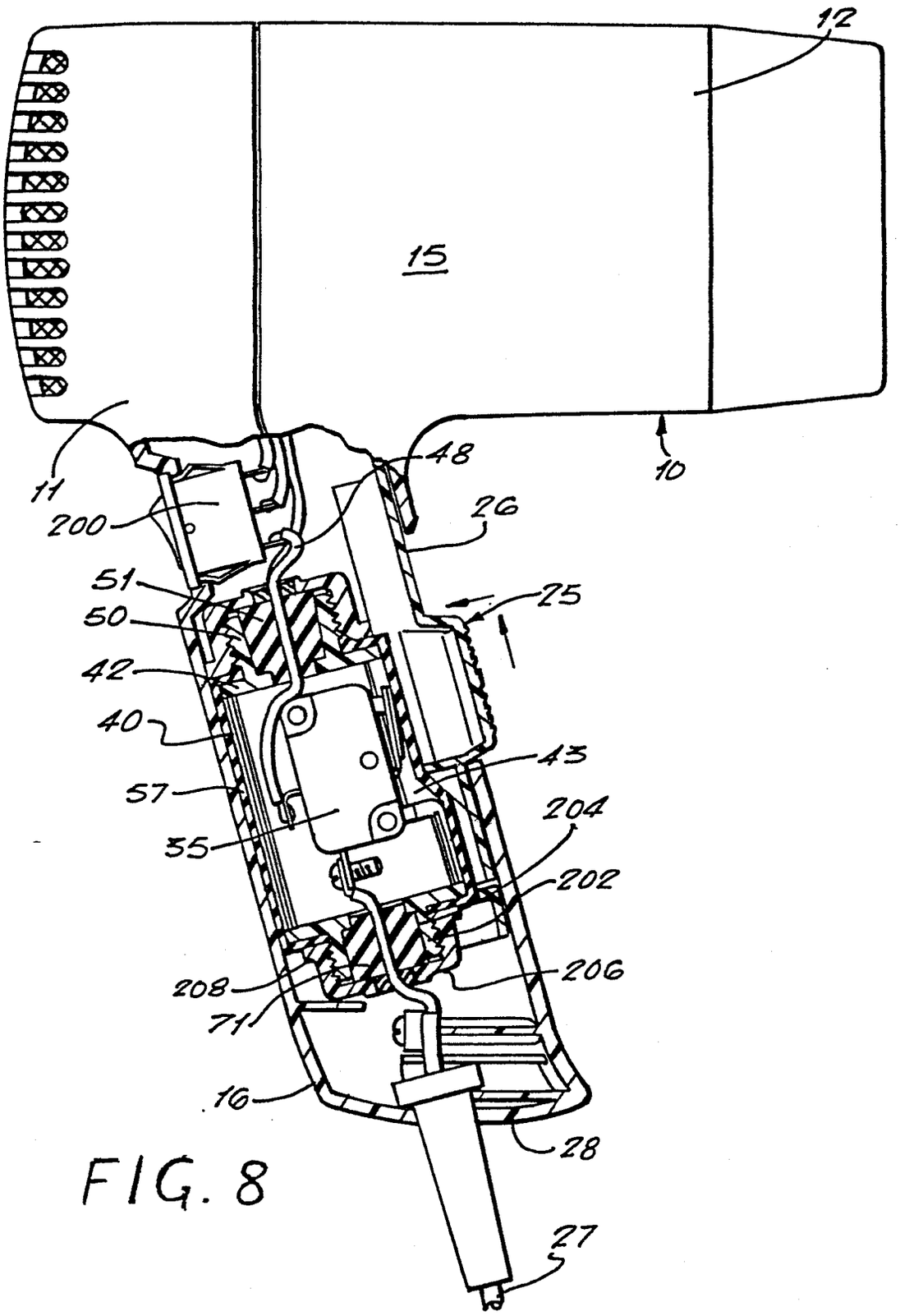

FIG. 8

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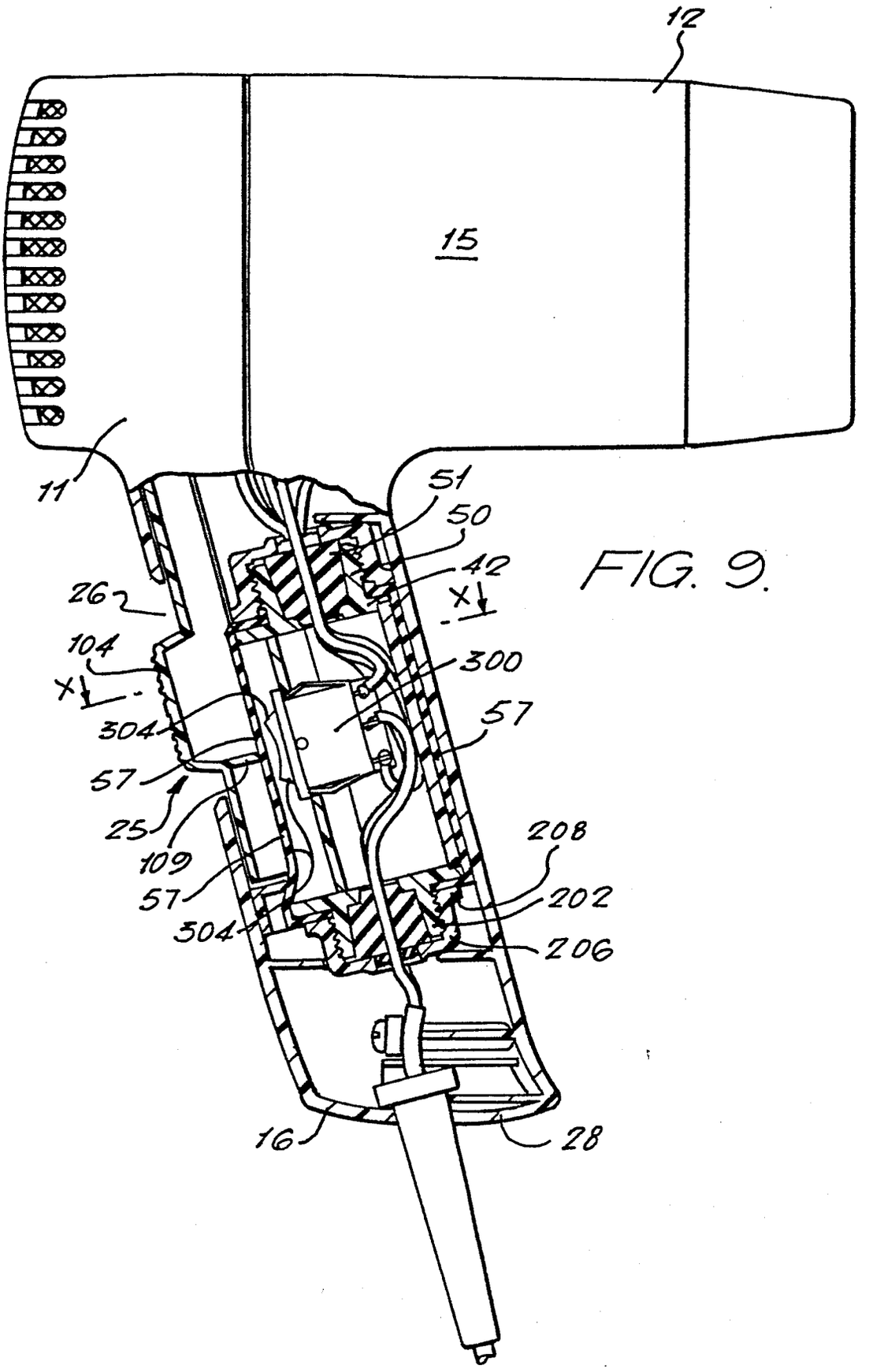

FIG. 9.

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FIG. 10.

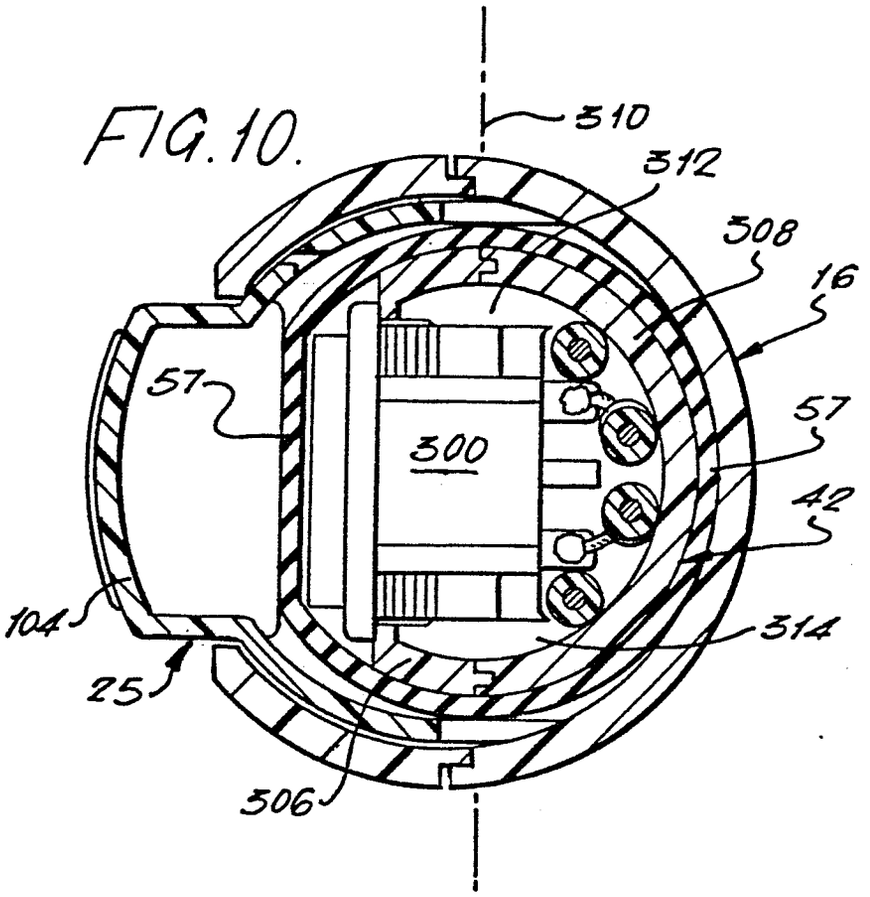

FIG. 11.