

(19)



Europäisches Patentamt

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(11)

EP 1 157 652 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

28.11.2001 Bulletin 2001/48

(51) Int Cl.7: **A47L 9/18**, A47L 9/28

(21) Application number: **00830370.3**

(22) Date of filing: **23.05.2000**

(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) **Machine for cleaning**

(57) A machine for cleaning (1) comprising a body (2) that contains a tank (5) for a liquid (6) and suction means (16, 17) contained inside body (2) in fluid communication with the said tank (5) via a suction path (15, 18, 26) is characterized in that it includes means (19,

20) for detecting presence of the said liquid (6) downstream from the said tank (5), the said detecting means (19, 20) being connected operationally to the suction means (16, 17) for stopping the suction upon detection of the presence of the said liquid (6).

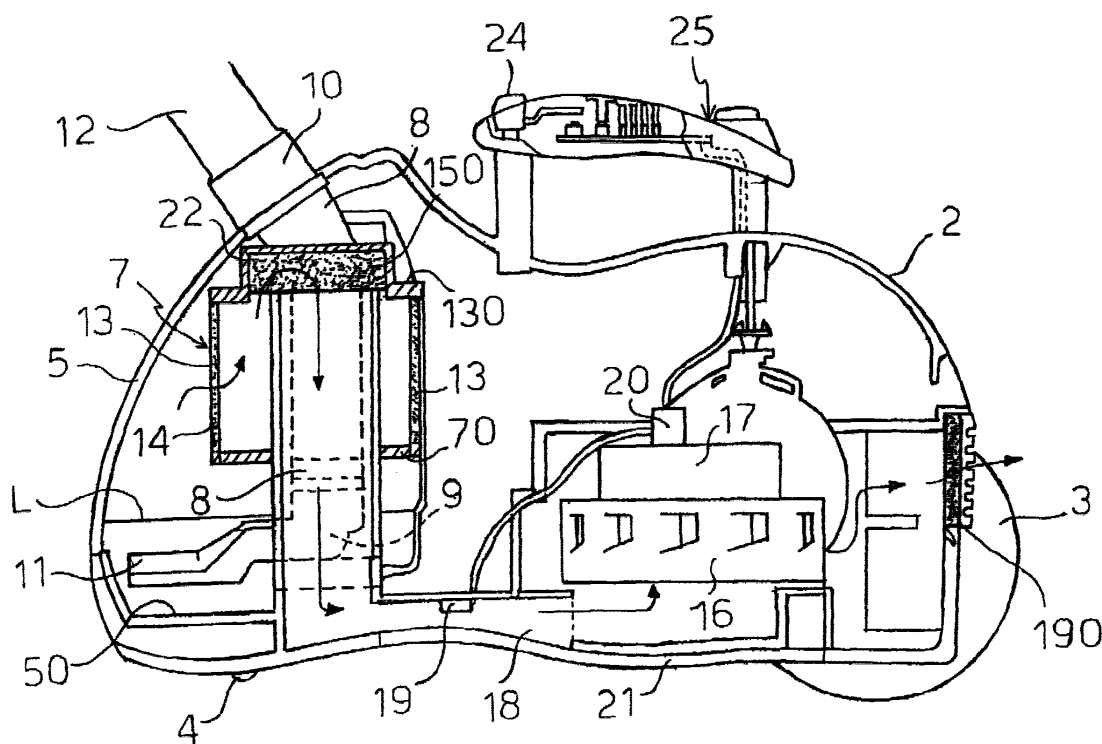


FIG.2

Description

[0001] More generally, the present invention relates to a machine for cleaning, particularly for domestic use, for example a vacuum cleaner or a steam-cleaning machine.

[0002] In particular, the present invention relates to a machine for cleaning comprising a body that has a tank intended to contain and/or collect a liquid, a vacuum line for the operations of cleaning and means for suction contained within the body in fluid communication with the tank.

[0003] For example, in vacuum cleaners, the tank contains a liquid for laying the dust by a flow of air sucked from a surface being cleaned and the suction means comprise a suction pump, driven by a motor, in fluid communication with the tank.

[0004] The liquid for laying the dust, referred to hereinafter as "air purifying liquid", usually consists of water or an aqueous solution containing detergents, deodorants, etc.

[0005] The air, purified of dust, leaves the tank and is returned to the surroundings after passing through the suction path downstream from the tank in which the suction pump is located.

[0006] Although the vacuum cleaners mentioned above are satisfactory from a practical standpoint, they have the serious drawback that the air purifying liquid can flow into the suction path downstream from the tank and/or can be transported into the said path by the purified air, despite the fact that the tank is generally provided with filters for retaining particles of liquid.

[0007] This problem may arise on account of considerable turbulence that develops in the tank following mixing of the aspirated air with the purifying liquid or because of clumsy manoeuvring of the machine during use which promotes overflowing of liquid towards the suction path downstream from the tank.

[0008] Furthermore, it should be noted that the air purifying liquid can form foam that can be transported by the purified air leaving the tank.

[0009] In any event, the purifying liquid present in the aforesaid suction path, transported by the air, can come into contact with electrical components of the machine, endangering the user.

[0010] Moreover, the purifying liquid can cause unfavourable clogging of the filters for removing residual dust, eventually compromising their operational efficiency. These filters are arranged along the suction path downstream from the tank, generally near the air outlet hole of the machine.

[0011] The shortcomings mentioned above can also occur in the case of steam-cleaning machines equipped with means for aspiration of the condensate.

[0012] These machines are provided with a boiler contained inside the machine for generating the steam, with a nozzle for directing the steam onto a surface that is to be cleaned, and with means for aspiration of the

condensate from the said surface.

[0013] The condensate is collected in a tank contained inside the machine, this tank being in fluid communication with the suction means.

[0014] Therefore, for the aforesaid machines, there may be overflow and/or transport of condensate into the suction path downstream from the tank with the consequence that the condensate can come into contact in a dangerous manner with the electrical components of the machine.

[0015] To avoid the shortcomings mentioned in the foregoing, it has been suggested that a sensor be used for determining the level of liquid in the tank, for example a sensor with a float, combined with means for display and/or for controlling the machine.

[0016] However, determination of the liquid level is almost impossible because of the turbulence that develops in the tank and moreover, even in conditions of laminar flow of the liquid, the determination can be falsified by the presence of foam on the liquid used for cleaning.

[0017] The technical problem forming the basis of the present invention is that of providing a machine for cleaning that has structural and functional characteristics such as to overcome the shortcomings mentioned above with reference to the cleaning machines of the state of the art.

[0018] This problem is solved by a machine for cleaning comprising a body that contains a tank for a liquid and suction means contained inside the body in fluid communication with the said tank via a suction path, characterized in that it includes means for detecting presence of the said liquid downstream from the said tank, these detecting means being connected operationally to the suction means for stopping suction upon detection of the presence of the said liquid.

[0019] Further characteristics and advantages of the present invention will become clearer from the description of a preferred example of embodiment within the scope of a vacuum cleaner, given for guidance and without limitation, with reference to the appended drawings in which:

- Fig. 1 shows a side view of a vacuum cleaner according to the present invention,
- Fig. 2 shows a longitudinal sectional view of the machine in Fig. 1,
- Fig. 3 shows an exploded perspective view of a portion of the machine in Fig. 1;
- Fig. 4 shows a perspective view from below and with parts detached, of the machine in Fig. 1,
- Fig. 5 shows an enlarged view of a detail of the machine shown in Fig. 4.

[0020] Referring to the diagrams, the number 1 is used throughout for indicating a machine for domestic use, for cleaning by aspiration of dust, i.e. a vacuum cleaner.

[0021] The vacuum cleaner 1 comprises a body 2

equipped at the bottom with wheels 3 and 4 so that it can be transported easily.

[0022] Vacuum cleaner 1 further comprises, contained within body 2, a tank 5 that can be removed by extraction from body 2. Tank 5 is intended for collecting the dust and contains a liquid 6 up to a predetermined maximum level L, for example water, possibly mixed with deodorants, detergents, etc.

[0023] A hollow filter holder 7 is inserted in tank 5 and is traversed axially, in a substantially central position, by a pipe 8 for conveying a stream of air and dust inside tank 5.

[0024] Pipe 8 ends, externally to machine 1, in an element 10 for insertion of a hose 12 of a conventional type, which enables the operator to vacuum the dust from a surface that is to be cleaned.

[0025] Inside tank 5, pipe 8 has an end portion 9 that is bent to form an elbow and is provided at one free end with a mouth 11 for delivering a stream of air and dust from hose 12 and passing through pipe 8 in the said tank 5 below the surface L of fluid 6.

[0026] An annular grating 13 constitutes an outer side wall of filter holder 7 functioning as a first filtration element.

[0027] Inside the annular grating 13 there is an annular sponge filter 14, and at the top wall 130 of filter holder 7 there are two sponge filters 22, on opposite sides relative to pipe 8, for retaining particles of liquid entrained by the air purified of dust, leaving tank 5.

[0028] Tank 5 also has two opposite pipes 15 that are integral with it, for allowing the air purified of dust to exit from the bottom of tank 5 as indicated by the arrows in Fig. 2.

[0029] In particular, pipes 15 extend vertically from the base 50 of tank 5, on opposite sides relative to pipe 8, and end inside the hollow filter holder 7 in such a way that the rim 150 of their mouth comes up against a respective filter of the two filters 22.

[0030] Base 70 of filter holder 7 is provided with two holes 23, which are also located on opposite sides of pipe 8, for the insertion of pipes 15, these holes 23 being provided with suitable seals (not shown) to prevent liquid passing through them and into filter holder 7.

[0031] At the bottom, each of the pipes 15 is in fluid communication with the upper end of a respective pipe 26 which is integral with a seating 27 formed in body 2 of the machine and that acts as a support for tank 5.

[0032] At the bottom, pipes 26 are in turn connected in fluid communication with a hollow manifold 28 which is integral with body 2 and in fluid communication with a pipe 18.

[0033] Machine 1 further includes, contained inside body 2, a suction pump 16, driven by a motor 17, in fluid communication with pipe 18 and consequently with tank 5 via manifold 28 and the aforesaid pipes 26 and 15.

[0034] Near the rear end of body 2 there is also a removable filter 190 into which the air aspirated by pump 16 is passed before it is returned to the surroundings,

in order to retain any residual dust carried by the purified air.

[0035] Machine 1 further comprises means for detecting a liquid in the suction path downstream from tank 5 in the direction of air circulation.

[0036] These detecting means comprise sensors 19 of the presence of liquid and a control and monitoring unit 20 connected operationally to the said sensors as will be described below.

[0037] Preferably, sensors 19 are located in the suction path downstream from tank 5, and in particular between tank 5 and the suction means.

[0038] In the present embodiment, the sensing means are concretely a sensor 19 of the resistance type with an interdigitated double comb structure. This sensor is arranged along pipe 18 between tank 5 and suction pump 16.

[0039] In particular, sensor 19 is located in a chamber 180 defined in pipe 18. Chamber 180 is accessible from the outside, at the bottom of body 2 of machine 1, by removing a cover 21 fixed in a removable manner to the said body 2, the said cover constituting a wall of the chamber.

[0040] In this way, sensor 19 can be reached from the outside for any operations of replacement or cleaning.

[0041] Obviously, a person skilled in the art can envisage substitution of the aforesaid sensor 19 with other types of liquid sensors that are functionally equivalent, of the electrical, electronic or mechanical type.

[0042] Furthermore, a person skilled in the art might also envisage a number of sensors arranged along the suction path downstream from tank 5.

[0043] Sensor 19 is connected operationally to the control and monitoring unit 20 of the machine, and in its turn this unit is connected operationally to suction motor 17 and to a switch 24, for switching motor 17 on or off, arranged on a handle 25 on body 2.

[0044] In particular, the control and monitoring unit 20 provides establishment of a substantially constant potential difference at the heads of sensor 19. Since the two combs of sensor 19 are not connected together electrically, in the absence of detection of a liquid, the resistance of the sensor should be regarded as infinite and there is no passage of electric current.

[0045] If, however, some of the liquid 6 flows into pipe 15 under the effect of turbulence in tank 5 or for any other reason, it is transported by the air into pipe 18 and is deposited on sensor 19.

[0046] This causes closure of the electric circuit containing the sensor and a consequent passage of current that is detected by unit 20.

[0047] Depending on the amount of liquid that is deposited on sensor 19, a proportionally greater number of teeth of the two interdigitated combs is short-circuited.

[0048] The current flowing in the circuit is greater for a larger number of teeth short-circuited, hence the current increases in proportion to the amount of liquid on

the sensor.

[0049] When the current on the sensor reaches a predefined threshold value corresponding to an amount of liquid in the suction path greater than a safe value, unit 20 stops the suction motor 17, advantageously preventing transport of more liquid by the air into the suction path, which might damage components of the machine, particularly electrical components, and clog the outlet filter 190.

[0050] As already mentioned, control and monitoring unit 20 is also connected operationally to switch 24 for switching machine 1 on or off.

[0051] In the absence of detection of liquid by sensor 19, control and monitoring unit 20 enables switch 24 to switch motor 17 on or off by operating it for a time that is less than a predefined threshold value.

[0052] On the other hand, if liquid is detected by sensor 19, control unit 20 enables switch 24 for the switching-on of motor 17 only when the said switch is operated continuously for a time corresponding to or greater than the aforesaid threshold value.

[0053] In this way, re-starting of suction motor 17 is advantageously prevented in case of accidental operation of switch 24 when liquid is present in pipes 15, 18 and 26.

[0054] To restore normal operation of vacuum cleaner 1, the user must remove the liquid that has flowed into the abovementioned pipes.

[0055] This operation can be effected advantageously by the user by causing the liquid to be removed to the outside of machine 1 by a stream of air aspirated by suction motor 17, which is re-started for this purpose by operating switch 24 for a time corresponding to or greater than the predefined threshold value.

[0056] However, it is first necessary to remove filter 190 from the machine and discharge liquid 6 from tank 5 so as to prevent, on the one hand, further ingress of liquid into the suction path downstream from tank 5 and, on the other hand, to prevent the liquid 6 already present in the said path from clogging filter 190.

[0057] Once the liquid has been removed from the suction path, tank 5 is then charged with some more air purifying liquid and filter 190 is inserted in its seating so that the normal cleaning operations can be resumed.

[0058] The inventive step contained in the preferred example described above and referring to a vacuum cleaner is similarly applicable to a different machine for cleaning equipped with suction means such as a steam-cleaning machine equipped with suction means for collecting the condensate in a suitable tank.

[0059] Thus, for these machines as well it is possible to envisage a liquid detection system like that described above with sensing means arranged along the suction path downstream from the aforesaid tank.

[0060] The main advantage of the cleaning machine according to the present invention lies in its greater safety and useful life, since there is reduced risk of contact of liquids with components of the machine, particularly

electrical components and filters.

[0061] A further advantage of the cleaning machine according to the present invention also lies in its simplicity and inexpensiveness of manufacture since the introduction of means for detecting liquids does not entail large additional costs relative to the traditional cleaning machines.

[0062] For the purpose of satisfying contingent and specific requirements, a person skilled in the art will be able to make modifications, adaptations and substitutions of elements with others that are functionally equivalent, to the machine described above, though without leaving the scope of protection of the invention as defined by the following claims.

Claims

1. Machine for cleaning (1) comprising a body (2) that contains a tank (5) for a liquid (6) and suction means (16, 17) contained inside body (2) in fluid communication with the said tank (5) via a suction path (15, 18, 26), **characterized in that** it includes means (19, 20) for detecting presence of the said liquid (6) downstream from the said tank (5), the said detecting means (19, 20) being connected operationally to the suction means (16, 17) for stopping the suction upon detection of the presence of the said liquid (6).
2. Machine according to Claim 1, in which the said detecting means comprise sensing means (19) arranged in the said suction path (15, 18, 26).
3. Machine according to Claim 2, in which the said detecting means (19, 20) comprise a control and monitoring unit (20) connected operationally to the said sensing means (19) and the said suction means (16, 17), the said control and monitoring unit (20) being able to stop the said suction means (16, 17) following detection of the presence of the said liquid (6) by the said sensing means (19).
4. Machine according to Claim 3, in which the said control and monitoring unit (20) is also connected operationally to a switch (24) for actuating the said suction means (16, 17) in such a way that, in case of detection of the presence of liquid (6) by the said sensing means (19), the said suction means (16, 17) can be actuated by operating the said switch (24) for a time corresponding to or greater than a predefined threshold value, whereas in the absence of detection of the presence of liquid (6), the said suction means (16, 17) can be actuated by operating the said switch (24) for a time that is less than the said threshold value.
5. Machine according to any one of the preceding

claims, in which the said suction means (16, 17) comprise a suction pump (16) driven by a motor (17).

6. Machine according to Claim 5, in which the said sensing means (19) are arranged in a pipe (18) in fluid communication between the said tank (5) and the said suction pump (16). 5
7. Machine according to any one of the claims from 2 to 6, in which the said sensing means comprise at least one sensor (19) of the resistance type with an interdigitated double comb structure. 10

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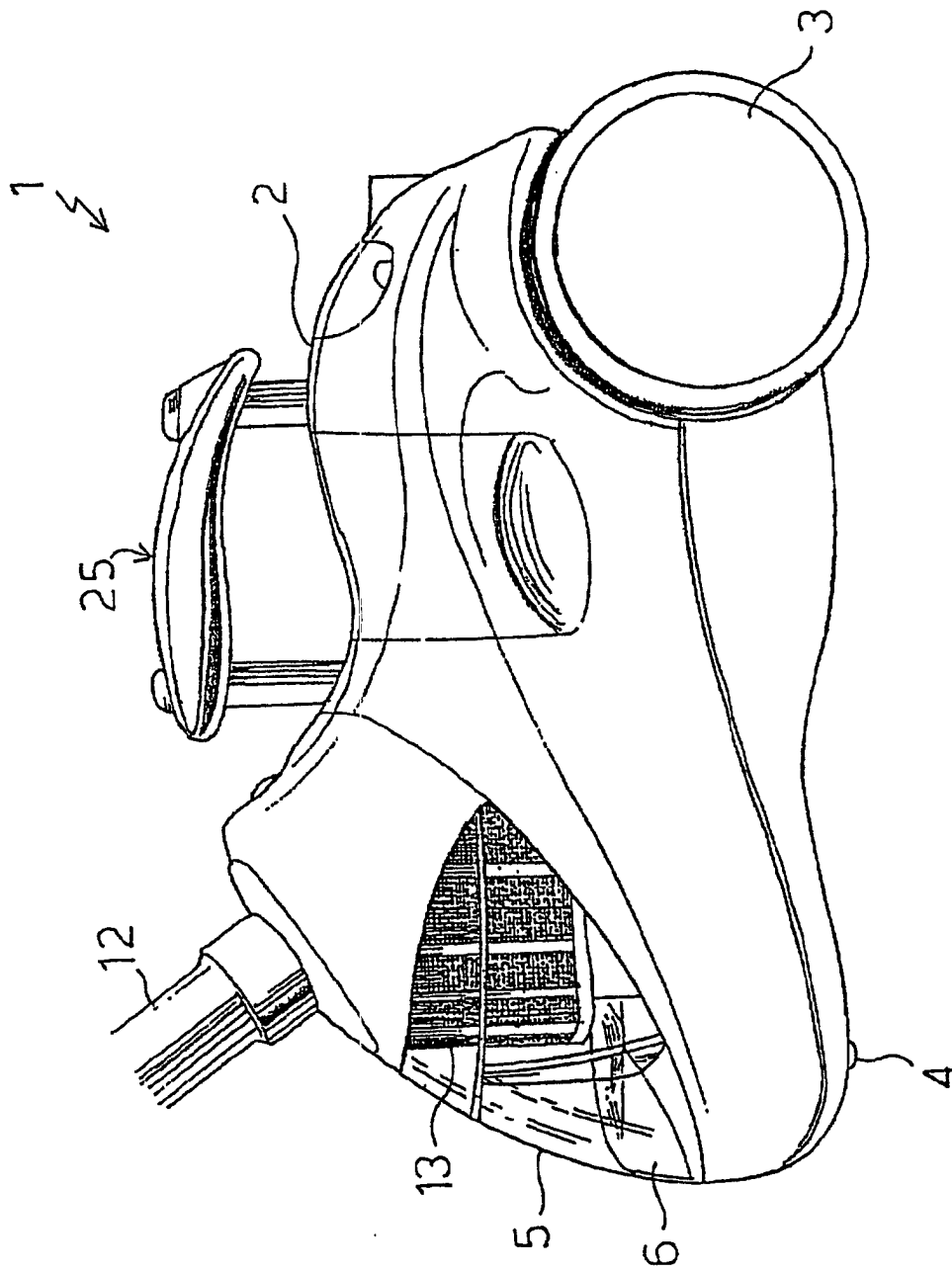


FIG. 1

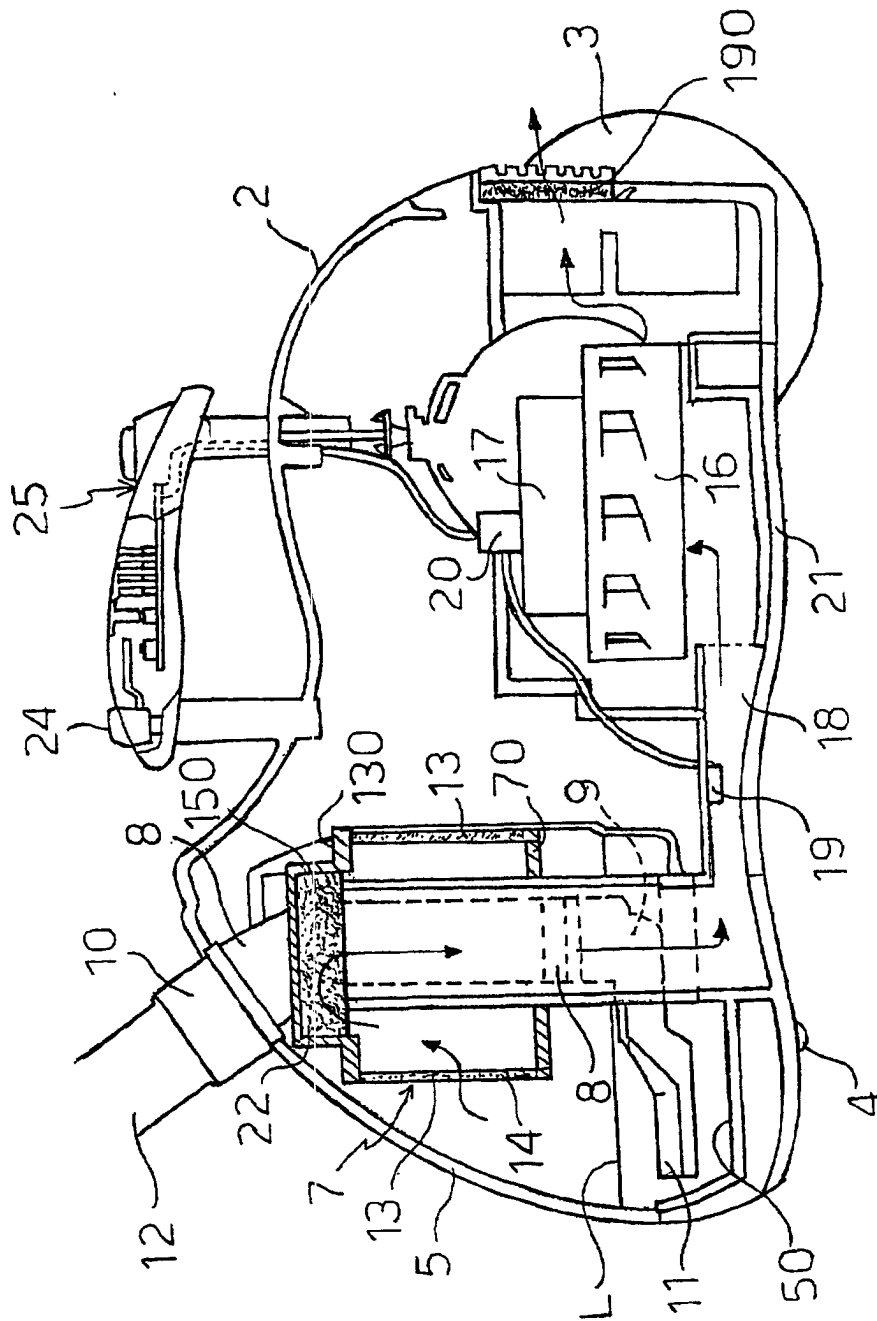


FIG. 2

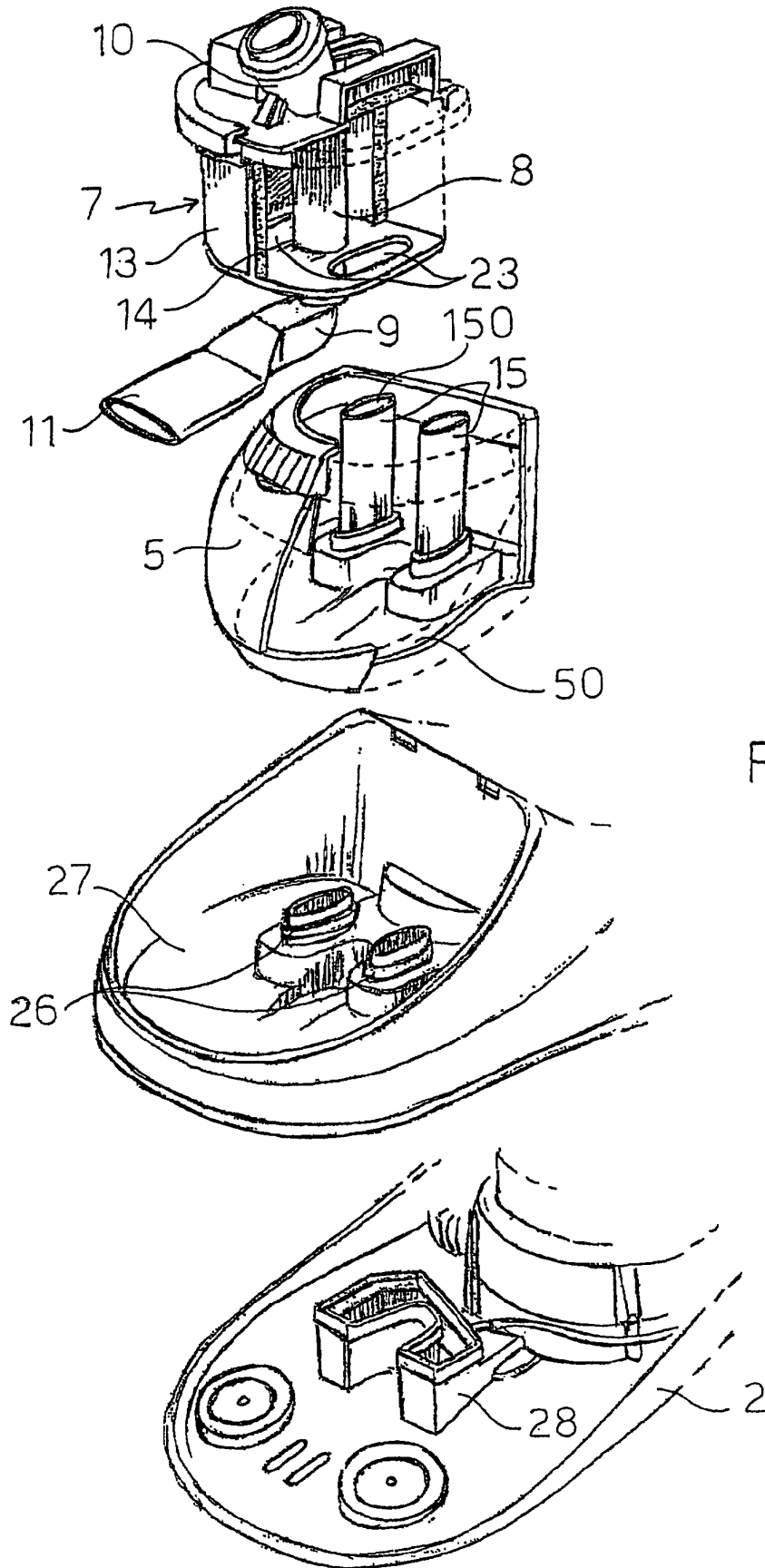
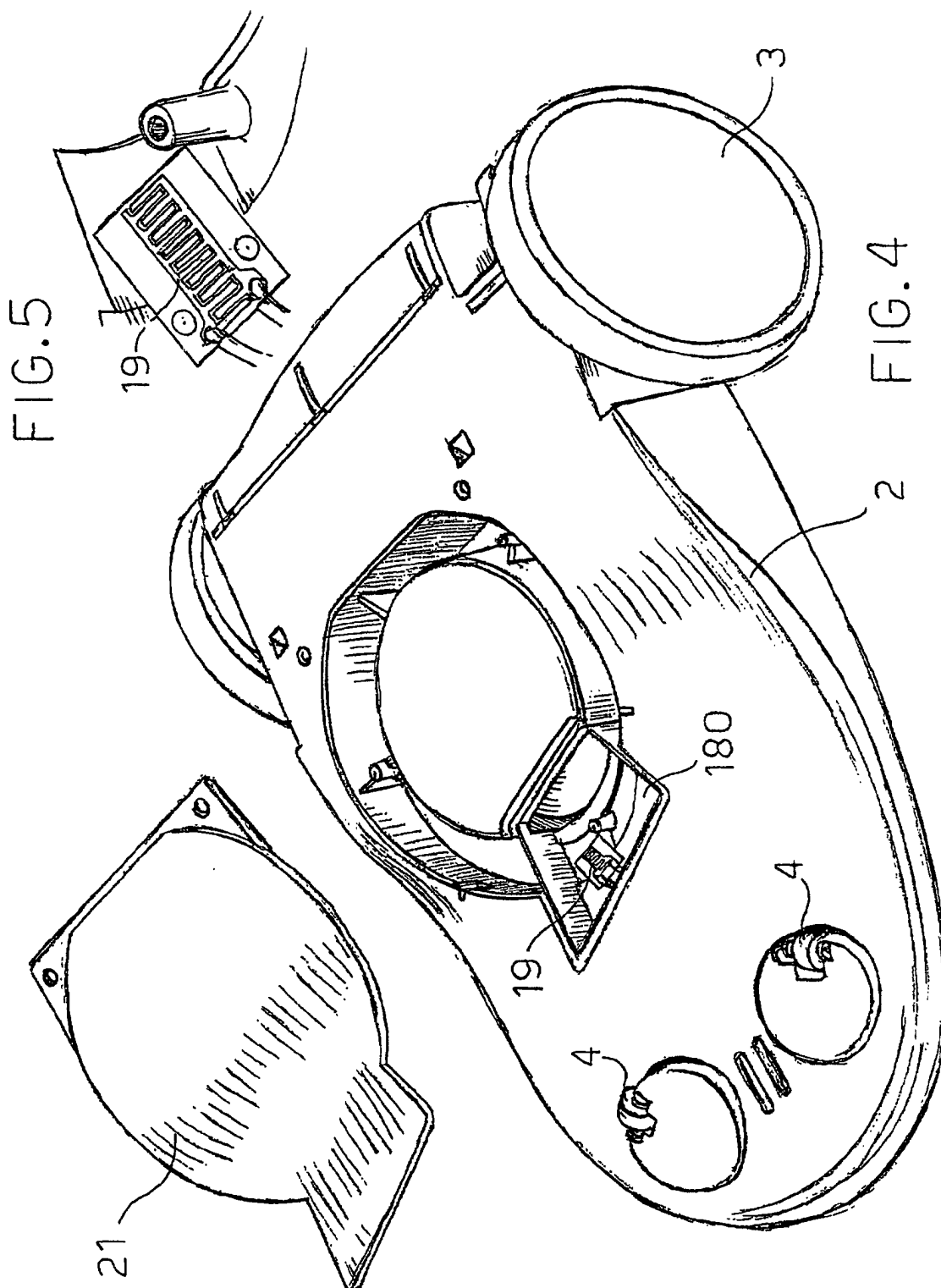


FIG.3





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EUROPEAN SEARCH REPORT

Application Number
EP 00 83 0370

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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 November 2000	Examiner Bourseau, A-M
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			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 00 83 0370

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