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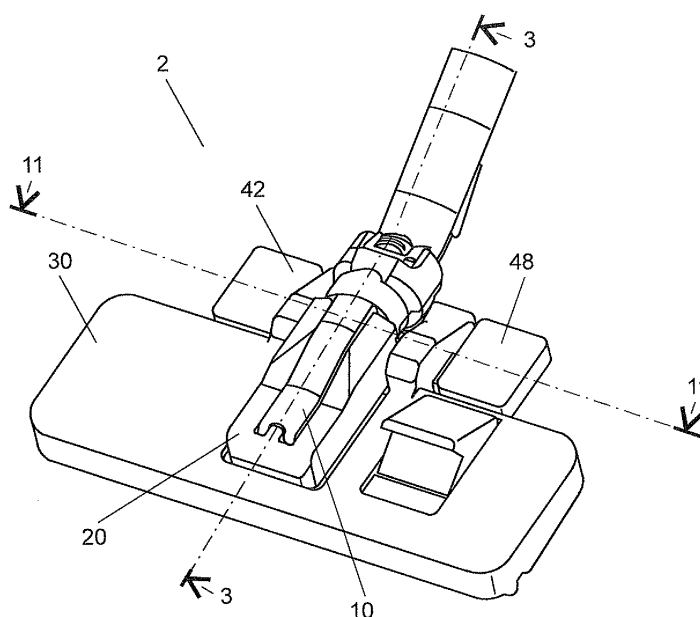
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(54) **SUCTION DEVICE FOR ELECTRIC CLEANER AND ELECTRIC CLEANER USING SAME**

(57) Suction tool (2) for an electric vacuum cleaner includes first suction tool (10) that has a first suction port for suctioning dust, and second suction tool (20) that has a second suction port communicating with the first suction port and that is detachably engaged with first suction tool (10). Moreover, the suction tool includes third suction

tool (30) that has a third suction port communicating with the second suction port and that is detachably engaged with second suction tool (20). Furthermore, the suction tool includes first operation part (42) for disengaging first suction tool (10) from second suction tool (20), and second operation part (48) for disengaging second suction tool (20) from third suction tool (30).

FIG. 2



Description**TECHNICAL FIELD**

[0001] The present invention relates to suction tools for electric vacuum cleaners and to electric vacuum cleaners using thereof.

BACKGROUND ART

[0002] In conventional suction tools for electric vacuum cleaners, a configuration aimed at improving ease of use for a user has been proposed in which a small-size nozzle is detachably attached to a floor nozzle such that the small-size nozzle can be detached from the floor nozzle by pushing down and lowering a operation lever disposed in the floor nozzle (see Patent Literature 1, for example).

[0003] FIG. 19 is a perspective view illustrating a configuration of the conventional suction tool for an electric vacuum cleaner.

[0004] Suction tool 200 includes floor nozzle 201 and small-size nozzle 202. Small-size nozzle 202 is detachably attached to floor nozzle 201 and includes connection pipe 204 to which an extension pipe (not shown) is connected.

[0005] Operation lever 203 is disposed in floor nozzle 201. Pushing down and lowering the operation lever 203 can release a gripping state of holder 205 detachably gripping small-size nozzle 202. This operation allows small-size nozzle 202 to be detached from floor nozzle 201.

[0006] However, there is still room for improvement in such a conventional suction tool for an electric vacuum cleaner, from the viewpoint of improving ease of use for the user.

[0007] That is, in suction tool 200, only small-size nozzle 202 is attachable to and detachable from floor nozzle 201. Suppose a case where the user uses a further smaller nozzle, e.g. a gap nozzle used for a gap area, which is further smaller in size than small-size nozzle 202. In this case, the user is required to remove both floor nozzle 201 and small-size nozzle 202 from the extension pipe, and then to couple the separately-prepared gap nozzle or the like to the extension pipe. Therefore, the attachment of the gap nozzle is sometimes performed at much expense in time and effort.

[0008] In addition, when the gap nozzle or the like is not in service, the user is required to keep the gap nozzle in storage somewhere, separately from floor nozzle 201 and small-size nozzle 202. Therefore, the storage of the gap nozzle sometimes costs time and effort.

[0009] Consequently, with the conventional suction tool for an electric vacuum cleaner, the attachment and detachment of the gap nozzle or the like have sometimes been a burdensome procedure for the user.

Citation List**Patent Literature**

- 5 **[0010]** Patent Literature 1: Japanese Patent Unexamined Publication No. 2003-339585

SUMMARY OF THE INVENTION

- 10 **[0011]** The invention is intended to provide a suction tool for an electric vacuum cleaner, in which different types of suction tools including a floor nozzle, a small-size nozzle, and a gap nozzle used for a gap area can be easily attached and detached, resulting in improved ease of use for a user.

- 15 **[0012]** The suction tool for an electric vacuum cleaner according to the present invention includes a first suction tool which has a first suction port for suctioning dust, and a second suction tool which has a second suction port communicating with the first suction port and is detachably engaged with the first suction tool. In addition, the suction tool includes a third suction tool which has a third suction port communicate with the second suction port and is detachably engaged with the second suction tool.
- 20 Moreover, the suction tool includes a first operation part which disengages the first suction tool from the second suction tool, and a second operation part which disengages the second suction tool from the third suction tool.

BRIEF DESCRIPTION OF DRAWINGS**[0013]**

35 FIG. 1 is a side-elevational view of an electric vacuum cleaner equipped with a suction tool for an electric vacuum cleaner, according to a first embodiment of the present invention.

FIG. 2 is a perspective view of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

40 FIG. 3 is a cross-sectional view of the suction tool for an electric vacuum cleaner taken along line 3-3 of FIG. 2.

45 FIG. 4 is a perspective view of a first suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

FIG. 5 is a bottom plan view of the first suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

50 FIG. 6 is a perspective view of a second suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

FIG. 7 is a bottom plan view of the second suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

55 FIG. 8 is a perspective view of a third suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

FIG. 9 is a plan view of the third suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

FIG. 10 is a bottom plan view of the third suction tool of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention.

FIG. 11 is a cross-sectional view of the suction tool for an electric vacuum cleaner, taken along line 11-11 of FIG. 2.

FIG. 12 is a partial cross-sectional view of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention, in a state where the first suction tool has been disengaged from the second suction tool.

FIG. 13 is a partial cross-sectional view of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention, in a state where the first suction tool is being removed.

FIG. 14 is a partial cross-sectional view of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention, in a state where the second suction tool has been disengaged from the third suction tool.

FIG. 15 is a partial cross-sectional view of the suction tool for an electric vacuum cleaner, according to the first embodiment of the invention, in a state where the second suction tool is being removed.

FIG. 16 is a partial cross-sectional view of a suction tool for an electric vacuum cleaner, according to a second embodiment of the present invention.

FIG. 17 is a partial cross-sectional view of another suction tool for an electric vacuum cleaner, according to the second embodiment of the invention.

FIG. 18 is a cross-sectional view illustrating a configuration of further another suction tool for an electric vacuum cleaner, according to the second embodiment of the invention.

FIG. 19 is a perspective view illustrating a configuration of a conventional suction tool for an electric vacuum cleaner.

DESCRIPTION OF EMBODIMENTS

[0014] Hereinafter, detailed descriptions of preferred embodiments of suction tools for electric vacuum cleaners according to the present invention will be made, with reference to the accompanying drawings. Note that, in the following descriptions, the same or corresponding parts are designated with the same numerals and symbols, and duplicate explanations thereof are sometimes omitted.

(FIRST EXEMPLARY EMBODIMENT)

[0015] Descriptions will be made of a suction tool for an electric vacuum cleaner according to a first embodiment of the present invention, with reference to FIGS. 1 to 11.

[0016] FIG. 1 is a side-elevational view of electric vacuum cleaner 100 equipped with suction tool 2 for an electric vacuum cleaner, according to the first embodiment of the invention. FIG. 2 is a perspective view of suction tool 2 for an electric vacuum cleaner. FIG. 3 is a cross-sectional view of suction tool 2 for an electric vacuum cleaner taken along line 3-3 of FIG. 2. FIG. 4 is a perspective view of first suction tool 10 of suction tool 2 for an electric vacuum cleaner, according to the first embodiment of the invention. FIG. 5 is a bottom plan view of first suction tool 10. FIG. 6 is a perspective view of second suction tool 20 of suction tool 2 for an electric vacuum cleaner, according to the first embodiment of the invention. FIG. 7 is a bottom plan view of second suction tool 20. FIG. 8 is a perspective view of third suction tool 30 of suction tool 2 for an electric vacuum cleaner, according to the first embodiment of the invention. FIG. 9 is a plan view of third suction tool 30. FIG. 10 is a bottom plan view of suction tool 2 for an electric vacuum cleaner, taken along line 11-11 of FIG. 2.

[0017] As shown in FIG. 1, electric vacuum cleaner 100 includes cleaner body 1, suction tool 2 for an electric vacuum cleaner, extension pipe 3, and hose 4.

[0018] Cleaner body 1 accommodates an electric blower (not shown) which generates suction air, and a dust collecting part (not shown) which collects dust.

[0019] Suction tool 2 for an electric vacuum cleaner suctions the dust on a surface to be cleaned.

[0020] Extension pipe 3 is such that one end thereof is detachably coupled with suction tool 2 for an electric vacuum cleaner and the other end thereof is equipped with at-hand holding part 5.

[0021] Hose 4 is such that one end thereof is detachably coupled with at-hand holding part 5 and the other end thereof is detachably coupled with cleaner body 1. Moreover, in the end portion of the hose in the extension pipe 3 side, at-hand holding part 5 is disposed which includes a handle-grip part (not shown) held by a user.

[0022] In addition, in the end portion of hose 4 in the cleaner body 1 side, coupling pipe 6 is disposed.

[0023] Moreover, in the upper surface of cleaner body 1, suction port 1a is disposed with which coupling pipe 6 is detachably coupled.

[0024] Furthermore, in a rear portion of cleaner body 1, a pair of wheels 7 for travelling is disposed.

[0025] Besides, on the bottom surface of a front portion of cleaner body 1, caster 8 is disposed for travelling.

[0026] Next, the configuration of suction tool 2 for an electric vacuum cleaner will be described in detail. As shown in FIGS. 2 and 3, suction tool 2 for an electric vacuum cleaner includes first suction tool 10 (a gap nozzle used for a gap area), second suction tool 20 (a small-size nozzle), and third suction tool 30 (a floor nozzle).

[0027] First suction tool 10 includes first suction port 10a for suctioning the dust.

[0028] Second suction tool 20 includes second suction port 20a communicating with first suction port 10a, and

is detachably engaged with first suction tool 10.

[0029] Third suction tool 30 includes third suction port 30a communicating with second suction port 20a, and is detachably engaged with second suction tool 20.

[0030] As shown in FIGS. 4 and 5, first suction tool 10 includes suction part 11, coupling part 12, and connection part 13.

[0031] Suction part 11 includes, in the lower surface thereof, first suction port 10a for suctioning the dust.

[0032] One end of coupling part 12 is coupled with extension pipe 3, and the other end thereof is connected to connection part 13.

[0033] Connection part 13 connects suction part 11 to coupling part 12.

[0034] First suction port 10a is formed throughout an area from the lower surface to a front portion of suction part 11. Moreover, in first suction port 10a, first reinforcing rib 14 is disposed for reinforcement.

[0035] The end portion of suction part 11 in the connection part 13 side is rotatably held by connection part 13. Moreover, the end portion of coupling part 12 in the connection part 13 side is held, rotatably in the up-and-down direction, by connection part 13.

[0036] On the upper surface of coupling part 12 in the connection part 13 side, first rotation-restriction part 15 is disposed to restrict the upward rotary movement of coupling part 12. Moreover, in the end portion of the lower surface of connection part 13 in the coupling part 12 side, second rotation-restriction part 16 is disposed to restrict the downward rotary movement of coupling part 12.

[0037] Coupling part 12 is restricted in the upward rotary movement thereof by the contact between first rotation-restriction part 15 and the end portion of connection part 13 in the coupling part 12 side. Also, the coupling part is restricted in the downward rotary movement thereof by the contact between second rotation-restriction part 16 and the lower surface of coupling part 12 in the connection part 13 side.

[0038] In a front portion of the upper surface of suction part 11, first recess 17 is disposed. In addition, on a side surface of suction part 11, second recess 18A is disposed which serves as a first to-be-engaged part.

[0039] First recess 17 fits onto first projection 24 (to be described later) disposed in second suction tool 20, and second recess 18A fits onto first claw 25A (to be described later), serving as a first engaging part, which is disposed in second suction tool 20. With this configuration, first suction tool 10 is detachably coupled with second suction tool 20.

[0040] As shown in FIGS. 6 and 7, in the central part of second suction tool 20, third recess 21 is disposed to which first suction tool 10 is detachably attached. Moreover, in the lower surface of second suction tool 20, second suction port 20a is disposed. Second suction port 20a communicates with first suction port 10a, with first suction tool 10 being attached to second suction tool 20. In second suction port 20a, second reinforcing rib 22 is disposed for reinforcement. Moreover, on the lower sur-

face of second suction tool 20, first brushes 23 are disposed to rake up the dust on the surface to be cleaned.

[0041] In the upper portion of a front portion of third recess 21, first projection 24 is disposed which fits into first recess 17 disposed in first suction tool 10. In addition, first claw 25A is disposed on a side surface of a rear portion of third recess 21, i.e. an inner side surface of a rear portion of second suction tool 20. Moreover, slit 26 is disposed forward of first claw 25A. Furthermore, under first claw 25A, contact part 27A is disposed which comes in contact with release part 44 disposed in second operation part 48 (to be described later).

[0042] First suction tool 10 is detachably held in third recess 21, through the fitting of first projection 24 into first recess 17 and the fitting of first claw 25A into second recess 18A. Moreover, in an outer side surface of second suction tool 20, first fitting mouth 28 is disposed which serves as a second to-be-engaged part. Furthermore, on the front surface of second suction tool 20, second projection 29 is disposed.

[0043] As shown in FIGS. 8 to 10, third suction tool 30 includes upper member 31 that forms the upper surface and the side surfaces of third suction tool 30, and lower member 32 that forms the lower surface of third suction tool 30.

[0044] In lower member 32 configuring the lower surface of third suction tool 30, third suction port 30a is disposed along the direction of the length of third suction tool 30. Third suction port 30a allows the upper and lower surfaces of third suction tool 30 to communicate with each other, and communicates with second suction port 20a in the state where second suction tool 20 is attached to third suction tool 30. Moreover, in a rear portion of the lower surface of third suction tool 30, roller 33 for traveling is rotatably disposed (see FIG. 3).

[0045] Into third suction tool 30, there are integrated second brush 34 to rake up the dust on the surface to be cleaned, and lip 35 to prevent the dust on the surface to be cleaned from escaping toward a rear portion of third suction tool 30. Moreover, in the upper surface of third suction tool 30, operation lever 36 is disposed that is rotatably held by third suction tool 30. Second brush 34 is disposed, movably in the up-and-down direction, forward of third suction port 30a. Lip 35 is disposed, movably in the up-and-down direction, backward of third suction port 30a. Moreover, second brush 34 and lip 35 are configured to protrude from the inside of third suction tool 30 to the outside of third suction tool 30, by the operation of operation lever 36 by the user.

[0046] In the substantially-central part of upper member 31 configuring the upper surface of third suction tool 30, fourth recess 37 is disposed to which second suction tool 20 is detachably attached. Moreover, in both the left and right sides of fourth recess 37, fifth recesses 38 are disposed into which first brushes 23 disposed on the lower surface of second suction tool 20 are inserted.

[0047] In a front portion of fourth recess 37, second fitting mouth 39 is disposed into which second projection

29 disposed in second suction tool 20 is fitted. In a rear portion of fourth recess 37, first ribs 40 for positioning are disposed. In addition, in the substantially-central part of fourth recess 37, cross-shaped second rib 41 for positioning is disposed.

[0048] Second suction tool 20 is such that the front portion of second suction tool 20 is positioned inside fourth recess 37 when second projection 29 fits into second fitting mouth 39. Moreover, Second suction tool 20 is such that the rear portion of second suction tool 20 is positioned inside fourth recess 37, when second rib 41 fits into second suction port 20a and the rear end portion of second suction tool 20 comes in contact with first ribs 40.

[0049] As shown in FIGS. 8 to 10, in a rear portion of third suction tool 30, first operation part 42 and second operation part 48 are respectively rotatably disposed. First operation part 42 is one for disengaging first suction tool 10 from second suction tool 20. Second operation part 48 is one for disengaging second suction tool 20 from third suction tool 30.

[0050] As shown in FIG. 11, first operation part 42 includes first press part 43, release part 44, and first arm 45. First press part 43 is disposed to be operable from the outside. Release part 44 disengages first suction tool 10 from second suction tool 20, and pushes up and lifts first suction tool 10. First arm 45 connects first press part 43 to release part 44.

[0051] Moreover, as shown in FIG. 8, release part 44 is configured to protrude from a rear portion of the upper surface of third suction tool 30. First operation part 42 is rotatably held by third suction tool 30 by means of first pivotal-support part 46 disposed in a lower portion of first arm 45. First operation part 42 is biased upward by first spring 47.

[0052] As shown in FIG. 11, second operation part 48 includes second press part 49, push-up part 50, second arm 51, and extended part 52.

[0053] Moreover, as shown in FIG. 8, second press part 49 is disposed to be operable from the outside. Push-up part 50 pushes up and lifts second suction tool 20. Second arm 51 connects second press part 49 to push-up part 50. Extended part 52 is extended upward from second arm 51. Push-up part 50 is configured to protrude from the rear portion of the upper surface of third suction tool 30.

[0054] In the upper end portion of extended part 52, second claw 53 is disposed which serves as a second engaging part to engage with first fitting mouth 28. Second claw 53 is configured to protrude from a side surface of the rear portion of third suction tool 30 (FIG. 9).

[0055] As shown in FIG. 11, second operation part 48 is rotatably held by third suction tool 30 by means of second pivotal-support part 54 disposed in a lower portion of second arm 51. Second operation part 48 is biased downward by second spring 55.

[0056] Second suction tool 20 is held by third suction tool 30 through the fitting of second claw 53 into first fitting

mouth 28. Moreover, second suction tool 20 is configured to be removable from third suction tool 30 by releasing the fitting between first fitting mouth 28 and second claw 53.

[0057] Hereinafter, operations and functions of the thus-configured suction tool for an electric vacuum cleaner will be described, with reference to FIGS. 1 to 3, and 11 to 15.

[0058] FIG. 12 is a partial cross-sectional view of suction tool 2 for an electric vacuum cleaner, according to the first embodiment of the present invention, in a state where first suction tool 10 has been disengaged from second suction tool 20. FIG. 13 is a partial cross-sectional view of suction tool 2 for an electric vacuum cleaner, in a state where first suction tool 10 is being removed. FIG. 14 is a partial cross-sectional view of suction tool 2 for an electric vacuum cleaner, in a state where second suction tool 20 has been disengaged from third suction tool 30. FIG. 15 is a partial cross-sectional view of suction tool 2 for an electric vacuum cleaner, in a state where second suction tool 20 is being removed.

[0059] First, a case will be described where the user cleans dust on a surface to be cleaned through the use of third suction tool 30, with hose 4 and extension pipe 3 being coupled with cleaner body 1, with reference to FIGS. 1 to 3, and 11. In this case, before cleaning the dust on the surface to be cleaned, the user couples both first suction tool 10 and second suction tool 20 to third suction tool 30, and couples extension pipe 3 to coupling part 12 of first suction tool 10.

[0060] When the user starts to operate cleaner body 1 for cleaning the dust on the surface to be cleaned, the electric blower (not shown) generates suction air. Upon generation of the suction air by the electric blower (not shown), the dust on the surface to be cleaned is suctioned from third suction port 30a disposed in the lower surface of third suction tool 30.

[0061] In the state where both first suction tool 10 and second suction tool 20 are coupled with third suction tool 30, third suction port 30a communicates with both second suction port 20a disposed in the lower surface of second suction tool 20 and first suction port 10a disposed in first suction tool 10.

[0062] Therefore, the dust suctioned from third suction port 30a is suctioned into suction part 11 of first suction tool 10, via second suction port 20a and first suction port 10a. The dust suctioned into suction part 11 of first suction tool 10 is in turn suctioned into cleaner body 1, via connection part 13, coupling part 12, extension pipe 3, and hose 4, and is then collected in the dust collecting part (not shown) disposed in cleaner body 1.

[0063] Next, a case will be described where the user cleans dust on a surface to be cleaned through the use of first suction tool 10, with reference to FIGS. 12 and 13. In this case, the user can remove only first suction tool 10 from the state where both first suction tool 10 and second suction tool 20 are coupled with third suction tool 30, by pushing down and lowering first press part 43 of

first operation part 42.

[0064] Since first press part 43 and release part 44 are connected to each other via first arm 45, the pushing down and lowering of first press part 43 of first operation part 42 causes first arm 45 to rotate around first pivotal-support part 46, which results in lifting-upward of release part 44 (FIG. 12).

[0065] Thus-lifted-upward release part 44 comes in contact with contact part 27A (see FIG. 6) disposed below first claw 25A of second suction tool 20, which causes the inner side surface of the rear portion of second suction tool 20 to be curved toward the outside of second suction tool 20 (FIG. 12). With this operation, the fitting between first claw 25A and second recess 18A are released, and first suction tool 10 is lifted upward (FIG. 13). This allows only first suction tool 10 to be removed from the state where both first suction tool 10 and second suction tool 20 are attached to third suction tool 30.

[0066] In this case, since slit 26 is disposed (FIG. 6) forward of first claw 25A, of the inner side surface of second suction tool 20, only the part where first claw 25A is disposed can be curved to release the fitting between first claw 25A and second recess 18A. Therefore, it is possible to easily disengage first suction tool 10 from second suction tool 20.

[0067] Moreover, when first suction tool 10 is coupled with second suction tool 20, the coupling of first suction tool 10 with second suction tool 20 can be performed by fitting first projection 24 into first recess 17 and fitting first claw 25A into second recess 18A.

[0068] Next, a case will be described where the user cleans dust on a surface to be cleaned through the use of second suction tool 20, with reference to FIGS. 14 and 15. In this case, by pushing down and lowering second press part 49 of second operation part 48, the user can remove second suction tool 20 from third suction tool 30, with second suction tool 20 remaining coupled with first suction tool 10.

[0069] Since second press part 49, push-up part 50, and second claw 53 are connected to each other via second arm 51, the pushing down and lowering of second press part 49 causes second arm 51 to rotate around second pivotal-support part 54, which results in releasing of the fitting between second claw 53 and first fitting mouth 28. Moreover, push-up part 50 pushes up and lifts second suction tool 20. This allows second suction tool 20 to be removed from third suction tool 30, with second suction tool 20 remaining coupled with first suction tool 10.

[0070] Moreover, when second suction tool 20 is coupled with third suction tool 30, second projection 29 is fitted into second fitting mouth 39, second rib 41 is fitted into second suction port 20a, and the rear end portion of second suction tool 20 is caused to come in contact with first ribs 40. This configuration allows the positioning of second suction tool 20 relative to third suction tool 30 and allows the fitting between second claw 53 and first fitting mouth 28, which results in the coupling of second

suction tool 20 with third suction tool 30.

[0071] In the embodiment as described above, when the user cleans the dust on the surface to be cleaned through the use of first suction tool 10, only the operation of first operation part 42 allows the easy release of the fitting between second recess 18A disposed in first suction tool 10 and first claw 25A disposed in second suction tool 20.

[0072] Moreover, when the user cleans the dust on the surface to be cleaned through the use of second suction tool 20, only the operation of second operation part 48 allows the easy release of the fitting between first fitting mouth 28 disposed in second suction tool 20 and second claw 53 disposed in second operation part 48.

[0073] In this way, it is possible to easily perform the switchover among first suction tool 10, second suction tool 20, and third suction tool 30, resulting in improved ease of use for the user.

[0074] Moreover, first operation part 42 and second operation part 48 are disposed, in the rear portion of third suction tool 30, to be operable from the outside. Therefore, the user is able to operate first operation part 42 or second operation part 48 by a simple action such as, for example, stepping on first operation part 42 or second operation part 48 with user's foot, which results in further improved ease of use for the user.

[0075] In addition, first operation part 42 and second operation part 48 are biased by first spring 47 and second spring 55, respectively. Accordingly, first operation part 42 and second operation part 48 can return automatically to their respective original positions, after the operations thereof. Consequently, after user's operation of first operation part 42 and second operation part 48, there is no need for returning first operation part 42 and second operation part 48 to their respective original positions with user's hand, foot, or the like, which results in further improved ease of use for the user.

[0076] Furthermore, when first suction tool 10 is coupled with second suction tool 20, first projection 24 disposed in second suction tool 20 is fitted into first recess 17 disposed in first suction tool 10, and also first claw 25A disposed in second suction tool 20 is fitted into second recess 18A disposed in first suction tool 10. Since this allows first suction tool 10 to be coupled with second suction tool 20, it is possible to reliably hold first suction tool 10 in second suction tool 20 with the simple configuration.

[0077] In addition, when second suction tool 20 is coupled with third suction tool 30, second projection 29 is fitted into second fitting mouth 39, second rib 41 is fitted into second suction port 20a, and the rear end portion of second suction tool 20 is caused to come in contact with first ribs 40. This configuration allows the positioning of second suction tool 20 inside third suction tool 30. Furthermore, since second suction tool 20 can be coupled with third suction tool 30 by fitting second claw 53 into first fitting mouth 28, it is possible to reliably hold second suction tool 20 inside third suction tool 30 with the simple

configuration.

[0078] Moreover, first operation part 42 not only releases the fitting between first suction tool 10 and second suction tool 20, but also pushes up and lifts first suction tool 10. With this configuration, it is possible to reliably disengage first suction tool 10 from second suction tool 20. Consequently, it is possible to sufficiently prevent first suction tool 10 from being forcibly removed from second suction tool 20 with first suction tool 10 remaining coupled with second suction tool 20, and thereby to prevent a possible breakage of first suction tool 10, second suction tool 20, or first operation part 42. This allows improved safety.

[0079] Furthermore, second operation part 48 not only releases the fitting between second suction tool 20 and third suction tool 30, but also pushes up and lifts second suction tool 20. With this configuration, it is possible to reliably disengage second suction tool 20 from third suction tool 30. Consequently, it is possible to sufficiently prevent second suction tool 20 from being forcibly removed from third suction tool 30 with second suction tool 20 remaining coupled with third suction tool 30, and thereby to prevent a possible breakage of second suction tool 20, third suction tool 30, or second operation part 48. This allows improved safety.

(SECOND EXEMPLARY EMBODIMENT)

[0080] Next, descriptions will be made of suction tool 92 for an electric vacuum cleaner according to a second embodiment of the present invention. FIG. 16 is a partial cross-sectional view of suction tool 92 for an electric vacuum cleaner, according to the second embodiment of the invention. Note that parts the same as or corresponding to those described in the first embodiment are designated with the same numerals and symbols, and explanations thereof are omitted.

[0081] As shown in FIG. 16, in suction tool 92 for an electric vacuum cleaner, first suction tool 10 is equipped with first claw 25B serving as a first engaging part, slit 26 (not shown), and contact part 27B. Moreover, second recess 18B serving as a first to-be-engaged part is disposed in second suction tool 20, at the position corresponding to first claw 25B. Note that the configurations of first claw 25B, second recess 18B, and contact part 27B are the same as those of first claw 25A, second recess 18A, and contact part 27A, respectively.

[0082] Moreover, release part 44 disposed in first operation part 42 is extended to the second operation part 48 side. Release part 44 is configured to disengage first suction tool 10 from second suction tool 20.

[0083] Comparison of suction tool 92 for an electric vacuum cleaner with suction tool 2 for an electric vacuum cleaner described in the first embodiment, shows a difference between them in the following point: In suction tool 92 shown in FIG. 16, first claw 25B, second recess 18B, and contact part 27B are formed on the left side as viewed from the front, and release part 44 as well is ex-

tended to the left side as viewed from the front.

[0084] Hereinafter, operations and functions of thus-configured suction tool 92 for an electric vacuum cleaner will be described.

[0085] First, suppose a case where a user cleans dust on a surface to be cleaned through the use of first suction tool 10. In this case, the user is able to remove only first suction tool 10 from the state where first suction tool 10 and second suction tool 20 are coupled with third suction tool 30, by pushing down and lowering first press part 43 of first operation part 42.

[0086] First press part 43 and release part 44 are connected to each other via first arm 45. Therefore, when first press part 43 of first operation part 42 are pushed down and lowered, first arm 45 rotates around first pivotal-support part 46 to lift release part 44 upward. Thus-lifted-upward release part 44 comes in contact with contact part 27B disposed below first claw 25B, which causes first suction tool 10 to be curved toward the inside of first suction tool 10. This releases the fitting between first claw 25B and second recess 18B, and also allows the pushing-up and lifting of first suction tool 10. Accordingly, it is possible to remove only first suction tool 10 from the state where first suction tool 10 and second suction tool 20 are attached to third suction tool 30.

[0087] Also in the embodiment as described above, when the user cleans the dust on the surface to be cleaned through the use of first suction tool 10, only the operation of first operation part 42 allows the easy release of the fitting between second recess 18B disposed in first suction tool 10 and first claw 25B disposed in second suction tool 20.

[0088] Moreover, in a case where the user cleans dust on a surface to be cleaned through the use of second suction tool 20, only the operation of second operation part 48 allows the easy release of the fitting between first fitting mouth 28 disposed in second suction tool 20 and second claw 53 disposed in second operation part 48, in the same manner as for the first embodiment described above. Accordingly, it is possible to easily perform the switchover among first suction tool 10, second suction tool 20, and third suction tool 30, resulting in improved ease of use for the user.

[0089] Although suction tools 2 and 92 for electric vacuum cleaners have been described up to this point, the aforementioned configurations are not to be construed as limitations of suction tools for electric vacuum cleaners according to the present invention.

[0090] FIG. 17 is a partial cross-sectional view of another suction tool 82 for an electric vacuum cleaner, according to the second embodiment of the invention. In FIG. 17 as well, constituent elements the same as or corresponding to the aforementioned ones are designated with the same numerals and symbols, and explanations thereof are omitted.

[0091] In this example, the major configuration of suction tool 82 for an electric vacuum cleaner is in common with those of aforementioned suction tools 2 and 92 for

electric vacuum cleaners except in that soft member 58 is disposed on each of first end 56 in the outer side of the lower surface of first operation part 42 and second end 57 in the outer side of the lower surface of second operation part 48.

[0092] Suppose a case where either first operation part 42 or second operation part 48 is pushed down and lowered, and the surface to be cleaned is in contact with first end 56 in the outer side of the lower surface of first operation part 42 or second end 57 in the outer side of the lower surface of second operation part 48, respectively. Even in such the case, soft member 58 is disposed on each of first end 56 in the outer side of the lower surface of first operation part 42 and second end 57 in the outer side of the lower surface of second operation part 48.

[0093] With this configuration, it is possible to sufficiently prevent the surface to be cleaned from being scratched by either first end 56 in the outer side of the lower surface of first operation part 42 or second end 57 in the outer side of the lower surface of second operation part 48.

[0094] In addition, during the operation by the user of either first operation part 42 or second operation part 48, soft member 58 is in contact with the surface to be cleaned, which can prevent third suction tool 30 from moving. Accordingly, the user is able to stably operate first operation part 42 or second operation part 48, resulting in improved ease of use for the user.

[0095] FIG. 18 is a cross-sectional view illustrating a configuration of further another suction tool 72 for an electric vacuum cleaner, according to the second embodiment of the invention.

[0096] In this example, the major configuration of suction tool 72 for an electric vacuum cleaner is in common with those of the aforementioned suction tools 2 and 92 for electric vacuum cleaners except in that first seal member 59 is disposed, between first suction tool 10 and second suction tool 20, which is configured with a soft material having high wear resistance.

[0097] First seal member 59 may be disposed at the perimeter of first suction port 10a of first suction tool 10, or may be disposed at a portion, in contact with first suction port 10a, of second suction tool 20. With this configuration, it is possible to further efficiently prevent an air leakage from between first suction tool 10 and second suction tool 20, with first suction tool 10 being attached to second suction tool 20. This allows improved suction force of electric vacuum cleaner 100.

[0098] In addition, by disposing first seal member 59 in first suction tool 10, it is possible to prevent the surface to be cleaned from being scratched due to the contact between the surface and the end portion of first suction port 10a in the to-be-cleaned surface side, when the user uses only first suction tool 10 to clean the dust on the surface to be cleaned.

[0099] Moreover, as shown in FIG. 18, second seal member 60 may be disposed, between second suction tool 20 and third suction tool 30, which is configured with

a soft material having high wear resistance. Second seal member 60 may be disposed at the circumference of second suction port 20a disposed in second suction tool 20, or may be disposed at a portion, in contact with second suction port 20a, of third suction tool 30. With this configuration, it is possible to further efficiently prevent an air leakage from between second suction tool 20 and third suction tool 30, with second suction tool 20 being attached to third suction tool 30. This allows improved suction force of electric vacuum cleaner 100.

[0100] Furthermore, in the case where second seal member 60 is disposed in second suction tool 20, when the user cleans the dust on the surface to be cleaned through the use of second suction tool 20, it is possible to prevent the surface to be cleaned from being scratched due to the contact between the surface and the end portion of second suction port 20a in the to-be-cleaned surface side.

[0101] As described above, in suction tools 2, 72, 82, and 92 for electric vacuum cleaners, for using each of the tools with first suction tool 10 being removed from second suction tool 20, only the operation of first operation part 42 allows the disengagement of first suction tool 10 from second suction tool 20. Moreover, for using each of the tools with second suction tool 20 being removed from third suction tool 30, only the operation of second operation part 48 allows the disengagement of second suction tool 20 from third suction tool 30. Therefore, it is possible to easily perform the switchover among first suction tool 10, second suction tool 20, and third suction tool 30, resulting in improved ease of use for the user.

[0102] Moreover, in the embodiments, the cases have been exemplified where both first operation part 42 and second operation part 48 are disposed in third suction tool 30; however, the present invention is not limited to the cases. For example, at least one of first operation part 42 and second operation part 48 may be disposed in third suction tool 30.

[0103] With this configuration, the user is able to operate, by a simple action, the at least one of first operation part 42 and second operation part 48, thereby allowing the ease-of-use suction tool for an electric vacuum cleaner.

[0104] Furthermore, in the embodiments described above, the cases have been exemplified where both first operation part 42 and second operation part 48 are disposed in the rear portion of third suction tool 30; however, the present invention is not limited to the cases. For example, at least one of first operation part 42 and second operation part 48 may be disposed in the rear portion of third suction tool 30.

[0105] With this configuration, the user is able to operate, by a simple action, the at least one of first operation part 42 and second operation part 48, thereby allowing the ease-of-use suction tool for an electric vacuum cleaner.

[0106] In addition, in the embodiments described above, the cases have been exemplified where first claw

25A serving as the first engaging part is disposed in the second suction tool 20 side and second recess 18A serving as the first to-be-engaged part is disposed in the first suction tool 10 side; however, the present invention is not limited to the cases. For example, in one of first suction tool 10 and second suction tool 20, first claw 25A and 25B may be disposed which serve as the first engaging part that detachably engages first suction tool 10 with second suction tool 20. In the other one, second recess 18A and second recess 18B may be disposed, at the positions corresponding to the first engaging part, which serve as the first to-be-engaged part that engages with the first engaging part.

[0107] With this simple configuration, it is possible not only to reliably engage first suction tool 10 with second suction tool 20, but also to disengage first suction tool 10 from second suction tool 20 by only the operation of first operation part 42, which allows the ease-of-use suction tool for an electric vacuum cleaner.

[0108] Moreover, in the embodiment described above, the case has been exemplified where both first seal member 59 and second seal member 60 are formed of the soft material having high wear resistance; however, the present invention is not limited to the case. For example, at least one of first seal member 59 and second seal member 60 may be formed of the soft material having high wear resistance.

[0109] With this configuration, it is possible to prevent degradation due to wear of the at least one of first seal member 59 and second seal member 60, which allows the suction tool for an electric vacuum cleaner with high durability.

[0110] Furthermore, in the embodiment described above, the configuration has been exemplified where soft members 58 are disposed on both end portions of first operation part 42 and second operation part 48; however, the present invention is not limited to the exemplified configuration. For example, the configuration may be such that the soft material is disposed at the end portion of at least one of first operation part 42 and second operation part 48.

[0111] With this configuration, even when the at least one of first operation part 42 and second operation part 48 comes in contact with the surface to be cleaned, it is possible to prevent the surface to be cleaned from being scratched by the at least one of first operation part 42 and second operation part 48.

INDUSTRIAL APPLICABILITY

[0112] As described above, the suction tools for electric vacuum cleaners and the electric vacuum cleaners equipped with the tools according to the present invention can provide the exceptional advantage that the switch-over among first suction tool, second suction tool, and third suction tool can be easily performed.

[0113] This allows improved ease of use for a user; therefore, the invention is useful for home-use electric

vacuum cleaners, industrial electric vacuum cleaners, and the like which are equipped with suction tools for electric vacuum cleaners.

REFERENCE MARKS IN THE DRAWINGS

[0114]

1	cleaner body
10	1a suction port
2, 72, 82, 92	suction tool for an electric vacuum cleaner
3	extension pipe
4	hose
15	5 at-hand holding part
6	coupling pipe
7	wheel
8	caster
10	first suction tool
20	10a first suction port
11	suction part
12	coupling part
13	connection part
14	first reinforcing rib
25	15 first rotation-restriction part
16	second rotation-restriction part
17	first recess
18A, 18B	second recess (first to-be-engaged part)
20	second suction tool
30	20a second suction port
21	third recess
22	second reinforcing rib
23	first brush
24	first projection
35	25A, 25B first claw (first engaging part)
26	slit
27A, 27B	contact part
28	first fitting mouth (second to-be-engaged part)
40	29 second projection
30	third suction tool
30a	third suction port
31	upper member
32	lower member
45	33 roller
34	second brush
35	lip
36	operation lever
37	fourth recess
50	38 fifth recess
39	second fitting mouth
40	first rib
41	second rib
42	first operation part
55	43 first press part
44	release part
45	first arm
46	first pivotal-support part

47	first spring
48	second operation part
49	second press part
50	push-up part
51	second arm
52	extended part
53	second claw (second engaging part)
54	second pivotal-support part
55	second spring
56	first end
57	second end
58	soft member
59	first seal member
60	second seal member
100	electric vacuum cleaner

Claims

1. A suction tool for an electric vacuum cleaner, the tool comprising:
 - a first suction tool including a first suction port for suctioning dust;
 - a second suction tool including a second suction port communicating with the first suction port, the second suction tool being detachably engaged with the first suction tool;
 - a third suction tool including a third suction port communicating with the second suction port, the third suction tool being detachably engaged with the second suction tool;
 - a first operation part for disengaging the first suction tool from the second suction tool; and
 - a second operation part for disengaging the second suction tool from the third suction tool.
2. The suction tool for an electric vacuum cleaner according to claim 1, wherein at least one of the first operation part and the second operation part is disposed in the third suction tool.
3. The suction tool for an electric vacuum cleaner according to claim 2, wherein the first operation part and the second operation part are disposed in a rear portion of the third suction tool.
4. The suction tool for an electric vacuum cleaner according to claim 1, wherein
 - a first engaging part is disposed in one of the first suction tool and the second suction tool, the first engaging part detachably engaging the first suction tool with the second suction tool, and
 - a first to-be-engaged part is disposed in the other one of the first suction tool and the second suction tool, at a position corresponding to the first engaging part, the first to-be-engaged part engaging with the first engaging part.

5. The suction tool for an electric vacuum cleaner according to claim 1, wherein
 - a second engaging part is disposed in the second operation part, the second engaging part detachably engaging the second suction tool with the third suction tool, and
 - a second to-be-engaged part is disposed in the second suction tool, at a position corresponding to the second engaging part, the second to-be-engaged part engaging with the second engaging part.
6. The suction tool for an electric vacuum cleaner according to claim 1, wherein the first operation part disengages the first suction tool from the second suction tool, and pushes up and lifts the first suction tool.
7. The suction tool for an electric vacuum cleaner according to claim 1, wherein the second operation part disengages the second suction tool from the third suction tool, and pushes up and lifts the second suction tool.
8. The suction tool for an electric vacuum cleaner according to claim 1, wherein a first seal member is disposed between the first suction tool and the second suction tool.
9. The suction tool for an electric vacuum cleaner according to claim 1, wherein a second seal member is disposed between the second suction tool and the third suction tool.
10. The suction tool for an electric vacuum cleaner according to claim 8, wherein the first seal member is formed of a soft material having high wear resistance.
11. The suction tool for an electric vacuum cleaner according to claim 9, wherein the second seal member is formed of a soft material having high wear resistance.
12. The suction tool for an electric vacuum cleaner according to claim 1, wherein a soft material is disposed on an end portion of at least one of the first operation part and the second operation part.
13. An electric vacuum cleaner, comprising:
 - a cleaner body including an electric blower for generating suction air; and
 - the suction tool for an electric vacuum cleaner according to any one of claims 1 to 12.

FIG. 1

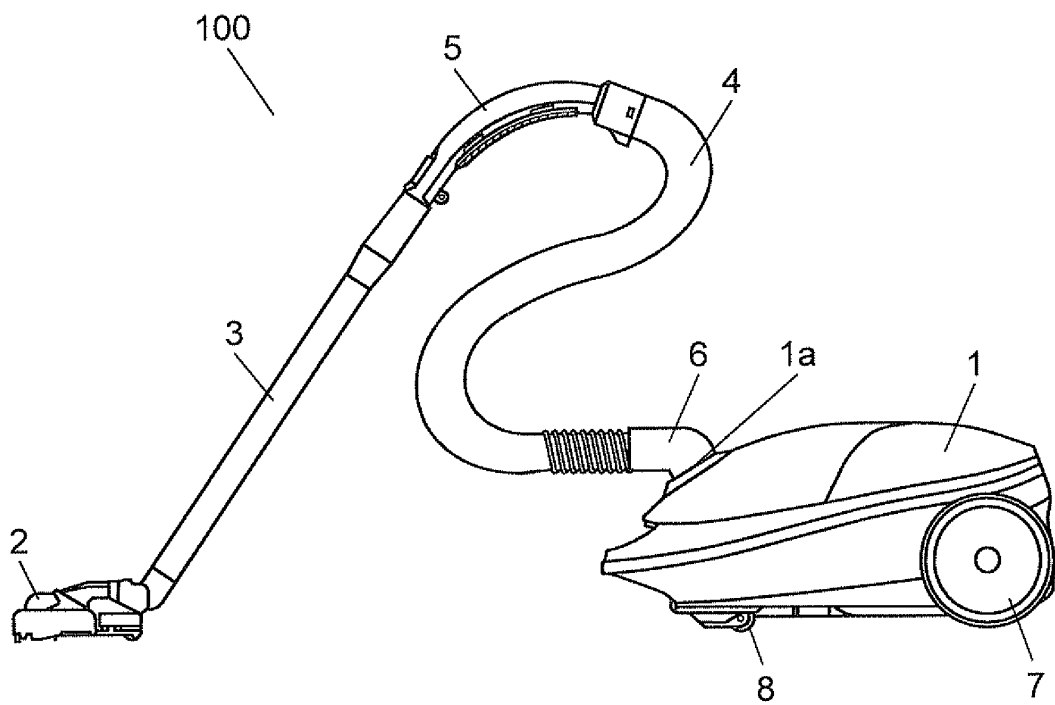


FIG. 2

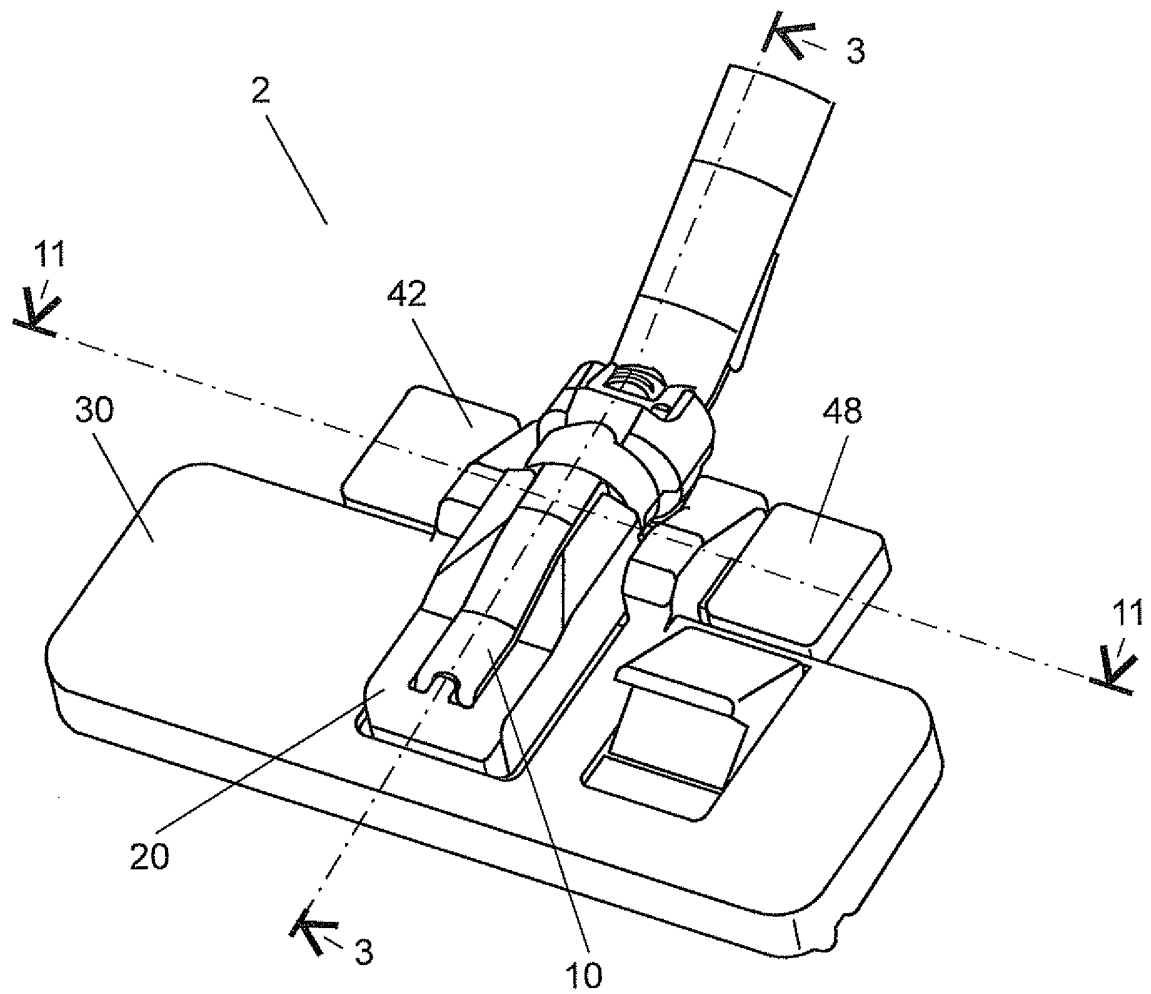


FIG. 3

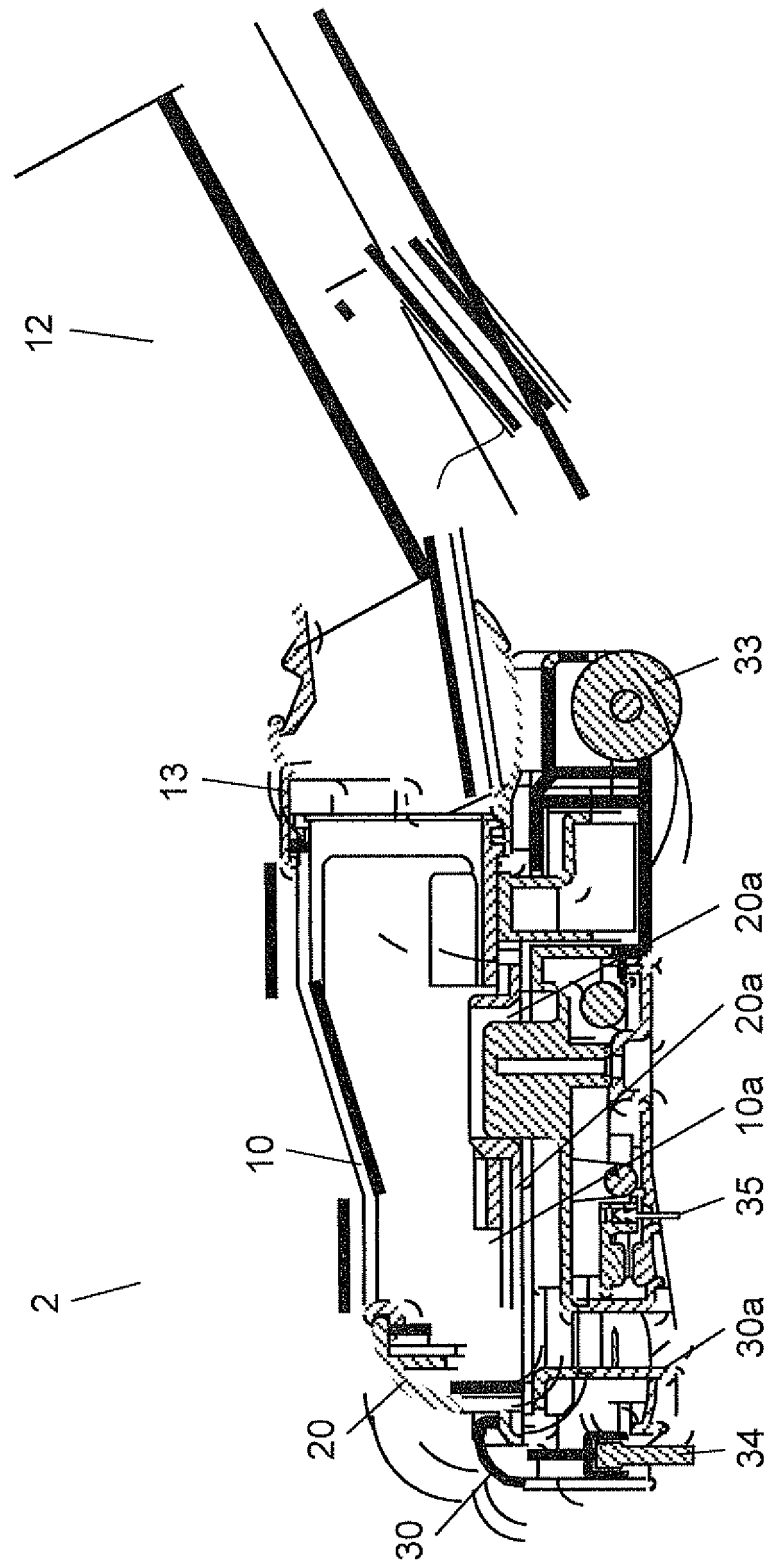


FIG. 4

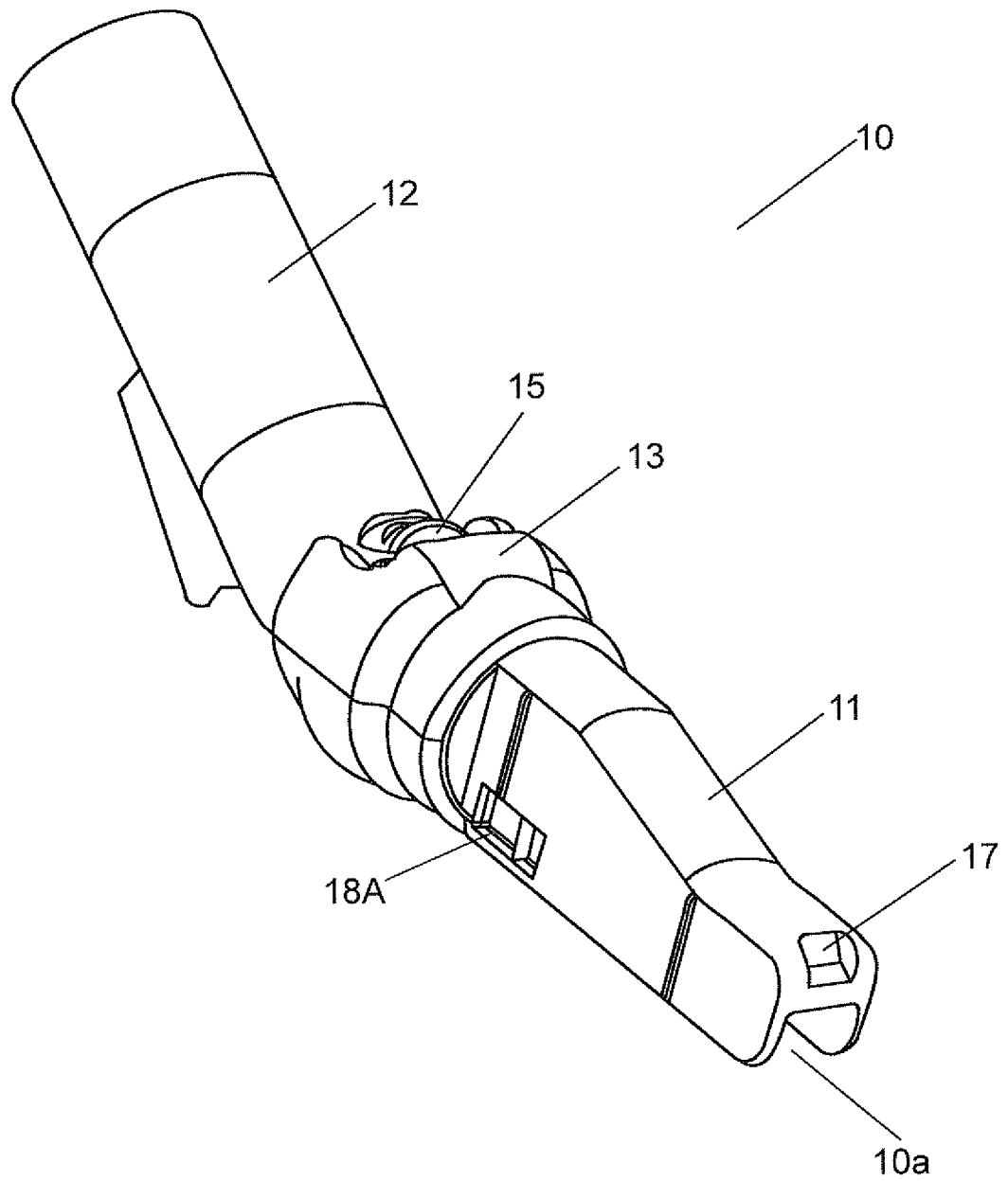


FIG. 5

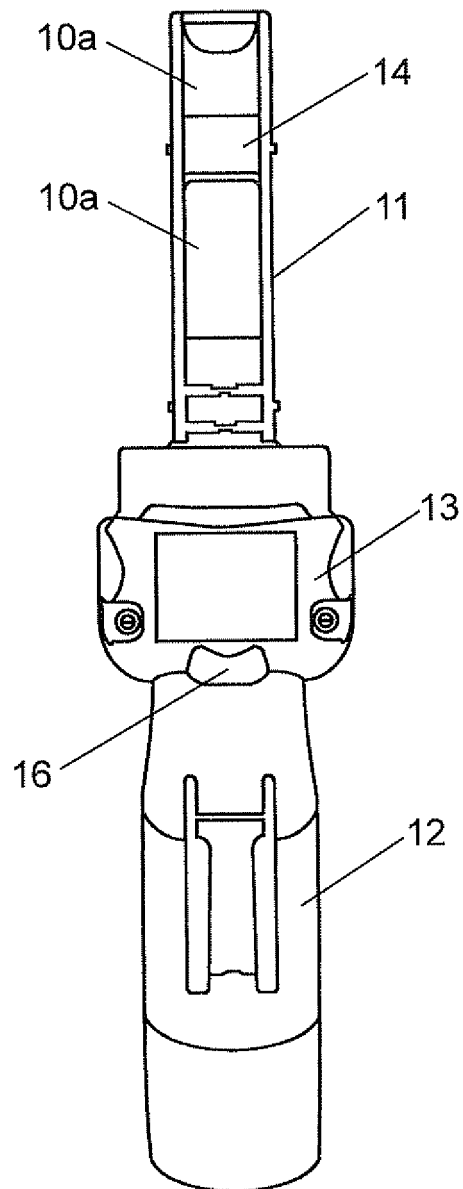


FIG. 6

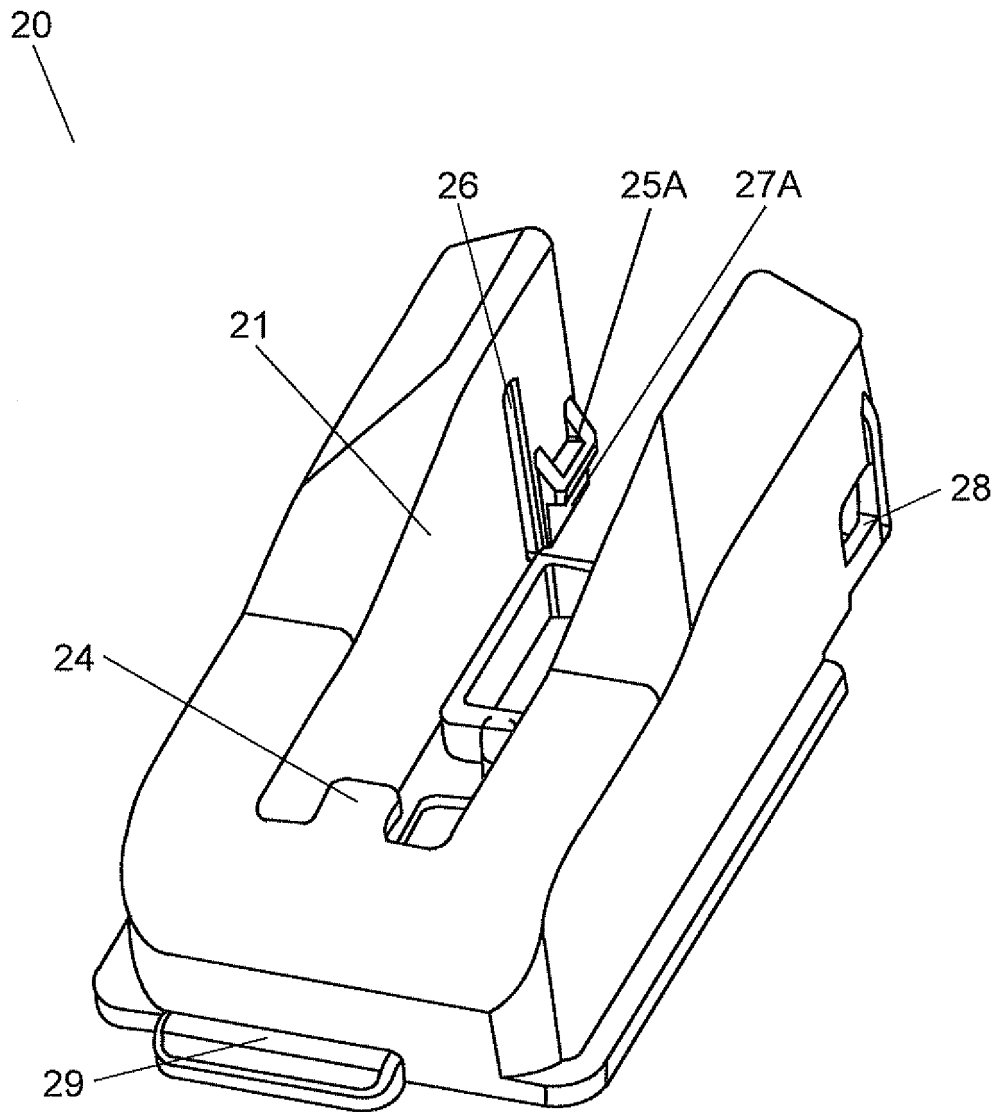


FIG. 7

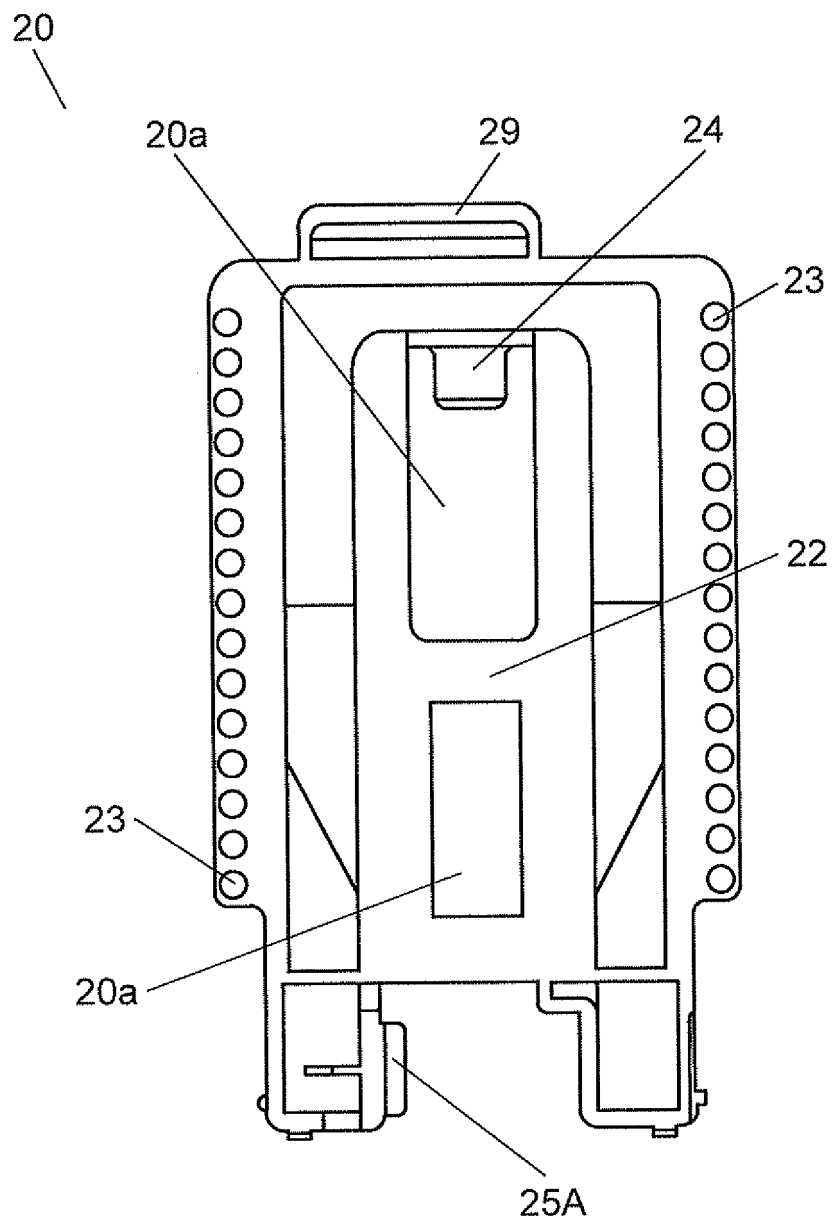


FIG. 8

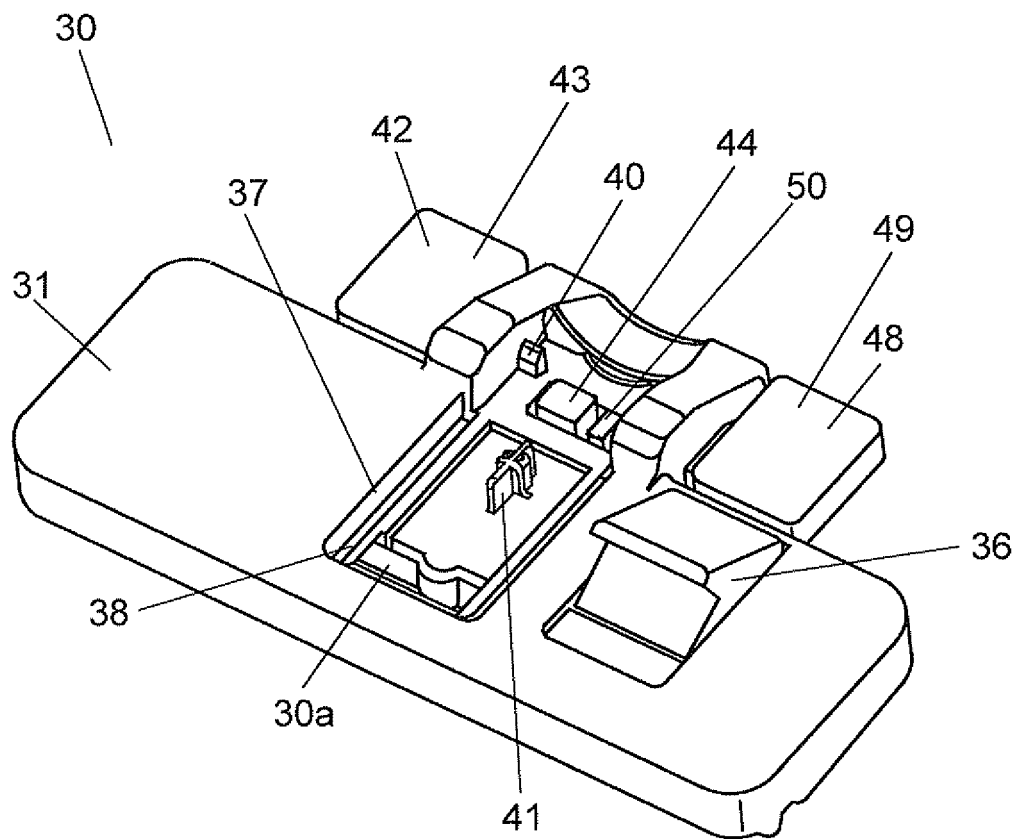


FIG. 9

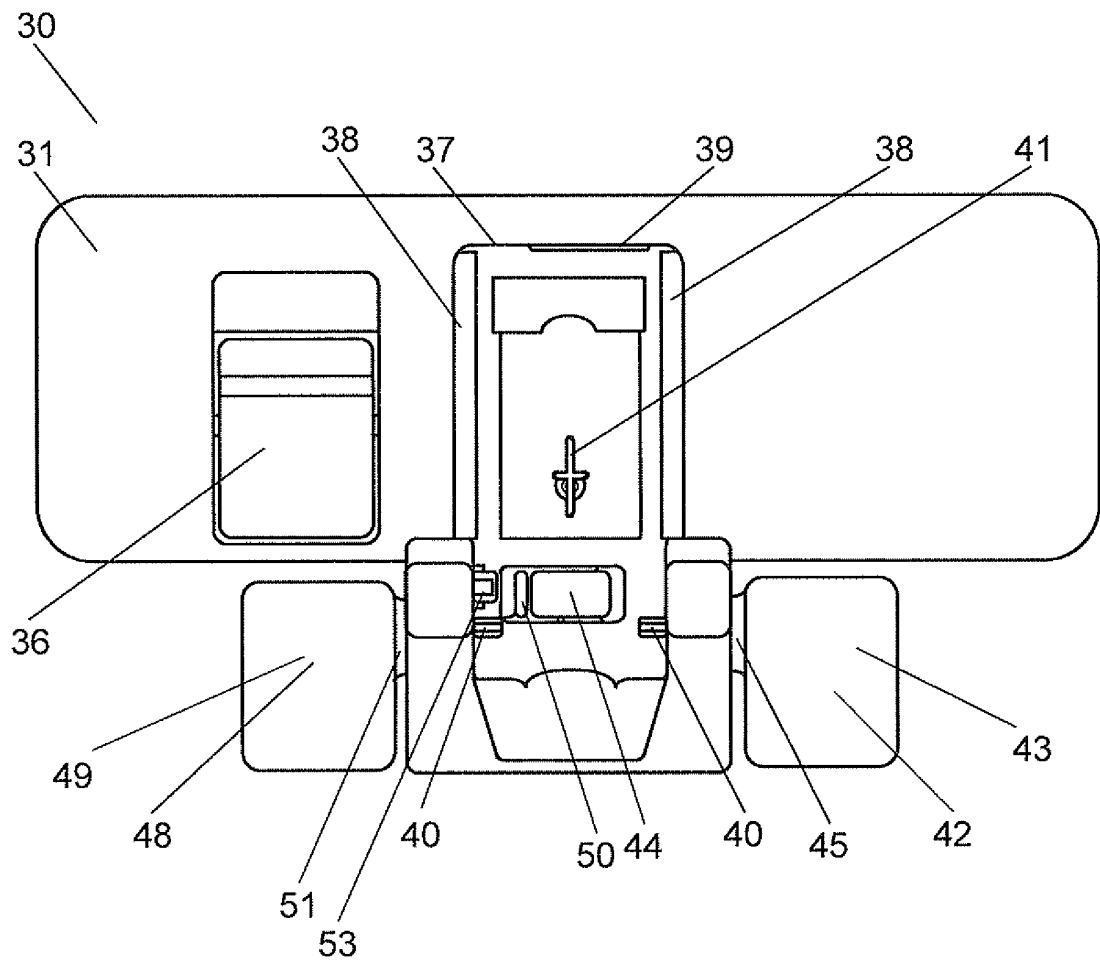


FIG. 10

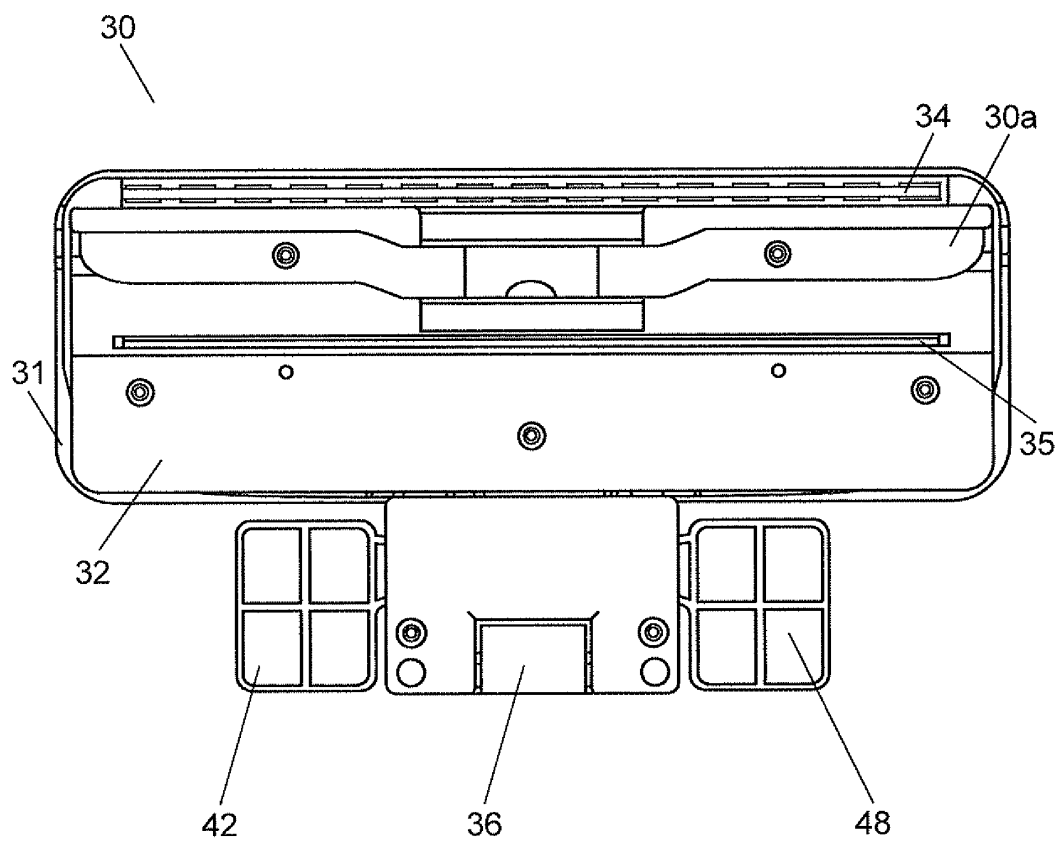


FIG. 11

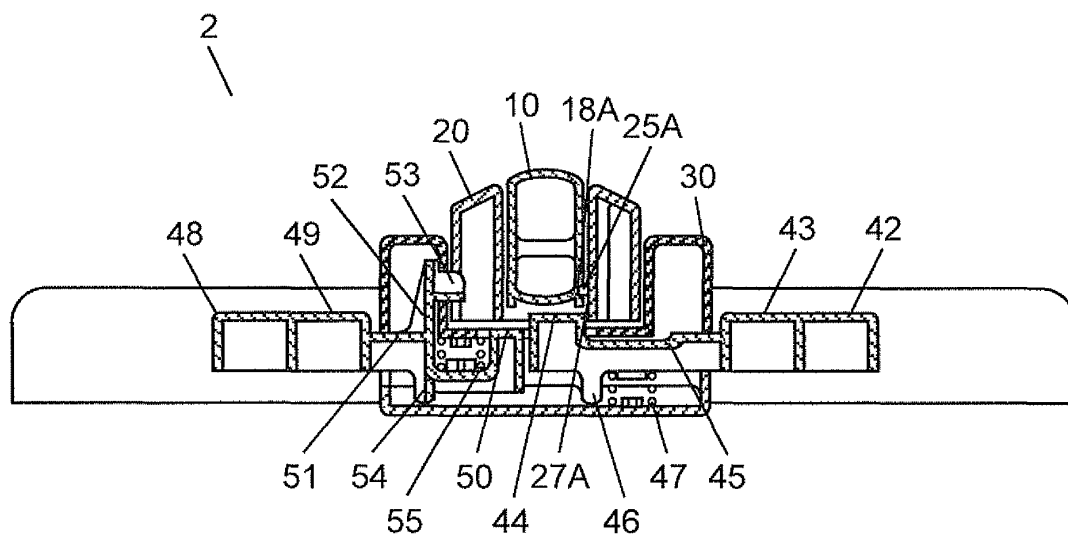


FIG. 12

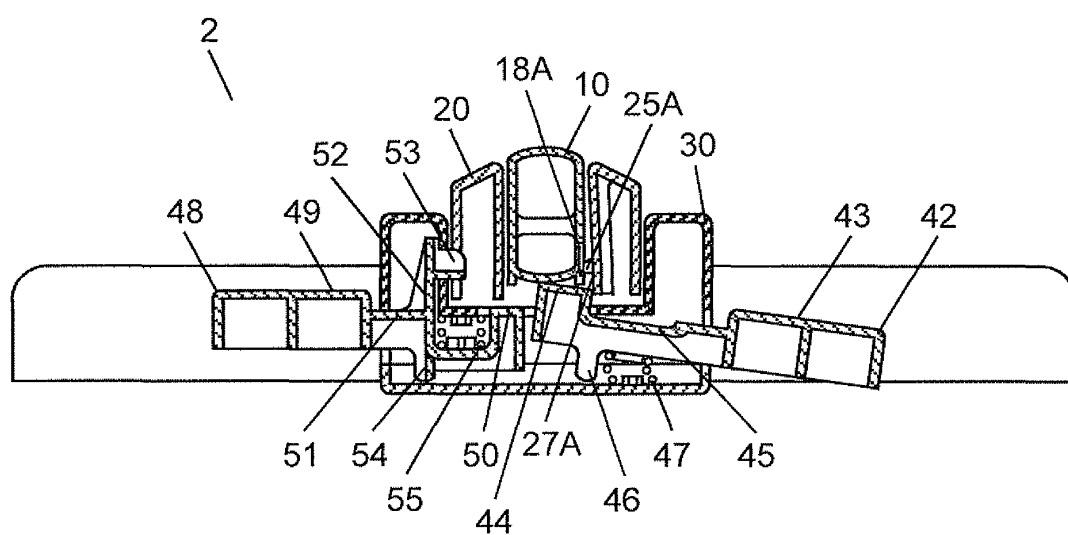


FIG. 13

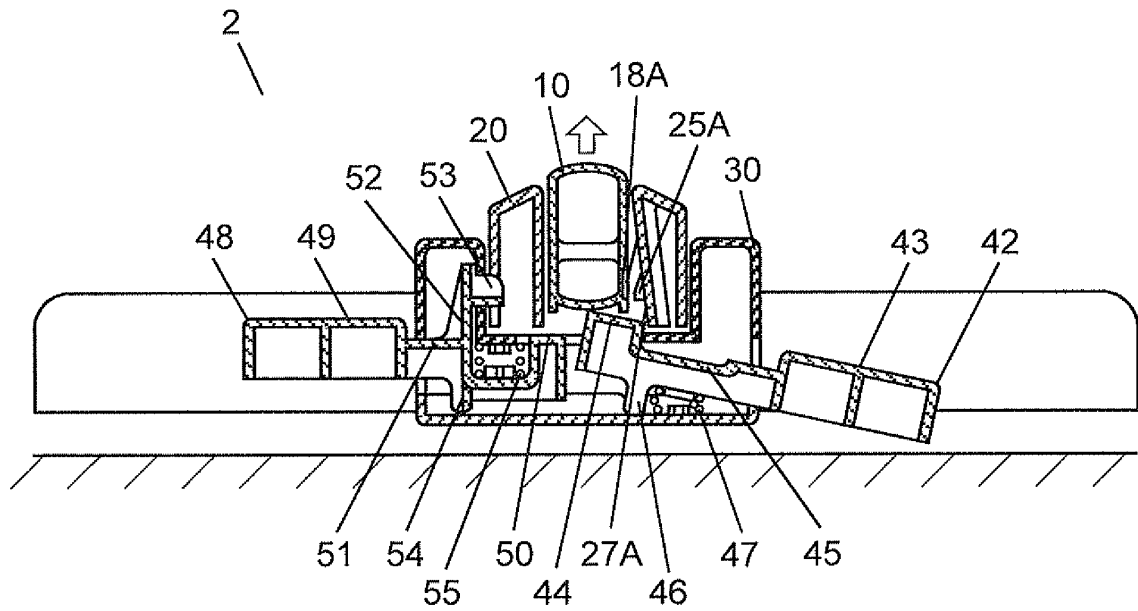


FIG. 14

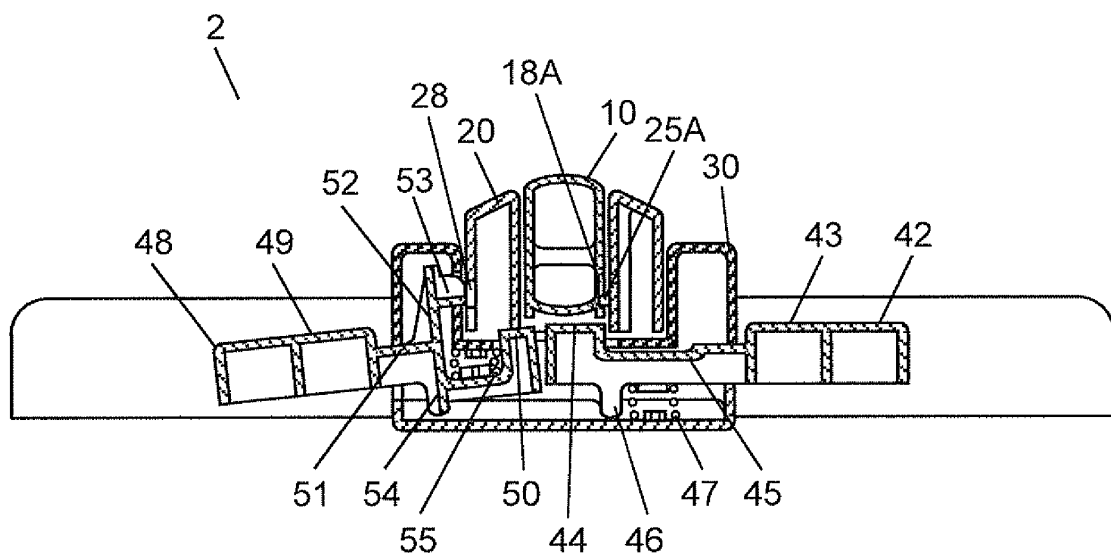


FIG. 15

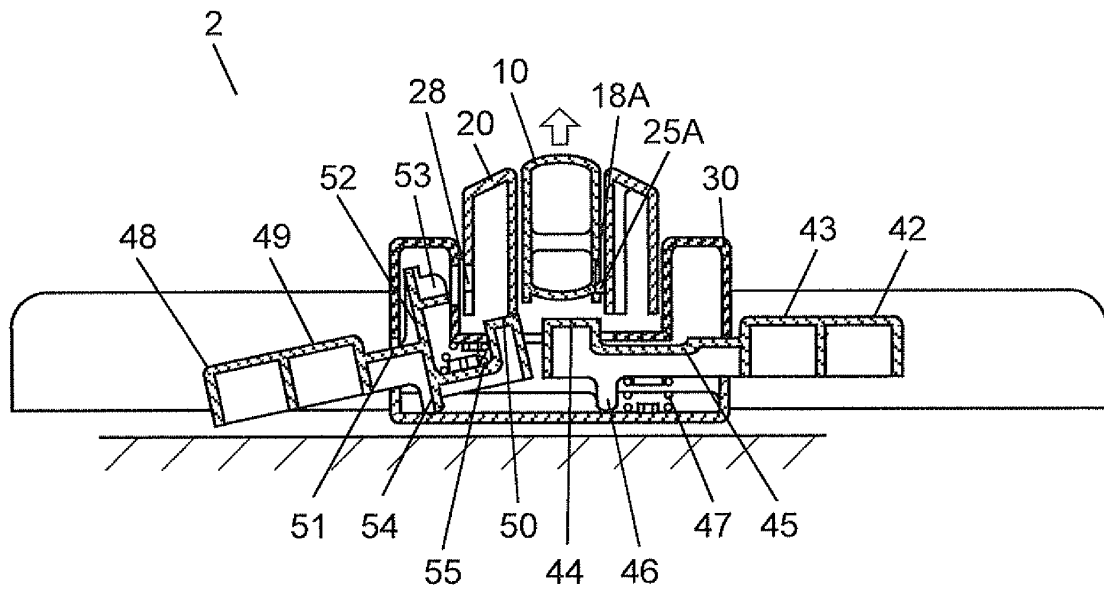


FIG. 16

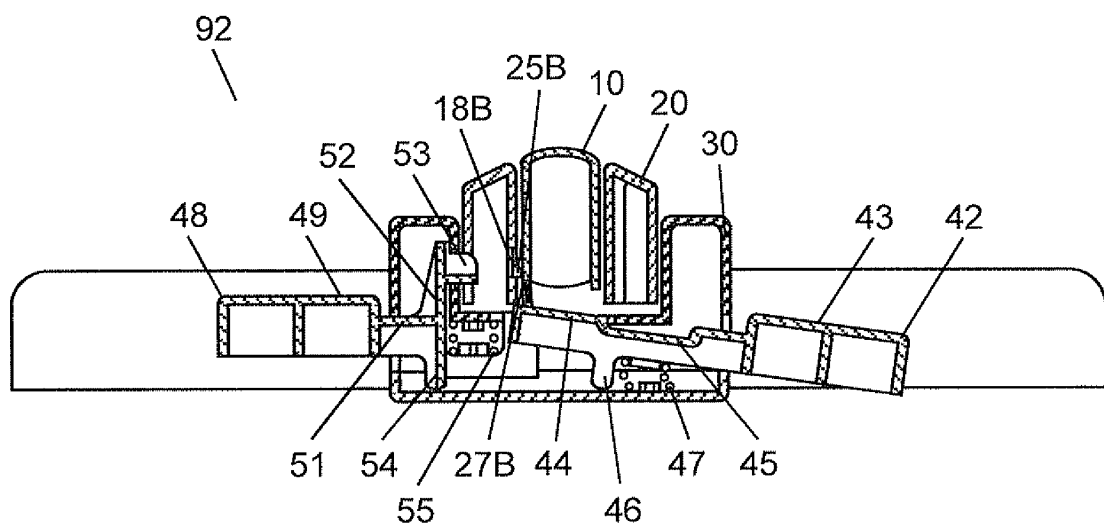


FIG. 17

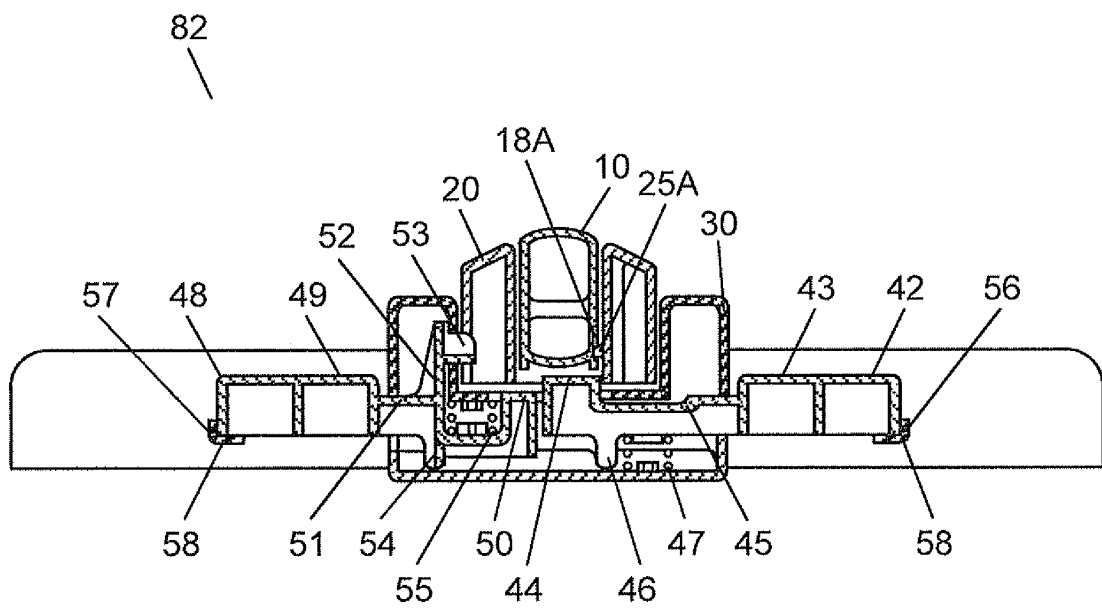


FIG. 18

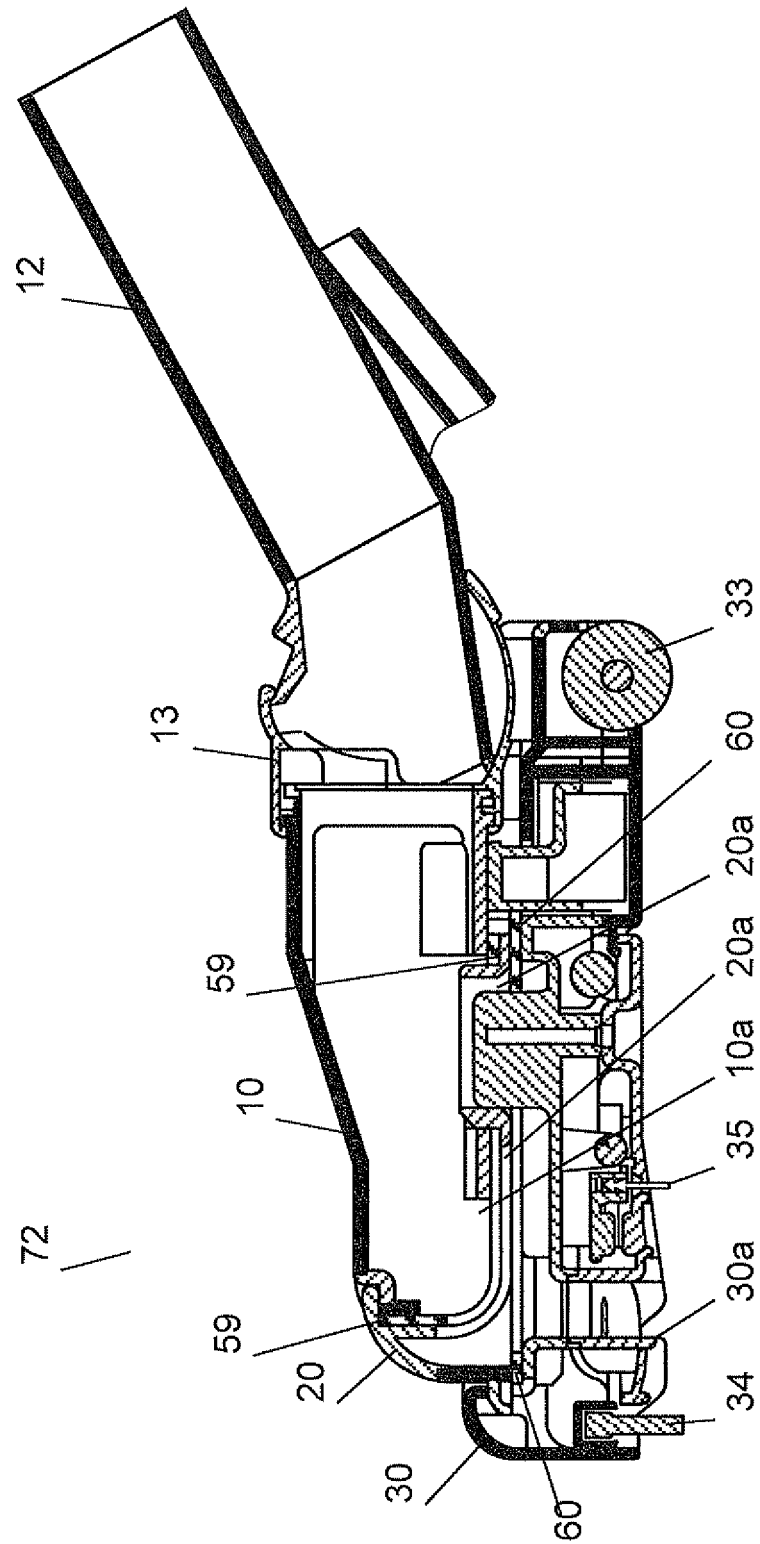
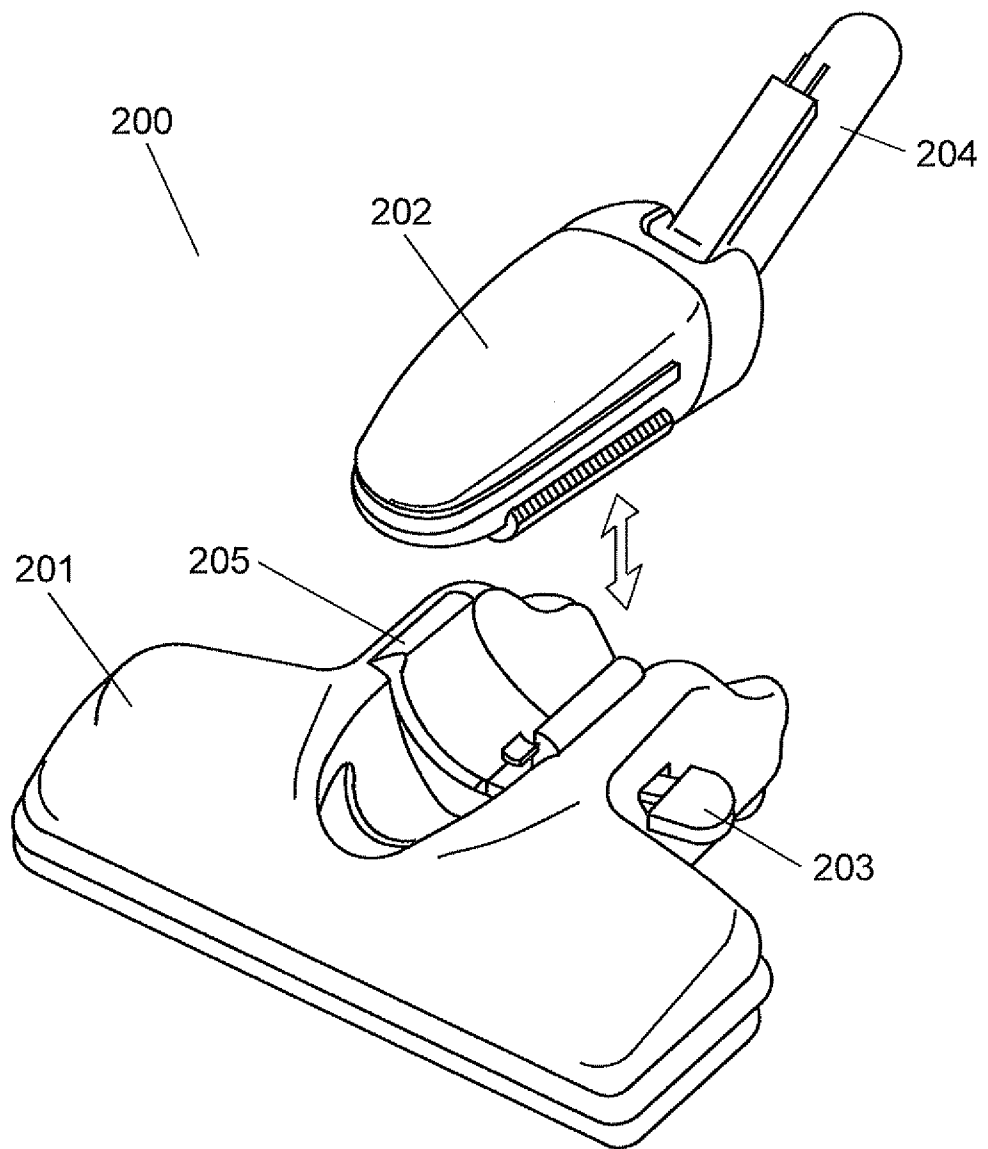


FIG. 19



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/006076

A. CLASSIFICATION OF SUBJECT MATTER A47L9/02 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) A47L9/02		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2011 Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 091458/1981 (Laid-open No. 202860/1982) (Tokyo Electric Co., Ltd.), 24 December 1982 (24.12.1982), entire text; all drawings (Family: none)	1, 2, 4-11, 13 3, 12
Y A	JP 2003-339585 A (Matsushita Electric Industrial Co., Ltd.), 02 December 2003 (02.12.2003), paragraphs [0026] to [0047]; fig. 1 to 10 & US 2003/0217431 A1 & EP 1364608 A2 & CN 1460446 A	1, 2, 4-11, 13 3, 12
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 25 November, 2011 (25.11.11)		Date of mailing of the international search report 06 December, 2011 (06.12.11)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

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