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A request for correction of the drawings has been filed pursuant to Rule 88 EPC. A decision on the request will be taken during the proceedings before the Examining Division (Guidelines for Examination in the EPO, A-V, 3.).

(54) Upright vacuum cleaner with mobile motor housing

(57) An upright vacuum cleaner, comprising a motor housing adapted to house motor means, a flexible suction pipe having a first end connected to the motor housing and a second end defining a suction mouth, and a handle structure for the motor housing and the suction pipe. The handle structure comprises at least two substantially elongated rigid elements, connected to each other through at least one articulated joint. The motor housing is mobile with respect to said handle structure between a first operating position, in which the motor housing locks said at least one articulated joint, and a second operating position, in which the motor housing unlocks said at least one articulated joint, allowing said vacuum cleaner to take up an articulated configuration. Such an articulated configuration is particularly advantageous to carry out the cleaning of difficult-to-reach zones, like the spaces between furniture and floor.

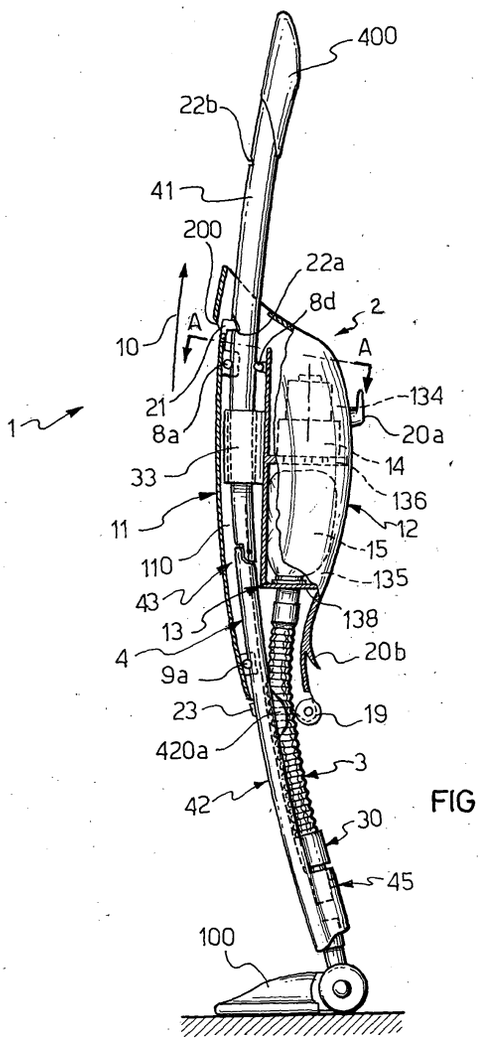

FIG.1

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Description

[0001] The present invention refers to an electric broom.

[0002] Throughout the present description and the subsequent claims, the term "electric broom" is used to indicate an electrically operated suction cleaning device intended to be globally and directly manoeuvred by the user during cleaning operations.

[0003] Electrically operated suction cleaning devices are known; in particular, for domestic cleaning, today electric brooms and vacuum cleaners are commonly used.

[0004] The operating principle of an electrically operated suction cleaning device, either an electric broom or a vacuum cleaner, is known in the art. Normally, such a device comprises an electric motor which actuates a rotor connected, by means of a suction pipe, to a suction mouth. Further tools, such as extension tubes, sliding blocks, brushes or nozzles with different shapes and functions can be mounted on such a suction mouth. The dust and dirt sucked up reach a collection bag through suitable filtration means. The electric motor, the rotor and the collection bag are housed in a machine body, from which the suction pipe extends.

[0005] Whilst still being based upon the same operating principle, the two types of device identified above are, however, manoeuvred and/or used in a substantially different way. In the case of electric brooms, during cleaning operations the user directly manoeuvres the entire device (i.e. both the machine body and the suction pipe); in the case of vacuum cleaners, on the other hand, the user directly manoeuvres just the suction pipe, whereas the machine body is typically mounted on a trolley moved by towing or it is carried over the shoulder.

[0006] A general technical problem common both to electric brooms and to vacuum cleaners, is that relating to the difficulty and awkwardness of use of such devices in cleaning hidden or difficult-to-reach zones, which may be, for example, the spaces between a bed or another piece of furniture and the floor. To carry out the cleaning of such zones the user must, indeed, bend down or take up awkward and/or tiring positions. In particular, in the case of use of an electric broom, the user is forced to tilt the whole electric broom towards the floor to a greater degree the smaller is the space and, to do this, he has to bend down. This, in addition to involve awkward positions during the cleaning operations, can be even more tiring with respect to use, in analogous conditions, a vacuum cleaner, since in the case of electric brooms the user must support the weight of the whole broom and not just of the suction pipe.

[0007] The prior art has some solutions to the problem discussed above. In particular, in the field of vacuum cleaners, these solutions foresee the use of flexible suction pipes and articulated extension tubes.

[0008] For example, patent application EP 1 226 777 discloses an extension tube for suction pipes of a vacuum cleaner comprising an upper portion equipped with grip means and able to be associated with the suction pipe and a lower portion carrying the suction mouth, connected together through an articulated joint which allows the user to bend one portion of the extension tube with respect to the other portion by a predetermined angle and to maintain such a position by locking means of the articulated joint.

[0009] Patent FR 2 772 585 gives an alternative solution to the same problem. It describes an articulated pipe, particularly suitable for suction or ejection pipes of cleaning devices, comprising a first arm constituting a gripping element provided with a grip, a second mobile arm rotatably mounted on the first arm and suitable actuation means of the articulation placed between the two arms. The actuation means of the articulation can be of the mechanical, hydraulic or pneumatic type and are driven by suitable driving members arranged at the grip.

[0010] In the field of electric brooms, on the other hand, the known solutions to the problem discussed above substantially are reduced to the use of additional flexible suction pipes, possibly extendable through rigid extension tubes. The electric broom, in such a case, is used like a conventional vacuum cleaner; i.e. the user grips just the additional flexible suction pipe, whereas the machine body remains stationary with respect to the floor. However, the presence of a machine body that is stationary with respect to the floor substantially limits the functionality of such an electric broom with respect to that of a trolley-type vacuum cleaner, in which the machine body can, however, move with respect to the floor and follow the user during the cleaning operations.

[0011] The technical problem at the basis of the present invention is therefore that of improving the functionality and the operating possibilities of an electric broom in cleaning difficult-to-reach zones, like the spaces between furniture and floor, so as to overcome the drawbacks indicated above with reference to conventional electric brooms.

[0012] The present invention therefore relates to an electric broom, comprising:

- a machine body adapted to house motor means,
- a suction pipe having a first end connected to said machine body and a second end defining a suction mouth,
- a bearing structure for said machine body and said suction pipe,

characterised in that said suction pipe is flexible and in that said bearing structure comprises at least two substantially elongated rigid elements, connected with each other through at least one articulated joint, said machine body being mobile with respect to said bearing structure between a first operating position, in which said machine body locks said at least one articulated joint, and a second operating position, in which said machine body unlocks said at least one articulated joint, allowing said

electric broom to take up an articulated configuration.

[0013] Advantageously, the electric broom of the present invention thus has an articulated structure, this characteristic allowing the user to also carry out cleaning of spaces or other difficult-to-reach zones, maintaining a comfortable working position (i.e. without bending over or stooping down).

[0014] Even more advantageously, the electric broom of the present invention has the possibility of taking up different operating configurations according to the needs of use. In particular, it can take up a first non-articulated operating configuration, in which the machine body is in the first operating position and locks the articulated joint of the bearing structure thus preventing the articulation of the bearing structure (in this configuration the electric broom is used in a conventional manner), and a second articulated operating configuration, specific to the present invention, in which the machine body is in the second operating position and unlocks the articulated joint, thus allowing the articulation of the bearing structure. In this last configuration, the upper part of the electric broom can maintain the most comfortable tilt for the user gripping it, whereas the lower part can take up a different tilt, up to being substantially parallel to the surface to be cleaned, so as to be able to easily introduce it under furniture or in other spaces otherwise difficult to reach. Advantageously, the suction pipe, being flexible, can easily adapt to both of the configurations discussed above.

[0015] In the preferred embodiment of the electric broom of the present invention, the motor means comprise, in particular, an alternating current electric motor supplied via a cable; however, it is possible to foresee alternative embodiments comprising direct current electric motors supplied through batteries, that may be rechargeable.

[0016] In accordance with the present invention, in the electric broom of the present invention the articulated joint is therefore locked or else unlocked by simply moving the machine body on the bearing structure. This way of actuating the articulated joint avoids the provision of specific actuation means (such as those disclosed in patent application EP 1 226 777 and in patent FR 2 772 585 discussed above) which could be subject to failure and/or breaking.

[0017] Preferably, the machine body of the electric broom of the present invention is slidable on said bearing structure between said first operating position, in which the machine body covers said at least one articulated joint preventing the articulation of said at least two rigid elements, and said second operating position, in which the machine body uncovers said at least one articulated joint, allowing the articulation of said at least two rigid elements. The user can thus advantageously arrange the broom for passage from the non-articulated configuration to the articulated configuration, and vice-versa, by simply displacing the machine body from the first to the second operating position (i.e. displacing the machine body upwards) and vice-versa (i.e. displacing the machine body downwards).

[0018] In a less preferred, but still useful, alternative embodiment, the machine body, instead of being able to slide on the bearing structure, is rotatable with respect to the bearing structure, again so as to be able to lock/unlock the articulated joint with a simple movement of the machine body with respect to the bearing structure.

[0019] In an embodiment of the electric broom of the present invention, said at least one articulated joint comprises at least one hinge acting between said at least two rigid elements and, optionally, at least one return spring acting on said at least one hinge. Advantageously, the use of said at least one hinge allows passage from the non-articulated configuration to the articulated configuration by simply applying a pressure on the bearing structure or on the machine body and passage from the articulated configuration to the non-articulated configuration by simply lifting the bearing structure or the machine body, without the need to carry out further movements.

[0020] The additional use of said return spring, whilst still being optional, allows better control of said at least one articulated joint, both in the step of passage from one operating configuration to the other, and during the cleaning operations carried out in the articulated configuration. The rigidity of such a return spring can be calibrated based upon the relative weight of the at least two rigid elements and of the machine body.

[0021] Preferably, the electric broom of the present invention comprises stop means adapted to keep said machine body in said first and second operating positions. The presence of such stop means is particularly advantageous because they allow the machine body to remain in said first and second operating positions without having to constantly be supported by the user, thisbeing somewhat awkward and tiring.

[0022] In a preferred embodiment thereof, the electric broom of the present invention comprises support and sliding means of said machine body on a floor when said electric broom is in said articulated configuration. This allows the user to carry out the cleaning of the spaces between furniture and floor without having to bear the weight of the electric broom.

[0023] More preferably, said support and sliding means comprise a wheel associated at a lower end of said machine body. The presence of such a wheel advantageously allows to avoid said machine body resting directly upon the floor and/or sliding upon it, thus easing the moving of the electric broom and avoiding scratches or damage to the floor surface.

[0024] Preferably, said bearing structure has at least one longitudinal seat having a substantially C-shaped section for at least partially housing said suction pipe in a removable manner. Even more preferably, said bearing structure comprises, at a lower end thereof, a seat for removably receiving said second end of said suction pipe. Such characteristics allow the electric broom ob-

ject of the present invention to be given greater versatility. Indeed, it can be used in a conventional manner, when the flexible suction pipe is housed in the longitudinal seat with a C-shaped section of the bearing structure and its free end, defining the suction mouth, is housed in the respective seat provided at the lower end of the bearing structure. The flexible suction pipe can, however, also be removed from the bearing structure and be handled separately from the rest of the electric broom (in particular from the machine body); this is useful for reaching angles or other points which the electric broom could not reach or even to carry out the cleaning of sofas or other furnishings.

[0025] Preferably, said machine body is removably associated with said bearing structure. This characteristic gives further versatility in use of the electric broom object of the present invention. The user has, indeed, the possibility, after having removed said suction pipe from the seats described above, of withdrawing or completely extracting said bearing structure from said machine body and then using the electric broom substantially as a conventional vacuum cleaner, carrying the machine body over the shoulder and gripping the free end of said suction pipe for cleaning.

[0026] Further characteristics and advantages of the present invention shall become clearer from the following detailed description of a preferred embodiment thereof, made with reference to the attached drawings. In such drawings,

- figure 1 is a partial section side view of an electric broom in accordance with the present invention in a first operating configuration thereof;
- figure 2 is a side view of the electric broom of figure 1 in a second operating configuration thereof;
- figure 3 is a side view of the electric broom of figure 1 in a third operating configuration thereof;
- figure 4 is an exploded perspective view, from a first observation point, of a portion of the electric broom of figure 1;
- figure 5 is an exploded perspective view, from a second observation point, of the electric broom of figure 1;
- figure 6 is a side view of the electric broom of figure 1 in a further operating configuration thereof;
- figure 7 is a cross section of the electric broom of figure 1 taken at the line A - A;
- figure 8 is a perspective view of a detail of the electric broom of figure 1.

[0027] In the figures an electric broom in accordance with the present invention is indicated with 1. The electric broom 1 comprises a machine body 2, a flexible suction pipe 3 and a bearing structure 4 for the machine body 2 and for the suction pipe 3.

[0028] With particular reference to figures 1, 4 and 5, the machine body 2 comprises a front body 11 and a rear body 12, able to be associated with each other (through corresponding pins 110a and 110c respectively visible in figure 4 and 5) and overall forming an outer shell having a substantially ovoidal cross section. The machine body 2 also comprises an inner support structure 13 placed between the front body 11 and the rear body 12 and associated with them through corresponding pins 110b (visible in figure 4). The inner support structure 13 is suitable for supporting an electric motor 14 and a collection bag 15 of the dust sucked up (schematically illustrated in figures 1-3).

[0029] Between the front body 11 and the inner support structure 13 a space 110 is formed for housing the bearing structure 4 (see in particular figure 7).

[0030] The inner support structure 13 of the machine body 2, as shown in figure 1 and in greater detail in figure 4, comprises: un upper space 134 suitable for housing the motor 14; a lower space 135 suitable for housing the collection bag 15; a first shelf 136 suitable for supporting the motor 14 and provided with a through-hole 137 which allows the connection between the motor 14 and the collection bag 15; a second shelf 138, arranged below the first shelf 136, suitable for supporting the collection bag 15 and provided with a through-hole 139 which allows the connection between the collection bag 15 and the suction pipe 3. The side walls of the upper space 134 are provided with air vents 16a and 16b which ensure the ventilation of the electric motor 14.

[0031] The front body 11, as can be seen in figures 4 and 5, is manufactured in a single piece and comprises, at the air vents 16a and 16b, a plurality of slits 17a and 17b for allowing the passage of air between the inside of the machine body 2 and the outside.

[0032] The rear body 12 is, on the other hand, manufactured in three distinct portions 12a, 12b and 12c, respectively corresponding to the upper space 134, the lower space 135, and the connection zone between collection bag 15 and suction pipe 3. This advantageously allows inspection or intervention on the motor 14 or on the collection bag 15 without necessarily having to disassemble all of the rear body 12.

[0033] On the outer surface of the upper portion 12a and of the lower portion 12c some cable-winding hooks 20a and 20b are formed, suitable for allowing the power supply cable to be wound up when the electric broom 1 is not used. At its upper end, the rear body 12 comprises a hole 120 for housing the bearing structure 4.

[0034] The machine body 2 slides on the bearing structure 4 between a first operating position, illustrated in figure 1, and a second operating position, illustrated in figure 2. Such sliding takes place thanks to a plurality of sliding elements suitably placed between the machine body 2 and the bearing structure 4. Preferably, such a plurality of sliding elements comprises a first group of rollers 8a, 8b, 8c, 8d positioned at the upper end of the machine body 2 and visible in detail in the section of figure 7, and a second group of rollers 9a, 9b, 9c positioned at the lower end of the machine body 2 and also visible in figure 4. The first group of rollers com-

prises: a front roller 8a, a rear roller 8d and two side rollers 8b and 8c; the seats of the front roller 8a and of the two side rollers 8b, 8c are formed in the front body 11, whereas the seat of the rear roller 8d is formed in the inner support structure 13. The second group of rollers comprises: a front roller 9a and two side rollers 9b and 9c, the seats of which are all formed in the front body 11 (see figure 4). Such an arrangement of the rollers on the front body 11 and on the inner support structure 13 of the machine body 2 allows better guiding during the sliding of the machine body 2 on the bearing structure 4 and eases possible maintenance or replacement operations of one or more rollers; such operations can, indeed, be carried out by simply disassembling the front body 11 and/or the inner support structure 13 of the machine body 2. However, it is obvious that the sliding of the machine body 2 on the bearing structure 4 can be realised through technical solutions different to the one described above, such solutions in any case being conventional and easily identifiable for a person skilled in the art.

[0035] The sliding of the machine body 2 from the first to the second operating position is commanded by the user who grips the machine body 2 at a suitable handle 200 formed on the front body 11.

[0036] The electric broom 1 of the present invention is provided with means for keeping the machine body 2 in the aforementioned first and second operating position. Such means comprise a pawl 21, formed on the inner surface of the front body 11, near to its upper end. Such a pawl 21 is suitable for engaging in a cut 22a when the machine body 2 is in the first operating position (see figure 1) and in a cut 22b when the machine body 2 is in the second operating position (see figure 2), the cuts 22a and 22b being formed on the outer surface of the bearing structure 4. A limit stroke projection 23 is also provided, against which the machine body 2 abuts by gravity when it is in the first operating position.

[0037] In the space 110 a plurality of guide means is provided for the sliding of the machine body 2 on the bearing structure 4, suitable for keeping the bearing structure 4 in the correct position within the machine body 2 during the use of the electric broom 1. Such guide means comprise, in particular, a sliding rail 31, partially visible in figure 4, formed on the inner surface of the front body 11, a guide 32, visible in figure 5, formed on the outer surface of the inner support structure 13 and a sleeve 33, visible in figures 1-5, associated with the outer surface of the inner support structure 13 and adapted to house the bearing structure 4 in such a way as to still be able to withdraw or completely extract the bearing structure 4 from the machine body 2. In this respect, the bearing structure 4 comprises, at the upper end thereof, a grip 400 with a greater section with respect to that of the bearing structure 4 and of the hole 120 of the rear body 12, such a grip 400 being removably associated telescopically to the bearing structure 4 to allow the extraction of the bearing structure 4 from the machine body 2.

[0038] The bearing structure 4 comprises a substantially elongated first rigid element 41 and a second rigid element 42 also substantially elongated, connected with each other through an articulated joint 43, which allows the relative articulation of the aforementioned rigid elements.

[0039] In a first embodiment of the present invention, such an articulated joint 43 comprises a hinge 44; in another embodiment considered to be of interest (not shown), the articulated joint also comprises a return spring acting upon the hinge 44. The rigidity of such a return spring can be suitably chosen based upon the relative weight of the two rigid elements 41, 42 and of the machine body 2. In both of the quoted embodiments it is possible to pass from a non-articulated electric broom configuration (figure 1) to an articulated electric broom configuration (figure 3) by simply applying a pressure upon the grip 400 or upon the machine body 2 and to pass from the articulated configuration to the non-articulated configuration by simply lifting the grip 400 or the machine body 2.

[0040] At least one portion of the first rigid element 41 and of the second rigid element 42 (in the embodiment illustrated in the attached drawings, all of the second rigid element) have a C-shaped section, visible in figure 4 and in figure 8, for housing the suction pipe 3 so as to hold it in position during operation at the same time ensuring its protection and support. The keeping in position of the flexible suction pipe 3 in the rigid element 42 takes place with the help of two tabs 420a and 420b.

[0041] The second rigid element 42 of the bearing structure 4 comprises, at its lower end, a seat 45 for removably receiving a suction mouth 30 of the suction pipe 3. In a preferred embodiment, the coupling between the suction mouth 30 and the seat 45 is of the bayonet type, as shown in detail in figure 8. With reference to such a figure, the seat 45 comprises, in particular, a sleeve 46 adapted to house the free end of the suction pipe 3 defining the suction mouth 30. A substantially L-shaped cut 47 is formed on the sleeve 46, this cut being suitable for engaging a corresponding engagement projection 48 formed on the surface of the suction mouth 30. It is, however, possible to foresee types of coupling different to the one described above, like, for example, a coupling with a snap mechanism comprising an ovoidal button acting in the seat 45 and adapted to snap engage in a corresponding recess or hole formed on the side surface of the suction mouth 30 and disengageable from the aforementioned recess or hole through a suitable release pedal.

[0042] The machine body 2 comprises, at a lower end portion thereof, a wheel 19 housed in a suitable seat 190 and adapted to rest the machine body 2 on the floor when the broom is in the articulated configuration (figure 3) at the same time avoiding the machine body sliding on the floor itself.

[0043] The broom of the present invention can be

equipped with conventional accessories such as a sliding block 100 associated with the lower end of the bearing structure 4 and of the suction pipe 3 in a totally conventional manner.

[0044] The operation of the electric broom of the present invention can be illustrated with reference to figures 1, 2 and 3, which show, overall, three different operating configurations thereof.

[0045] In figure 1 the non-articulated configuration is represented, in which the machine body 2 abuts against the limit stroke projection 23 and the pawl 21 engages in the cut 22a; the broom body 1 is thus in said first operating position and covers the articulated joint 43 locking it. To pass to the articulated configuration, represented in figure 2, the user makes the machine body 2 slide in the direction indicated by the arrow 10 in figure 1, acting upon the handle 200, until the pawl 21 is positioned in the cut 22b; the machine body is thus in said second operating position and uncovers the articulated joint 43, making it operative. The user then applies a light pressure upon the front part of the machine body 2 to actuate the articulation. In figure 3 a typical articulated configuration is represented, particularly advantageous for carrying out cleaning under furniture or in other spaces being difficult to reach in a non-articulated configuration. In such a non-articulated configuration the second rigid element 42 of the bearing structure 34 is substantially parallel to the floor surface to be cleaned, whereas the first rigid element 41, on which the machine body 2 abuts in said second operating position, keeps a tilt with respect to such a surface which is comfortable for the user; the machine body 2 comes into contact with the floor surface through the support wheel 19. To go back to the non-articulated configuration, first of all the user slightly lifts the electric broom, by acting on the grip 400, so as to allow the articulated joint 43 to go back into the non-articulated rest position. Then, by acting upon the handle 200, the user disengages the pawl 21 from the cut 22b and makes the machine body 2 slide in the opposite direction to the one indicated by the arrow 10 until it is once again brought into said first operating position, in which the machine body 2 abuts against the limit switch projection 23 and locks the articulated joint 43.

[0046] A further way of use is shown in figure 6, which shows the electric broom of the present invention in the non-articulated configuration, with the suction pipe 3 extracted from its housing in the bearing structure 4 and the suction mouth 30 free from the seat 45, so that the user can directly manoeuvre just the suction pipe 3.

Claims

1. Electric broom, comprising:

- a machine body adapted to house motor means,
- a suction pipe having a first end connected to said machine body and a second end defining a suction mouth,
- a bearing structure for said machine body and said suction pipe, **characterised in that** said suction pipe is flexible and that said bearing structure comprises at least two substantially elongated rigid elements, connected to each other through at least one articulated joint, said machine body being mobile with respect to said bearing structure between a first operating position, in which said machine body locks said at least one articulated joint, and a second operating position, in which said machine body unlocks said at least one articulated joint, allowing said electric broom to take up an articulated configuration.

2. Electric broom according to claim 1, wherein said machine body is able to slide on said bearing structure between said first operating position, in which said machine body covers said at least one articulated joint preventing the articulation of said at least two rigid elements, and said second operating position, in which said machine body uncovers said at least one articulated joint, allowing the articulation of said at least two rigid elements.

3. Electric broom according to any one of the previous claims, comprising stop means adapted to keep said machine body in said first and second operating positions.

4. Electric broom according to any one of the previous claims, comprising support and sliding means of said machine body on a floor when said electric broom is in said articulated configuration.

5. Electric broom according to claim 4, wherein said support and sliding means of said machine body on a floor comprise a wheel associated with said machine body at a lower end thereof.

6. Electric broom according to any one of the previous claims, wherein said bearing structure has at least one longitudinal seat having a substantially C-shaped section for at least partially housing said suction pipe in a removable manner.

7. Electric broom according to any one of the previous claims, wherein said bearing structure comprises, at a lower end thereof, a seat for removably receiving said second end of said suction pipe.

8. Electric broom according to any one of the previous claims, wherein said machine body is removably associatedwith said bearing structure.

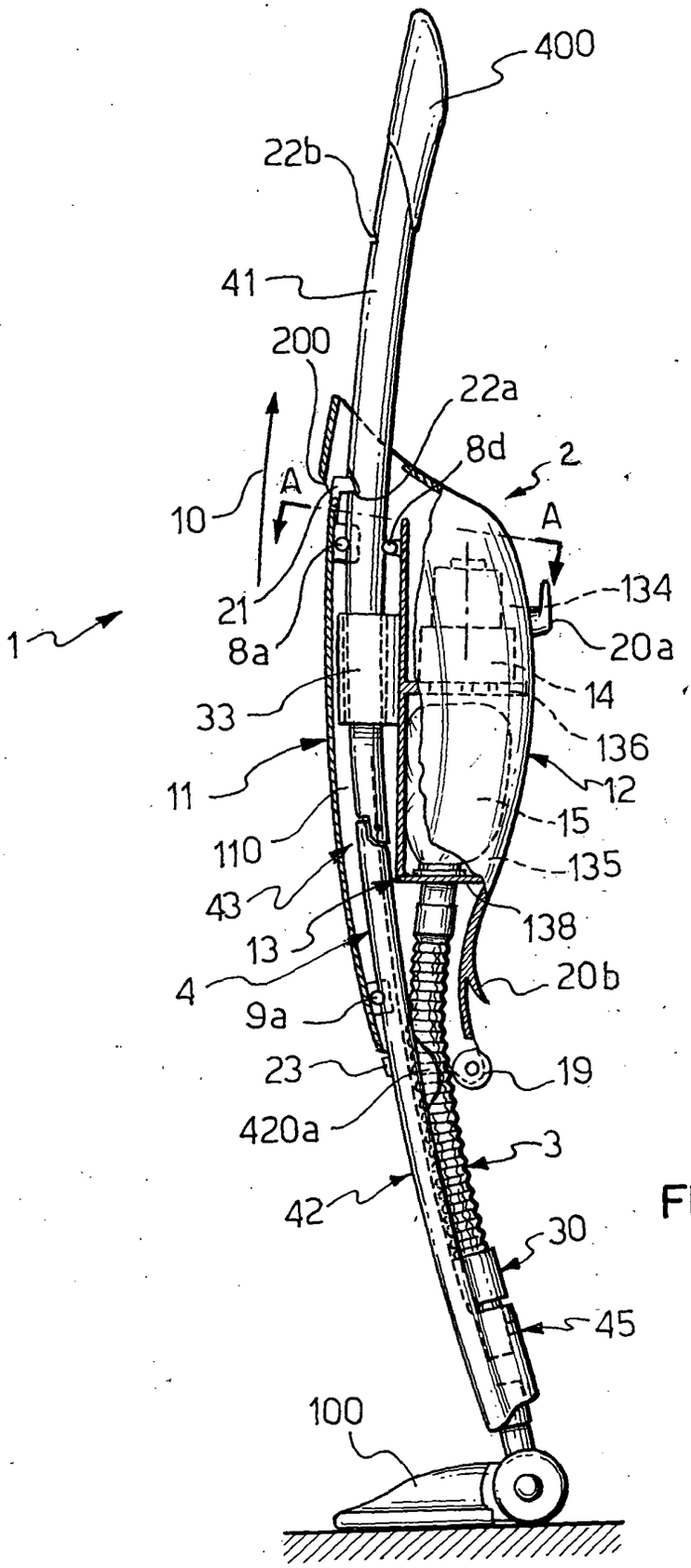
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FIG.1

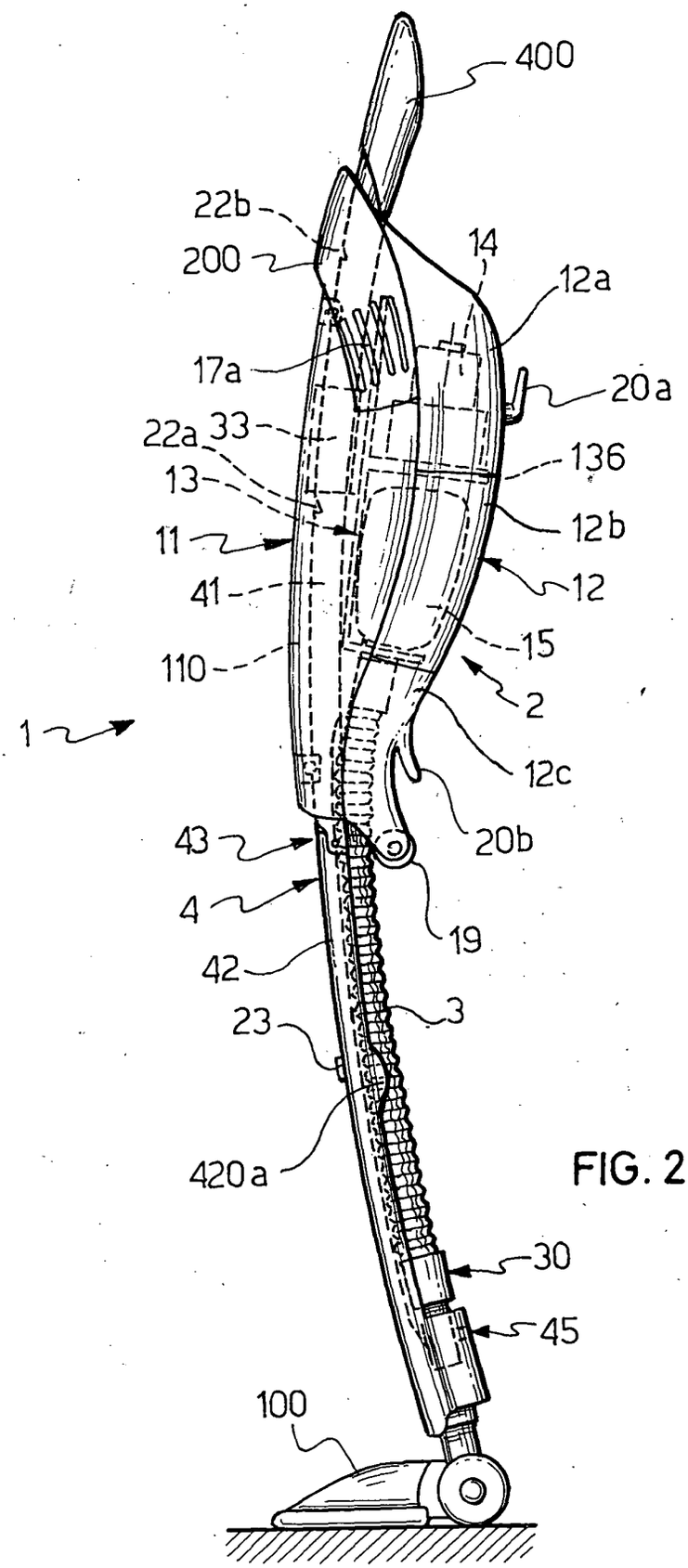
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FIG. 2

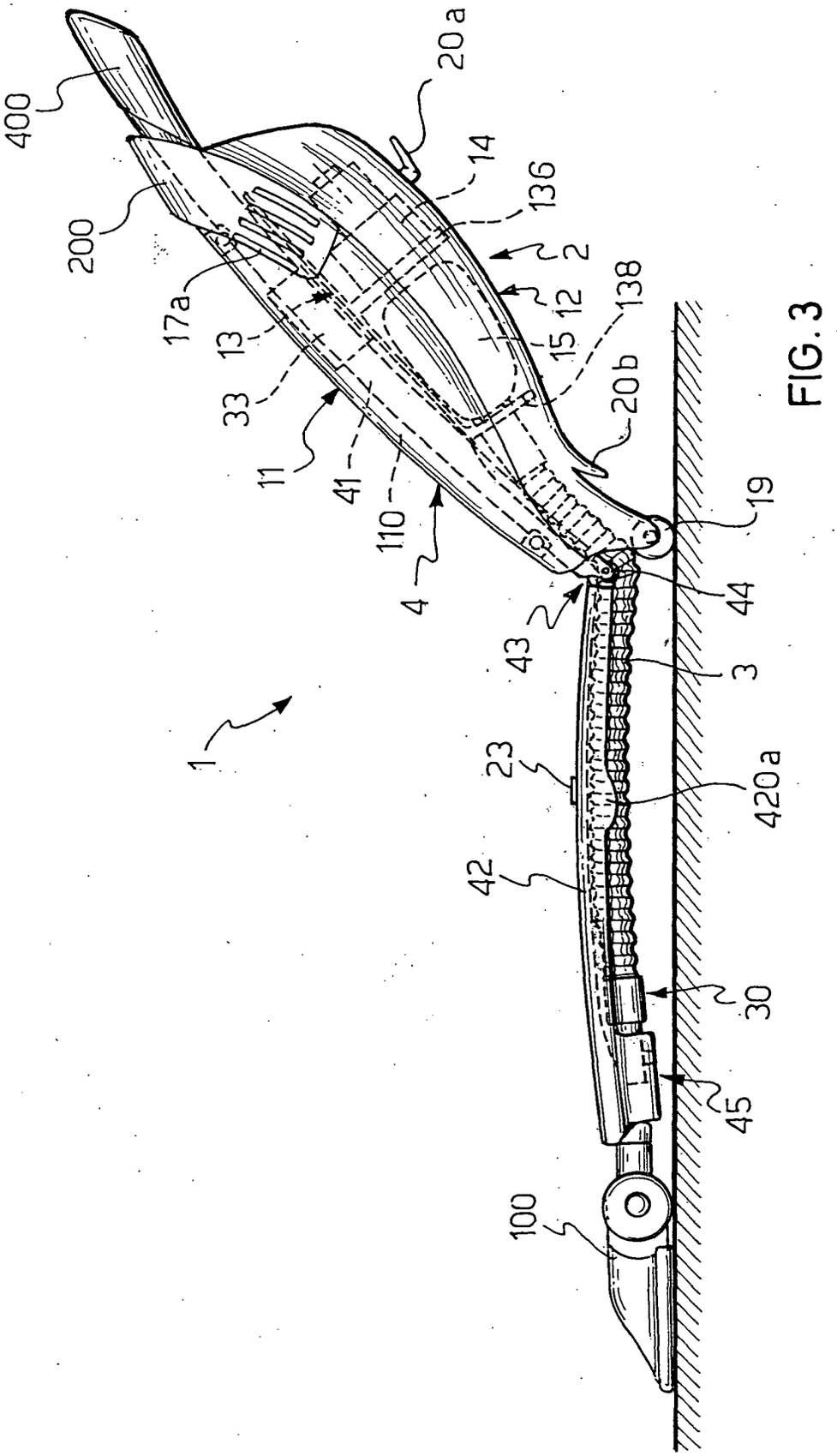
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FIG. 3

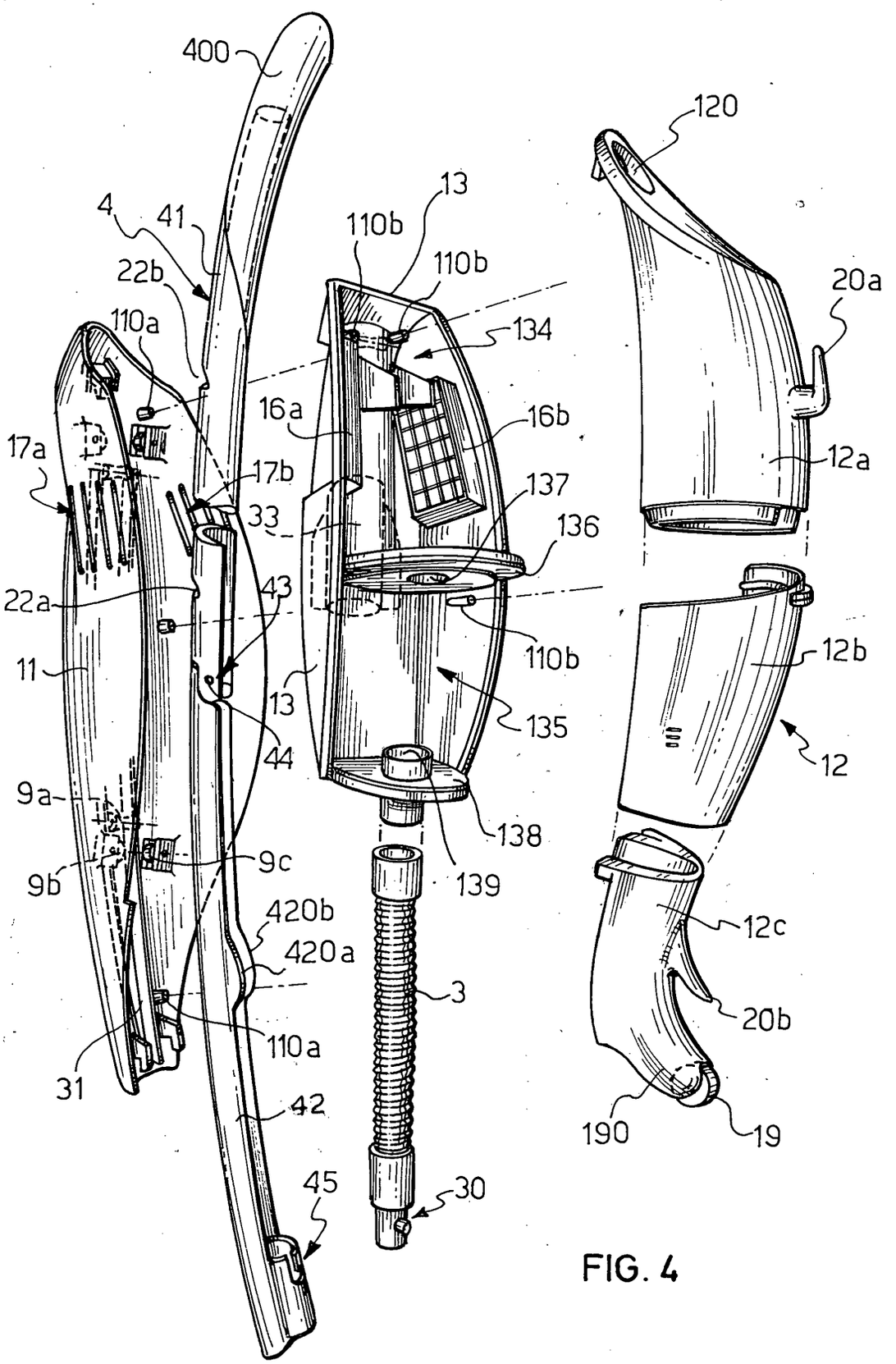
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FIG. 4

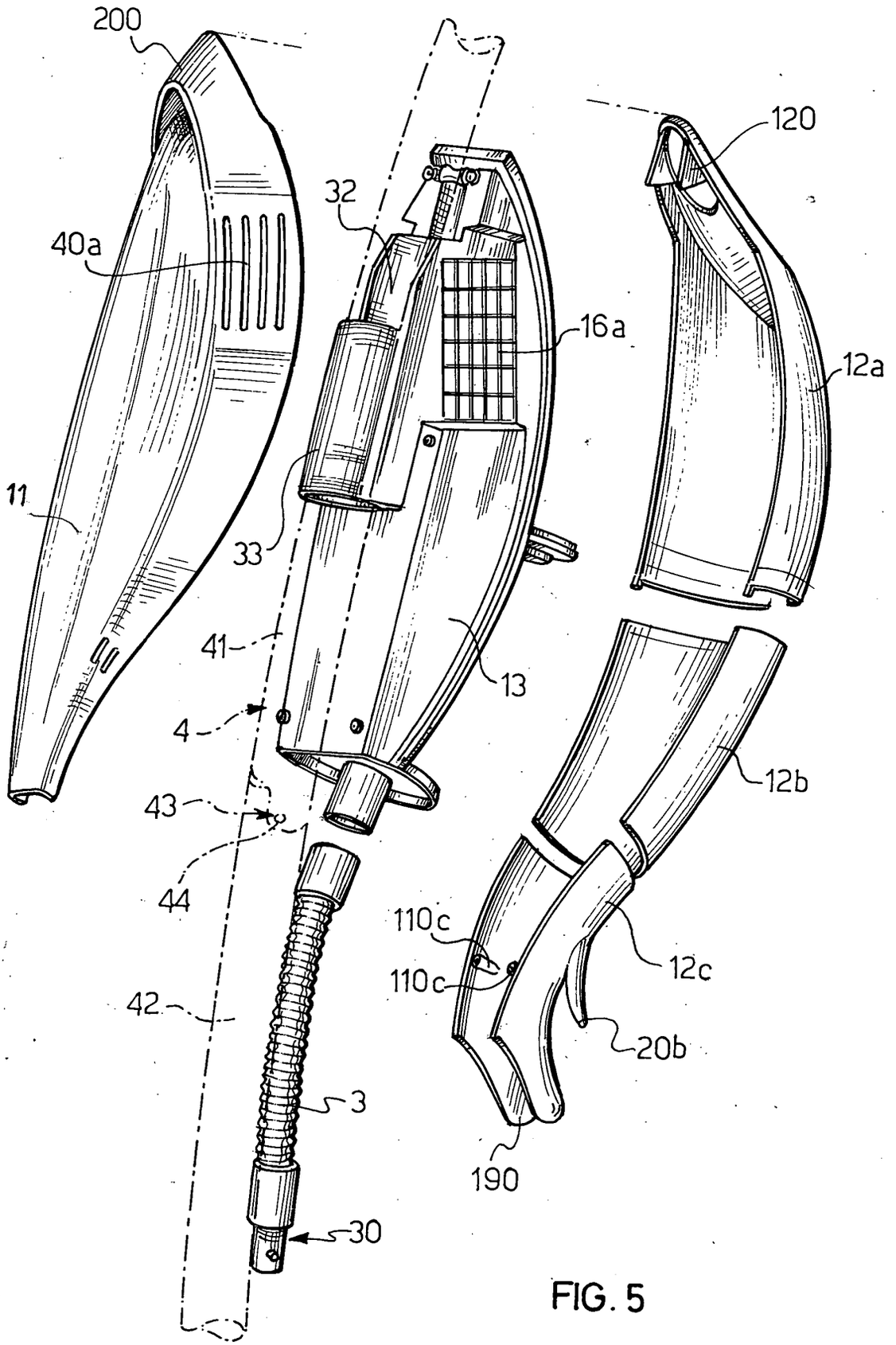
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FIG. 5

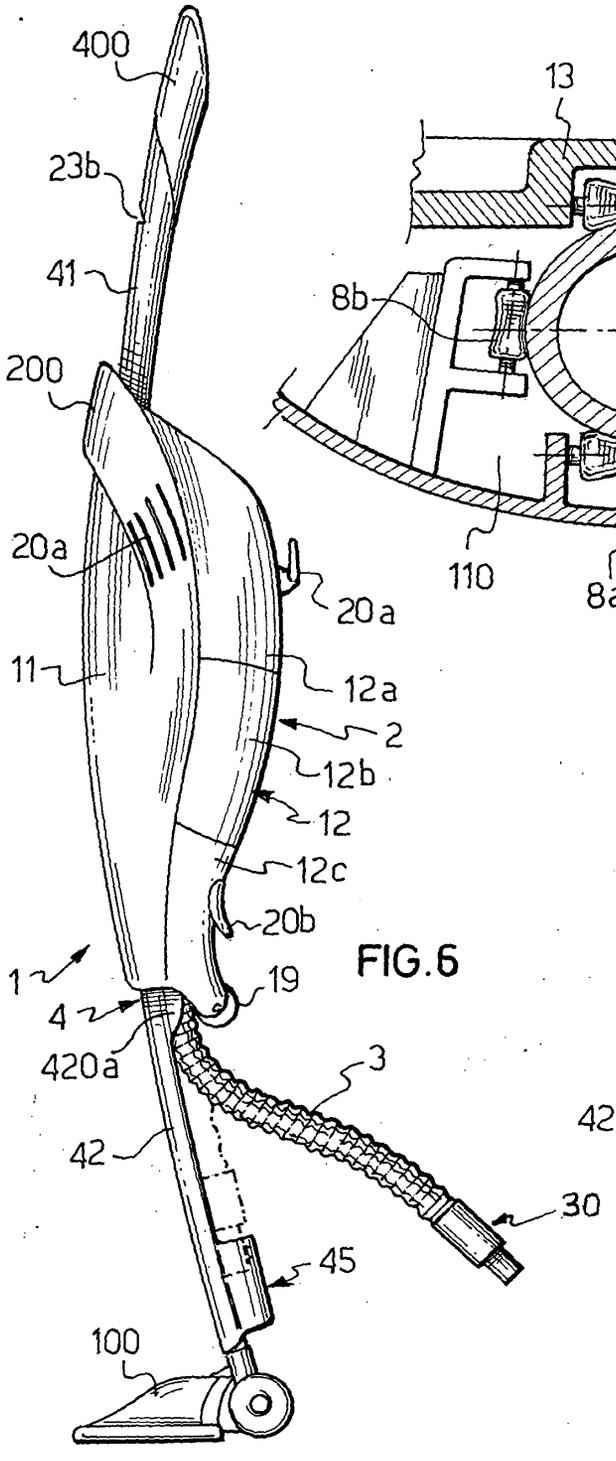


FIG.6

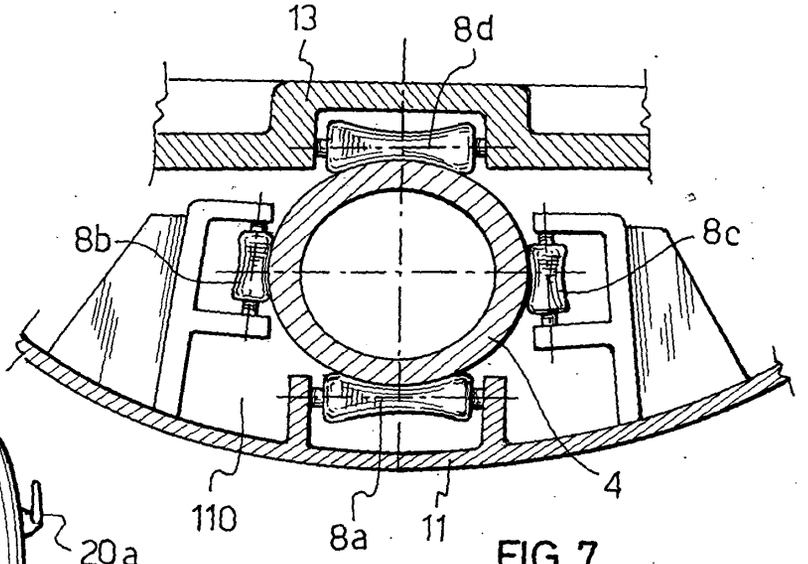
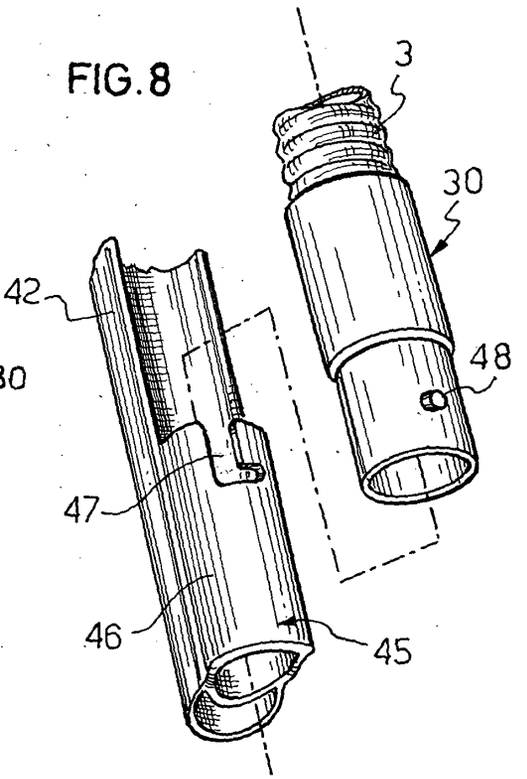


FIG.7

FIG.8



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Application Number
EP 03 42 5671

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