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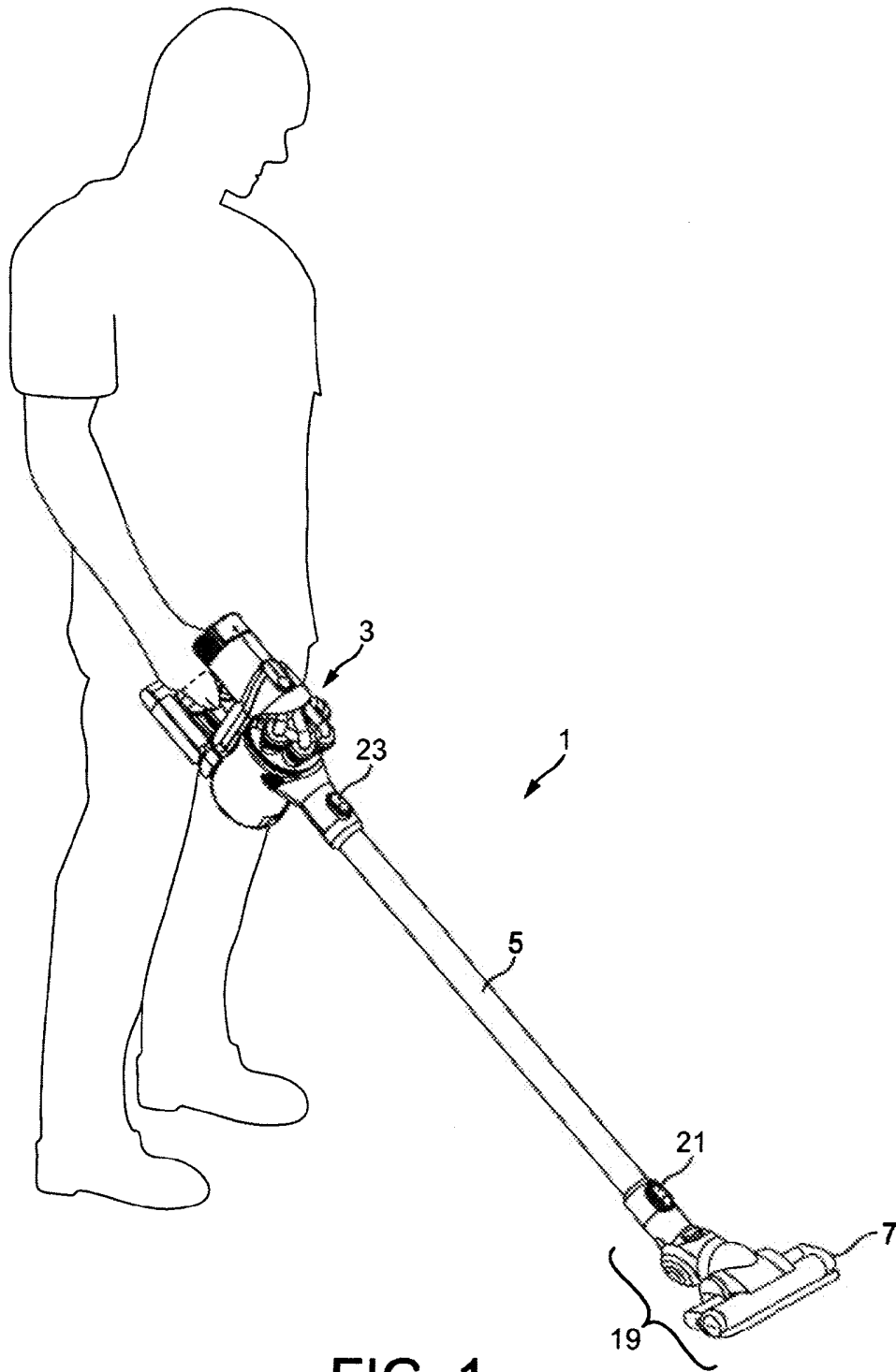


FIG. 1

01 12 11

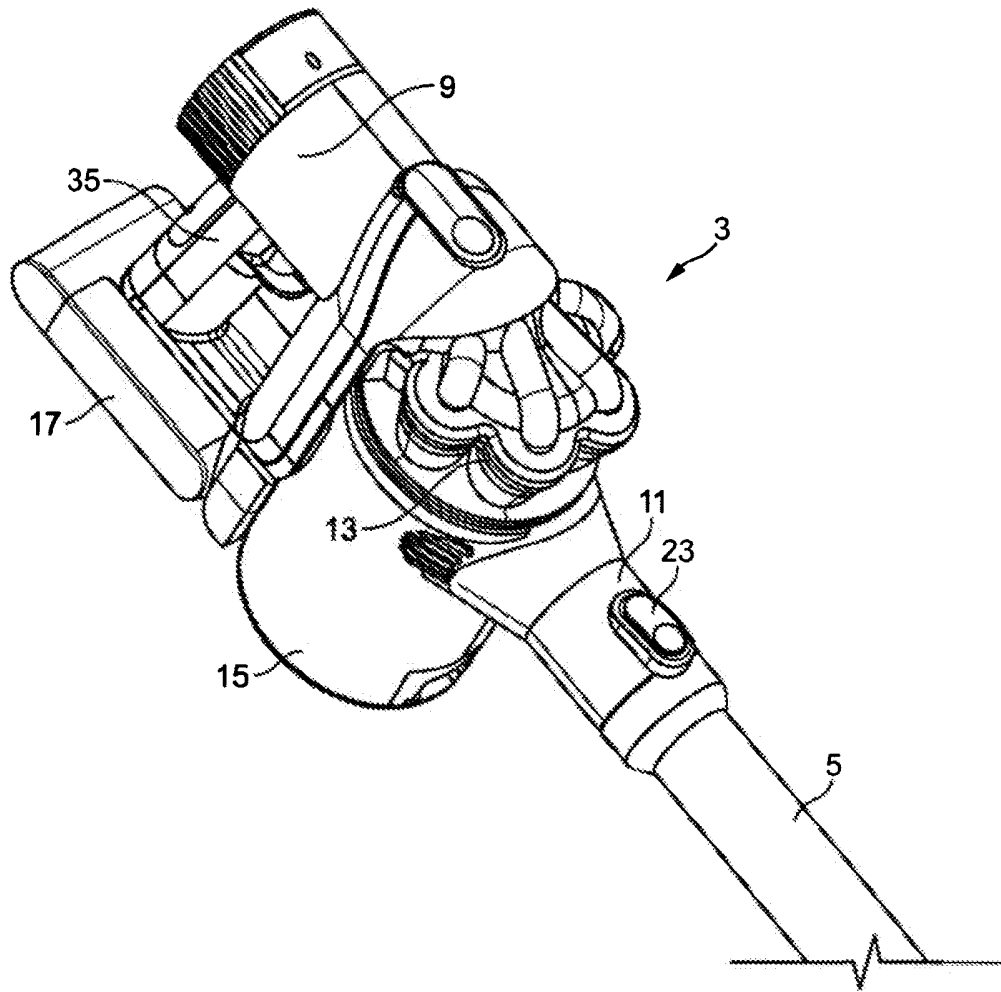


FIG. 2

01 12 11

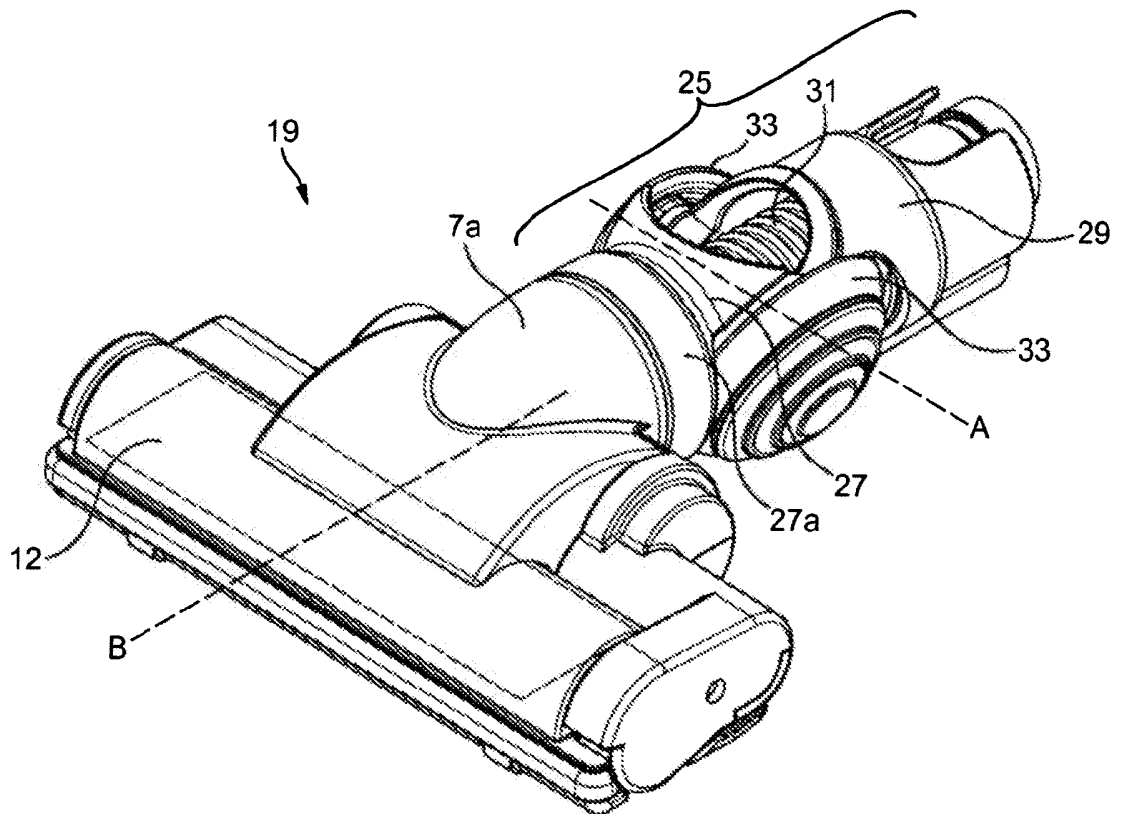


FIG. 3

01 12 11

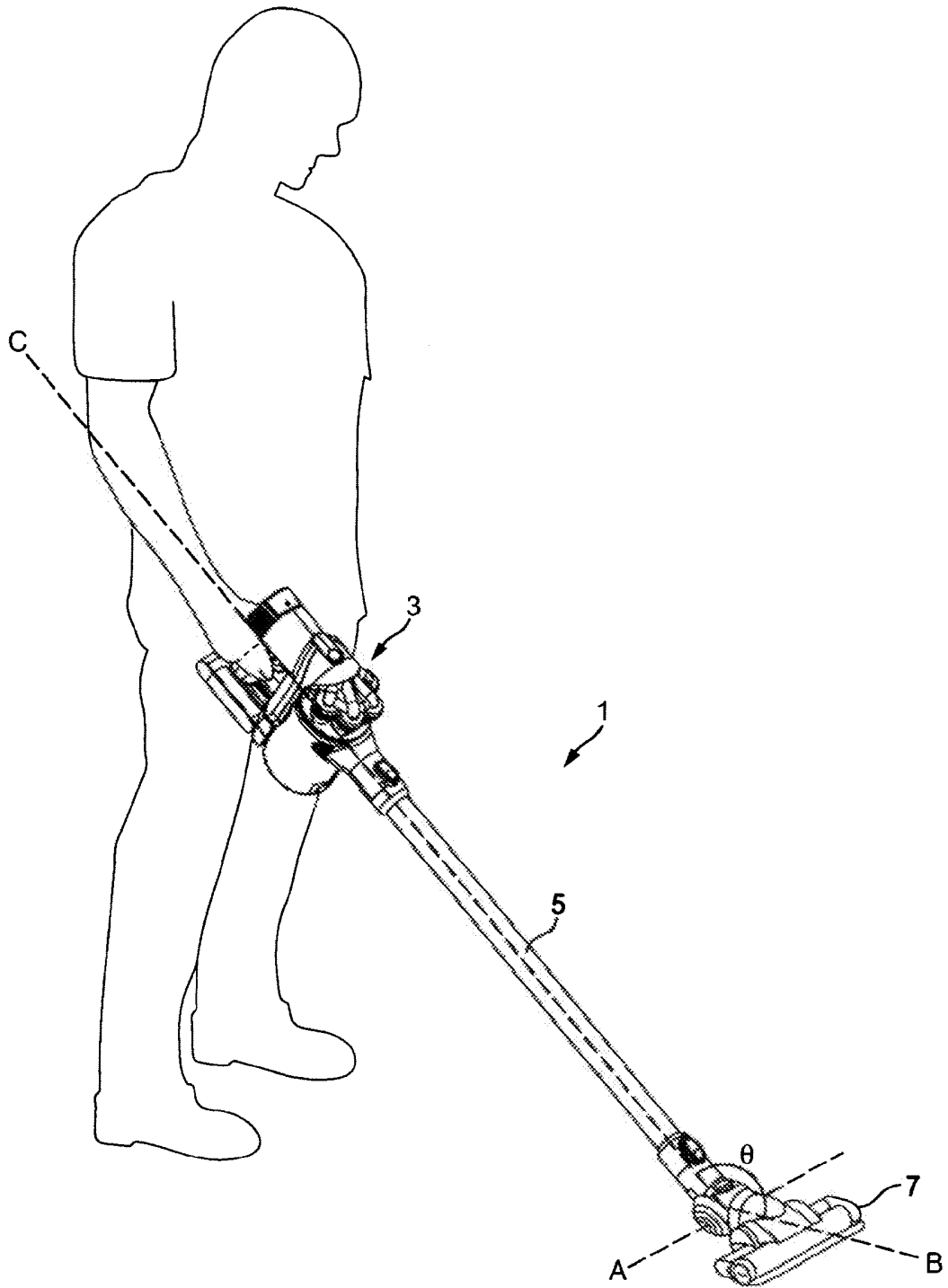


FIG. 4

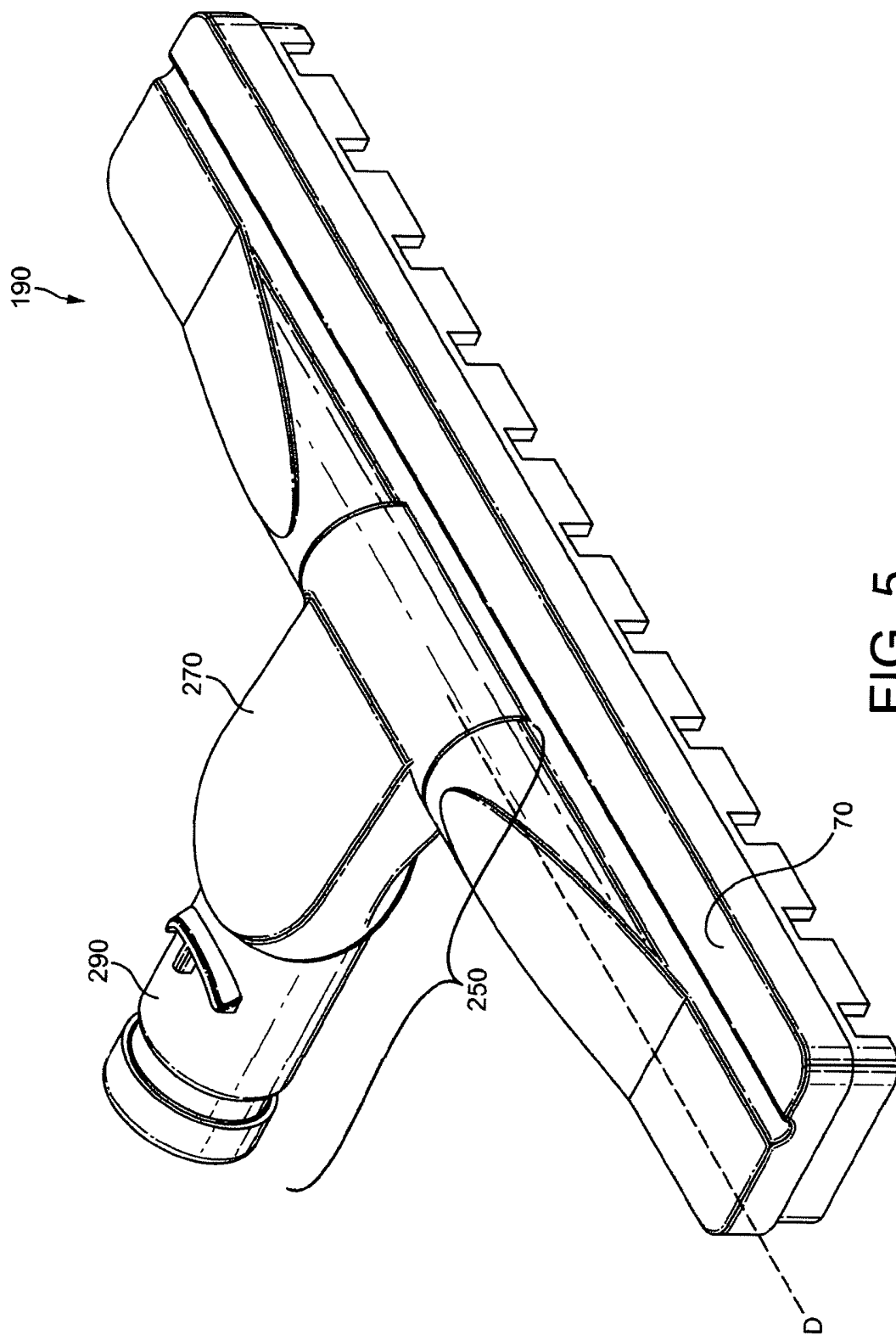


FIG. 5

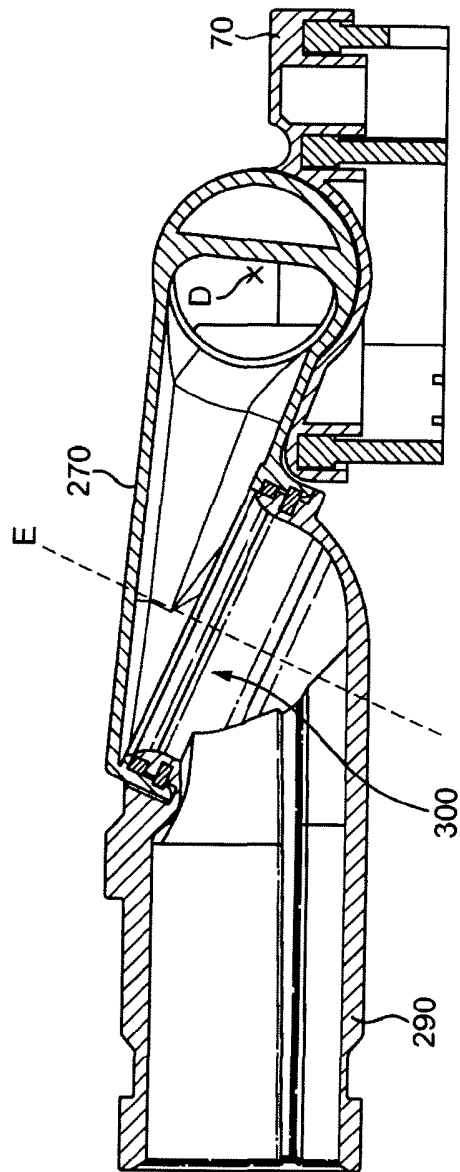


FIG. 6

A Vacuum Cleaner

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The present invention relates to the field of vacuum cleaners, and more specifically to “stick-vac” type vacuum cleaners of the general type comprising a handheld vacuum cleaner which is attached to an elongate, rigid wand and which is fluidly connected to a cleaner head provided at the end of the wand.

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Broadly speaking, there are four types of vacuum cleaner: “upright” vacuum cleaners, “cylinder” cleaners (also referred to as “canister” cleaners), “handheld” vacuum cleaners and “stick” vacuum cleaners, the latter being popularly referred to as “stick-vac” cleaners, or simply “stick-vacs”.

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Upright cleaners and cylinder cleaners are well known. They tend to be mains-operated and are used for relatively heavy-duty cleaning applications.

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Handheld vacuum cleaners are relatively small, highly portable vacuum cleaners, best suited to relatively low duty applications such as spot cleaning floors and upholstery in the home, interior cleaning of cars and boats etc. Unlike upright cleaners and cylinder cleaners, they are designed to be carried in the hand during use, and tend to be battery-operated.

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Stick-vac cleaners essentially offer a lightweight, functional alternative to upright cleaners for relatively low duty floor-cleaning applications, such as cleaning up floor spills.

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Broadly speaking, there are two distinct types of stick-vac. The first type is, in a sense, an ultra slim-line upright cleaner, though usually “cordless” rather than mains-operated. An example of this type of stick-vac cleaner is shown in UK Patent Application No.

GB2377880A1, in this case additionally incorporating a removable, handheld vacuum-cleaner.

5 The second type of stick-vac cleaner is a spin-off from the handheld vacuum cleaner, and comprises a handheld vacuum cleaner in combination with a rigid, elongate suction wand which effectively reaches down to the floor so that the user may remain standing while cleaning a floor surface. A floor tool is typically fixedly attached to the end of the rigid, elongate suction wand, or alternatively may be integrated with the bottom end of the wand. Designs of this type of stick-vac cleaner are shown in USD298875,
10 USD303173 and USD280033. In each case, the handheld suction unit incorporates the motor, the fan and some sort of separating apparatus, which may be a bag or a cyclonic separation system.

15 The present invention relates to stick vac cleaners of the second type. In the case of these stick vac cleaners, the wand and floor tool are typically conceived and marketed as low-cost accessories for a handheld vacuum cleaner, and as such the functionality of the cleaner in stick vac mode tends to be relatively poor compared to dedicated stick vac cleaners of the first type.

20 It is an object of the present invention to seek to provide an improved stick vac cleaner of the second general type described above.

According to the present invention there is provided a stick-vac cleaner comprising a handheld vacuum cleaner which is attached to an elongate, rigid wand and which is
25 fluidly connected to a cleaner head provided at the end of the wand, wherein the cleaner head is connected to the wand via a mechanical steering couple for directionally steering the cleaner head in plane parallel contact with the floor as the wand is rotated about its axis.

30 By providing a mechanical steering couple between the wand and cleaner head according to the present invention, the manoeuvrability of the stick-vac cleaner is

greatly improved compared to conventional stick-vac cleaners of the second general type..

Any suitable mechanical steering couple may be used. In particular, the mechanical steering couple may be configured to constrain the wand and the cleaner head for co-rotation about the wand axis whilst permitting relative rotation of the wand and cleaner head about an axis which is non-parallel to the wand axis. This type of steering couple can be implemented relatively cheaply, whilst still providing a high degree of manoeuvrability for the cleaner.

The wand and the cleaner head may be coupled for relative rotation along a rotatable scarf joint or via an elbow joint. The use of a scarf joint is considered to be particularly advantageous, in that it provides a mechanical turning advantage for the cleaner head during steering.

The wand may be hingedly connected to the cleaner head passively for varying the lie angle between the wand and the cleaner head. A variable lie angle helps maintain the cleaner head in contact with the floor across a relatively wide range of turning angles during steering of the cleaner head. Here, the term “lie angle” is somewhat analogous to the lie angle between the sole of a golf club head and the shaft of the club.

In the case where the wand and cleaner head are coupled by an elbow joint, this elbow joint may be a hinged elbow joint for varying the lie angle between the cleaner head and the wand.

The dust-laden air may be ducted to the handheld vacuum cleaning unit through the wand. The wand thus advantageously serves the dual purpose of fluidly connecting the cleaner head to the hand held vacuum cleaner whilst also transmitting steering torque to the cleaner head.

The handheld vacuum cleaner may comprise a pistol grip handle. The provision of a pistol grip handle on the handheld vacuum cleaner is considered to be particularly advantageous in a stick-vac cleaner according to the present invention, because it tends to align a user's forearm with the wand (the wand being analogous to the barrel of a pistol). Consequently, steering of the cleaner can be controlled primarily through supination and pronation of the forearm, which is comfortable and natural for the user.

A pistol grip handle also provides good leverage for effective transmission of steering torque between the handle and the cleaner head (via the wand), and in particular reduces the tendency for a user's hand to roll "over the top" of the handle as the handle is rotated to steer the cleaner head. The provision of a straight pistol grip which extends perpendicular to the wand is considered to be particularly beneficial in this regard.

The provision of a pistol grip handle does not make it essential to use a trigger, though use of a trigger may of course be convenient, for example to switch the handheld cleaner on and off.

The handheld vacuum cleaner will comprise some form of motor, which will be a relatively heavy component in the handheld vacuum cleaner. Advantageously, this motor may be positioned at or near the upper end of the pistol grip, so that the weight of the motor may be supported more comfortably on top of the user's hand.

The handheld vacuum cleaner may incorporate a cyclonic separation system, in which case the wand may be axially aligned with a tangential inlet to the cyclonic separation system. The dirty air thus feeds directly into the cyclonic separation system along the preferred inlet axis. This reduces "discontinuity" pressure losses between the wand and the separation system, which is particularly advantageous in the present case because of the relatively high pressure drop across the ends of the (relatively long) wand.

Embodiments of the invention will now be described, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view showing a stick vac cleaner in use;

Figure 2 is a close-up perspective view of part of the stick-vac cleaner in Figure 1;

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Figure 3 is a perspective view of a floor tool forming part of the stick-vac cleaner shown in Figure 1;

Figure 4 is a view corresponding to Figure 1, but illustrating various operational axes of rotation associated with steering the stick-vac cleaner across the floor;

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Figure 5 is a perspective view showing an alternative floor tool which may form part of a stick vac cleaner in accordance with the invention; and

15 Figure 6 is a cross-sectional side view of the tool shown in Figure 5.

Figure 1 shows a stick-vac cleaner 1 in use, comprising a handheld vacuum cleaner 3 which is carried in the hand, an elongate wand 5 attached to the handheld cleaner 3 and which reaches down to the floor and a cleaner head 7 provided at the end of the wand 5, which makes contact with the floor (the floor itself, though implicit, is not explicitly shown in Figure 1).

20

Referring to Figure 2, the handheld vacuum cleaner 3 comprises a motor-driven fan which is arranged inside a motor casing 9 for drawing air in through a suction nozzle 11 positioned at the front of the hand held vacuum cleaner 3. The elongate wand 5 is connected to the suction nozzle 11, and the cleaner head 7 is in turn connected to the lower end of the wand 5. In use, dirty air is drawn in through a suction opening 12 (Figure 3) on the underside of the cleaner head 7 and is ducted to the suction nozzle 11 on the handheld vacuum cleaner 3, through the wand 5.

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Dirty air entering the suction nozzle 11 passes through a cyclonic separation system 13, where dirt is separated from the air, before the relatively clean air is then exhausted back to atmosphere via one or more fine-particulate filters (not visible). The dirt which is separated from the airflow inside the cyclonic separating system 13 is collected in a bin 15 for disposal. The hand held vacuum cleaner 3 is powered by a multi-cell rechargeable battery which is housed in a battery pack 17.

The cleaner head 7 forms part of a floor tool 19 which is detachable from the wand 5 by means of a catch 21. The wand 5 is in turn detachable from the handheld cleaner 3 by means of a catch 23. The handheld cleaner 3 can thus be used in isolation as a stand-alone handheld vacuum cleaner by detaching the wand 5 or, alternatively, the handheld vacuum cleaner 3 and wand 5 can be used in combination as a “long reach” handheld vacuum cleaner by detaching the floor tool 19. The use of a detachable floor tool is not essential: for example, the cleaner head 7 may be permanently secured to the wand 5.

The floor tool 19 is shown in more detail in Figure 3, detached from the wand 5.

The floor tool 19 comprises an articulated neck portion 25 which acts as a mechanical steering couple between the wand 5 and the cleaner head 7.

The neck portion 25 comprises a front part 27, the front end of which is connected to the cleaner head 7, and a rear part 29, the rear end of which incorporates the catch 21 for detachable connection to the wand 5. The front part 27 is pivotally connected to the rear part 29, so that the front and rear parts 27, 29 are constrained for relative movement about an axis A. The front and rear parts 27, 29 thus effectively form a hinged elbow joint which allows for variation in the lie angle θ between the cleaner head 7 and wand 5 when the floor tool is connected to the wand 5 (see Figure 4). Thus, the lie angle is adaptable to suit the height of the particular user and, in use, the cleaner can be moved into a lower profile orientation, as desired, for example to clean underneath a bed.

A flexible duct in the form of a hose 31 extends through the articulated neck portion 25. The hose 31 flexibly connects the cleaner head 7 to the end of the wand 5 in use so as not to hinder articulation of the neck portion 25 about the axis A.

- 5 The front end of the front part 27 is shaped as a cylindrical collar 27a. This cylindrical collar 27a is connected to the cylindrical end of a rear outlet duct 7a on the cleaner head 7 by a conventional circlip or snap ring arrangement (not visible in Figure 3) which constrains the cleaner head 7 and front part 27 for relative rotation about the axis B of the cylindrical collar 27a. A conventional gasket arrangement (not shown) can be used
10 to form a compression seal between the cleaner head 7 and the neck portion 25; this seal should preferably be a low-friction seal (for example using a PTFE-coated gasket), so as not to hinder free rotation of the cleaner head 7 relative to the neck portion 25.

- The neck portion 25 functions as a steering couple by constraining the cleaner head 7
15 and wand 5 for co-rotation about the wand axis C, whilst nevertheless permitting relative rotation of the cleaner head 7 and the front part 27 about the axis B, which in use is non-parallel to the axis C (see Figure 4). Accordingly, steering of the cleaner head 7 can be controlled by rotating the wand 5 about the wand axis C to direct the cleaner head 7 in the desired direction. As the wand rotates about the axis C, co-rotation of the
20 cleaner head 7 with the wand 5 and relative rotation of the collar 8 and rear outlet duct 7a combine to turn the cleaner head 7 in plane parallel contact with the floor, so that the cleaner head 7 does not bank about the axis B as it turns. Hinging movement of the wand 5 and cleaner head 7 about axis A may also help to maintain the cleaner head 7 in plane parallel contact with the floor, particularly for large turning angles, though this
25 hinging movement is not considered essential to obtain the benefit of directional steering.

- A pair of domed wheels 33 is provided on the front part 27. The domed wheels 33 are mounted on stub axles (not visible) either side of the neck portion 25. These stub axles
30 are each angled downwardly to set the respective wheel at a corresponding fixed, positive camber angle. This camber angle is the same for each of the wheels 33, so that

the wheels form a “V” when viewed from the front. As the wand 5 is rotated about the wand axis C, the dome-shaped wheels 33 bank accordingly to maintain rolling contact with the floor. The dome-shaped wheels 33 are thus better able to track through the turn than conventional “flat-sided” wheels.

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The handheld vacuum cleaner 3 is provided with a pistol grip handle 35 (see Figure 2), which tends to position a user’s forearm parallel to the wand 5. Consequently, steering of the cleaner 1 can be controlled primarily through supination and pronation of the forearm, and is therefore natural and comfortable for the user. A pistol grip also

10 provides good leverage for effective transmission of steering torque from the handle 35 to the cleaner head 7 (via the wand 5 and neck portion 25), and in particular reduces the tendency for a user’s hand to roll “over the top” of the handle as the handle is rotated to steer the cleaner head 7.

15 The motor casing 9 is provided at the upper end of the pistol grip handle 35. Consequently, the weight of the motor inside the motor casing 9 is comfortably supported on top of a user’s hand during use of the cleaner 1.

Figure 5 shows an alternative floor tool 190 which may be connected to the wand 5 in
20 accordance with the invention to provide a mechanical steering couple between the wand 5 and a cleaner head.

The floor tool comprises an articulated neck portion 250 which incorporates a front duct part 270 and a rear duct part 290. The front duct part 270 is fluidly connected to a
25 cleaner head 70. The rear duct part 290 is configured to push fit onto the wand 5 (the end of the wand may need to be modified accordingly to accommodate the push fit).

The front duct part 270 is pivotally connected to the cleaner head 70 so that the front part 270 and cleaner head 70 are constrained for rotation about an axis D. This allows
30 for variation of the lie angle between the wand 5 and the cleaner head 70 in use.

The front duct part 270 is connected to the rear duct part 290 by a rotatable scarf joint 300, which constrains the front duct part 270 and rear duct part 290 for rotation about an axis E, non-parallel with the longitudinal axis of the rear duct part 290.

- 5 The front duct part 270 and rear duct part 290 together form an air duct for fluidly connecting the cleaner head 70 to the wand 5 in use.

The neck portion 250 acts as a mechanical steering couple between the wand 5 and the cleaner head 70 in similar manner to the neck portion 25. Thus, the neck portion 250 is
10 arranged to constrain the wand 5 and cleaner head 70 for co-rotation about the wand axis C whilst, nevertheless, permitting relative rotation of the wand 5 and cleaner head 70 about the axis E. Accordingly, as the wand 5 is rotated about the wand axis C, co-rotation of the cleaner head 7 with the wand 5 combines with relative rotation of the front part 270 and rear part 290 to turn the cleaner head 7 in plane parallel contact with
15 the floor.

The axis E is non-parallel with the floor, so that relative rotation of the front and rear parts 17, 19 about the axis E involves both a horizontal and vertical component (cf. relative rotation about the axis B in Figure 4, which is solely in a vertical plane).
20 Consequently, relative rotation of the front part 270 and rear part 290 not only counteracts undesirable banking of the cleaner head during steering, but also provides an associated mechanical advantage in turning the cleaner head 70 left or right, further improving manoeuvrability.

25 Air drawn in through the suction opening on the cleaner head need not be ducted through the wand. For example, the air may be ducted through a flexible hose running alongside the wand; in this arrangement, the wand would nevertheless couple to the cleaner head in similar manner for providing the necessary directional steering capability, so the wand would still physically connect the cleaner head to the handheld
30 vacuum cleaner, but the wand itself need not be hollow.

A stick-vac cleaner according to the present invention, examples of which have been described, is considered to offer significantly better manoeuvrability than existing “stick- vacs” of the same general type, bringing the functionality of this type of stick-vac more into line with the stick-vac cleaners of the first general type described above.

CLAIMS

1. A stick-vac cleaner comprising a handheld vacuum cleaner which is attached to an elongate, rigid wand and which is fluidly connected to a cleaner head provided at the end of the wand, wherein the cleaner head is connected to the wand via a mechanical steering couple for directionally steering the cleaner head in plane parallel contact with the floor as the wand is rotated about its axis.
2. A stick-vac cleaner according to claim 1, wherein, in use, the mechanical steering couple constrains the wand and the cleaner head for co-rotation about the wand axis whilst permitting relative rotation of the wand and cleaner head about an axis which is non-parallel to the wand axis.
3. A stick-vac cleaner according to any preceding claim, in which the cleaner head and wand are coupled for relative rotation along a scarf joint or via an elbow joint.
4. A stick-vac cleaner according to any preceding claim, in which the wand is hingedly connected to the cleaner head for varying the lie angle between the wand and the cleaner head.
5. A stick vac cleaner according to claim 3, wherein the elbow joint is a hinged elbow joint for varying the lie angle between the cleaner head and the wand.
6. A stick-vac cleaner according to any preceding claim, wherein the handheld vacuum cleaner comprises a pistol grip handle.
7. A stick-vac cleaner according to claim 6, wherein the pistol grip handle is substantially straight.
8. A stick-vac cleaner according to claim 6 or 7, wherein the pistol grip handle extends substantially perpendicular to the wand.

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9. A stick-vac cleaner according to any of claims 6 to 8, wherein the handheld vacuum cleaner comprises a motor which is positioned at or near the upper end of the pistol grip handle.
10. A vacuum cleaner according to claim any preceding claim, wherein the handheld vacuum cleaning unit incorporates a cyclonic separation system.
11. A vacuum cleaner according to claim 10, wherein the wand is axially aligned with a tangential inlet to the cyclonic separation system.
12. A stick-vac cleaner according to any preceding claim, wherein the wand fluidly connects the handheld vacuum cleaner to the cleaner head.