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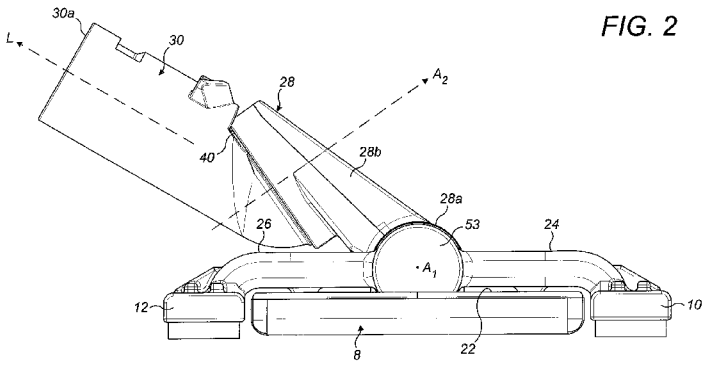
**(54) Title:** A FLOOR TOOL FOR A VACUUM CLEANING APPLIANCE

FIG. 2




**(57) Abstract:** A floor tool for a vacuum cleaning appliance, comprising a main body connected to a conduit, the main body comprising, a supporting member adapted to support a cleaning element and a suction nozzle adjacent an edge of the supporting member, wherein the suction nozzle defines a suction chamber, and wherein the suction chamber includes a first fluid outlet and a second fluid outlet in communication with the conduit.

# A Floor Tool for a Vacuum Cleaning Appliance

## Technical field

The present invention relates to a floor tool for a vacuum cleaning appliance.

## Background of the invention

Vacuum cleaners are generally supplied with a range of tools for dealing with different cleaning tasks. For example, such a tool may be a general purpose floor tool for on-the-floor cleaning of both hard and textile surface coverings. Typically, a floor tool comprises a main body which engages with a floor surface. The main body has a lower surface comprising a suction opening through which dirt and dust may be drawn into the floor tool due to a suction force generated by a vacuum cleaner to which the tool is attached. Although floor tools are adept at removing loose dirt and debris from a floor surface, they are less accomplished at removing other forms of dirt, for example stains, which may be left behind from liquid that is spilt on a hard floor covering. Of course, there are implements available for cleaning such stains. One example is shown in US2002/0 184726, in which a long handled cleaning implement includes a cleaning head to which a cleaning sheet is removably attached. Such an implement can then be used by a user to scrub or mop a hard floor surface to remove stubborn stains.

It also is known to combine the functionality of a vacuum cleaner floor tool with a cleaning sheet in order to provide the floor tool with the facility to wipe dirt and stains from a floor surface in addition to the usual function of sucking up loose dirt and debris. By way of example, JP9028638 discloses in which combines a mop with a vacuum cleaner floor tool by arranging an elongate nozzle adjacent a mop holder to which a mop is attached. The floor tool therefore carries out floor wiping and suctioning functions. As an extension to the floor tool disclosed in JP9028638, EP1608253 discloses a floor tool for a vacuum cleaner in which a rectangular supporting element

carries a disposable wipe and wherein elongate suction nozzles are positioned adjacent the fore and aft long edges of the support element.

Although such combined mop and suction floor tools have their advantages, the pick-up performance of such tools on hard floors tends to be compromised. It is to this end that the invention has been devised.

Summary of the invention

In a first aspect, the invention provides a floor tool for a vacuum cleaning appliance, the floor tool comprising a main body connected to a conduit, the main body including a supporting member adapted to support a cleaning element and a suction nozzle along an edge of the supporting member, wherein the suction nozzle defines a suction chamber, and wherein the suction chamber includes a first fluid outlet and a second fluid outlet in communication with the conduit.

By virtue of this configuration, the invention provides a floor tool which combines a hard floor wiping function with dirt and debris vacuuming capability having improved pickup performance since suction is distributed more evenly across the suction chamber.

The suction nozzle may include a surface engaging skirt member that depends from a surface of the suction nozzle and defines the outer periphery of the suction chamber.

In order to further increase the pickup performance, the skirt may further include a partition which extends between front and rear edge portions of the skirt thereby dividing the suction chamber into first and second sub-chambers.

Preferably, the skirt and dividing wall are a flexible material such as a strip of rubber, although it should be appreciated that a row of bristles of filaments, such as nylon bristles, is also acceptable.

The first suction chamber and the second suction chamber may each comprise an interior wall which partitions the suction chamber into a first suction channel and a second suction channel, wherein a dirt-bearing fluid flow is able to travel from the first suction channel into the second suction channel via at least one intermediate channel.

Such a configuration of flexible surface engaging means located about the suction chambers and within the suction chamber defines multiple flow channels that maintain the pressure levels within the suction channels as the tool is maneuvered over a surface. This improves the debris pickup performance of the floor tool, whilst protecting the cleaning sheet from accumulating loose debris.

Preferably, the surface engaging skirt member includes a first portion provided with openings along at least a portion of its length. In one embodiment, the openings are evenly spaced and take the form of a series of castellations, although the openings may be spaced unevenly and may be different sizes.

The first portion may be located on an edge of the suction nozzle remote from the edge of the support member and wherein the second portion may be located directly adjacent the edge of the support member.

To further improve pickup performance, a second suction nozzle may be positioned adjacent another edge of the support member. The second suction nozzle may be configured in the same way as the first suction nozzle, although the layout of the suction channels may be different.

This configuration of the surface engaging skirt member it provides the floor tool with a high pick up performance. In particular, a partially opened, or slotted/castellated, outboard edge/strip portion of the skirt member permits dirt and debris to enter the suction chamber at multiple points along the length of the suction nozzle, whilst a non-slotted inboard strip portion of the skirt member, that strip portion having a linear,

uniform edge to create a seal with an adjacent floor surface, in use, prevents dirt and debris from escaping from the suction nozzle and fouling the wipe sheet carried by the support member. In a further aspect, therefore, the invention resides in a floor tool for a vacuum cleaning appliance, comprising a main body connected to a conduit, the main body comprising a supporting member adapted to support a cleaning element and a suction nozzle adjacent an edge of the supporting member, wherein the suction nozzle includes a surface engaging skirt member that depends from a surface of the suction nozzle and defines an outer periphery of a suction chamber, the suction chamber including a first fluid outlet in communication with the conduit, and wherein the surface engaging skirt member includes a first portion provided with one or more openings along at least a portion of its length, where a second portion of the surface engaging skirt member opposing the first portion has a substantially uniform linear edge along its length.

The first portion may be located on an edge of the suction nozzle remote from the edge of the support member and wherein the second portion may be located directly adjacent the edge of the support member.

Although the surface engaging skirt member may be rigid, a better contact with the floor surface is achieved if the skirt member is flexible. This flexibility can be achieved by forming the skirt member from a resilient material such as a rubber or other polymer, or from a densely packed row of bristles/filaments.

The openings in the first portion may be regularly spaced, and of even dimension, for example in the form of castellations, or the openings may be formed irregularly. What is important is that dirt and debris can be admitted into the suction chamber along a significant portion of the length of the suction nozzle (for example, over half of its length).

In the context of this aspect of the invention, the suction chamber is provided with at least one suction outlet for air to be drawn out of the suction chamber. Preferably, two

outlets are provided to result in a higher flow rate which improves pickup capability, and these may be positioned an equal distance from respective ends of the suction chamber.

In a further aspect the invention provides a floor tool for a surface treating appliance, comprising a main body connected to a conduit, the main body comprising a supporting member adapted to support a cleaning element, a suction nozzle adjacent an edge of the support member, wherein the suction nozzle defines a first suction chamber and a second suction chamber located adjacent the first second chamber, and wherein each suction chamber includes a respective fluid outlet in communication with the conduit.

Beneficially, the side-by-side location of the two suction chambers improves the debris pickup performance of the floor tool across its entire width.

To enable the main body to be widely manoeuvrable over a surface, the conduit preferably comprises a front section and a rear section. The front section is pivotably connected to the main body for movement about a first axis to allow the rear section of the conduit to be raised and lowered relative to the main body, which allows the main body to be manoeuvred easily beneath furniture, and into gaps between furniture and walls as required. The range of articulation of the sections of the conduit about the first and second axes preferably enables the main body to be oriented both substantially perpendicular to a wand used to manoeuvre the tool over a floor surface, and substantially parallel to the wand.

Whilst the front section is pivotable to the main body in a substantially vertical plane, the rear section is pivotably connected to the front section for movement relative thereto about a second axis which is spaced from the first axis. This allows the rear section to be angled relative to the front section to assist in the pushing, or pulling, of the main body over a surface, such as a floor surface, in a variety of orientations of the main body relative to, for example, a wand connected to the rear section of the conduit. The pivoting connection between the front section and the rear section enables the rear

section to be connected to the front section so that it is located at least partially beneath the front section. This can allow the tool to have a low profile when the front section of the conduit is in its lowered position.

The suction nozzle may include a surface engaging skirt member that depends from a surface of the suction nozzle and defines the outer periphery of each of the first and second suction chambers. Further, a dividing wall may extend between sides of the surface engaging skirt member and may depend downwardly to the same extent as the surface engaging skirt member. Preferably, the skirt and dividing wall are a flexible material such as a strip of rubber, although it should be appreciated that a row of bristles of filaments, such as nylon bristles, is also acceptable.

The first suction chamber and the second suction chamber may each comprise an interior wall which partitions the suction chamber into a first suction channel and a second suction channel, wherein a dirt-bearing fluid flow is able to travel from the first suction channel into the second suction channel via at least one intermediate channel.

Such a configuration of flexible surface engaging means located about the suction chambers and within the suction chamber defines multiple flow channels that maintains the pressure levels within the suction channels as the tool is maneuvered over a surface. This improves the debris pickup performance of the floor tool, whilst protecting the cleaning sheet from accumulating loose debris.

In one embodiment, the interior wall is v-shaped such that one of the first or second suction channels is tapered. Preferably, the tapered suction channel has a narrowed middle region adjacent a castellated edge of the skirt such that fluid can flow through the apertures, or notches, in the skirt and into the suction channel. The second suction channel may communicate with a fluid outlet to which suction is applied, in use, such that fluid, in this case dirt-bearing air, is drawn from the first suction channel into the second suction channel.

This "division" of each suction chamber into two interconnected suction channels by the flexible surface engaging means establishes two different pressure regions within the main body. A relatively high vacuum is set up in the second suction channel which optimizes the performance of the tool for capturing dirt and dust located within crevices in a floor surface. Simultaneously, a relatively low vacuum may be established in the first suction channel, which can improve the performance of the tool for capturing debris located on the surface without significantly impairing the capture of dirt and dust within crevices.

Each fluid outlet of each nozzle may communicate with an intermediate conduit which is coupled to a manifold and preferably, each intermediate conduit is pivotably coupled to the manifold in order to allow the nozzles to be raised and lowered relative the supporting member. Such a configuration permits a cleaning sheet to be wrapped about the supporting member when the nozzles are in an elevated position and to be secured to the supporting member when the nozzles are placed into the lowered position. For this purpose, securing means may be provided which in one embodiment comprises a protruding formation, such as a knob, that depends from the intermediate conduit and which is engageable with a complementary shaped recess defined in the supporting member such that when the suction nozzles are put in the lowered position, the knob is received in to the recess and so secures the cleaning sheet to the supporting member.

Although the suction nozzle described above is particularly beneficial when used in combination with a supporting plate that is suitable for carrying a cleaning member, it is envisaged that such a suction nozzle would also confer a benefit in pick-up performance in a floor tool that does not have a wipe supporting member. Therefore, from a still further aspect, the invention resides in a floor tool for a vacuum cleaning appliance, comprising a main body connected to a conduit, the main body comprising a suction nozzle including a first suction chamber and a second suction chamber adjacent to the first suction chamber, and wherein each suction chamber includes a respective fluid outlet in communication with the conduit, wherein the first suction chamber and the second suction chamber each comprise an interior wall which partitions the suction

chamber into a first suction channel and a second suction channel, wherein a dirt bearing fluid flow is able to travel from the first suction channel into the second suction channel via at least one intermediate channel.

In order to avoid debris being trapped in certain regions of the suction channels, the interior wall may be shaped such that one of the first or second suction channels is tapered. As a further optional enhancement, a further floor engaging member may be provided transversely across the first or the second suction channels between the interior wall and an adjacent portion of the surface engaging skirt, preferably in a mid region of the channel. This helps to avoid debris 'hesitating' when it enters the first/second channel and therefore improves pick up performance.

The suction nozzle may include a surface engaging skirt member that depends from a surface of the suction nozzle and defines the outer periphery of each of the first and second suction chambers. Sections of the skirt member may be notched or crenellated to allow debris to pass through.

To define the first and second suction chamber, a dividing wall may depend from a housing of the suction nozzle to the same extent as the skirt and extend between sides of the skirt. The skirt and the dividing wall preferably are flexible, and may be formed from a resilient strip (e.g. rubber) or alternatively may be a plurality of tightly packed bristles or filaments.

It should be appreciated that preferred and/or optional features of first, second third and fourth aspects of the invention may be combined with each other as appropriate.

Brief description of the drawings

An embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a front perspective view of a floor tool according to the invention;

Figure 2 is a side view of the floor tool in Figure 1;

Figure 3 is a front perspective view of the floor tool in Figure 1, but with its suction nozzles in a raised position;

Figure 4 is a side view of the floor tool of Figure 3, partly in section, the section taken along the intermediate conduit;

Figure 5 is a side view in the manner of Figure 4, but with the suction nozzles in a lowered position;

Figure 6 is a plan view from below of the floor tool in Figure 1, with a portion enlarged for clarity;

Figure 7 is a simplified plan view, from below, of a floor tool of an alternative embodiment of the invention;

Figure 8 is a perspective view of a floor tool of an alternative embodiment of the invention;

Figure 9 is an underside view of the floor tool in Figure 8; and

Figure 10 is a stick-vacuum cleaner incorporating the floor tool of Figures 8 and 9.

Detailed description of the embodiments

With reference in general to Figures 1 to 6, a floor tool 2 comprises a main body 4 and a conduit 6 associated with the main body 4 which serves to connect the floor tool 2 to a

wand of a vacuum cleaner (not shown) and enables a user to manoeuvre the floor tool 2 across a surface to be cleaned.

The main body 4 comprises a generally oblong support member 8 on which can be carried a sheet-like cleaning element (shown in Figures 4 and 5), and first and second suction nozzles 10, 12 arranged adjacent respective long edges 14, 16 of the support member 8. Each of the suction nozzles 10, 12 is pivotably associated with an air manifold 20 that is mounted to an upper surface 22 of the support member 8. In the figures, the floor tool 2 is oriented such that its 'front' is facing towards the right hand side of the drawing. Therefore, the first and second suction nozzles 10, 12 can be considered to be a front suction nozzle 10 and a rear suction nozzle 12, respectively, and shall be referred to as such from now on.

In a general sense, the floor tool 2 has a dual function. Firstly, the support member 8 is adapted to carry a moisture bearing sheet of material, such as a commonly available poly-based disposable wipe, so that the floor tool 2 can be used to scrub stubborn stains and dirt from the floor surface. Secondly, the suction nozzles 10, 12 remove loose dirt and debris from the floor surface for conveyance to the associated vacuum cleaner in a dirt-bearing airflow that is drawn through the floor tool.

The front suction nozzle 10 is pivotably connected to the manifold 20 by respective first and second front intermediate conduits 24 and the rear suction nozzle 12 is connected to the manifold 20 by respective first and second rear intermediate conduits 26. Such a configuration enables the front and rear suction nozzles 10, 12 to be moved between a first position (the lowered position) in which each suction nozzle 10, 12 lies next to an adjacent long edge 14, 16 of the supporting member 8 so as to engage the floor surface for cleaning, and a second position (the raised position) in which the front and rear suction nozzles 10, 12 are pivoted with respect to the supporting member 8 so as to be elevated out of engagement with the floor surface. In this position, a cleaning sheet may be wrapped around the support member 8 to be secured when the suction nozzles 10, 12 are returned to the lowered position. The suction nozzles 10, 12 are shown in the

lowered position in Figures 1, 2 and 5, and are shown in the raised position in Figures 3 and 4.

The floor tool 2 interfaces with an associated vacuum cleaner by way of the connecting conduit 6 that is coupled to the manifold 20 in a portion between the front and rear intermediate conduits 24, 26, in effect forming a knuckle joint through which fluid may flow.

The conduit 6 is constructed in two parts - a front section 28 and a rear section 30 - that are fluidly connected and pivotable with respect to each other. The front section 28 has a head portion 28a that is connected to the main body 4, via the manifold 20, so that it can pivot about a first axis Ai. A neck portion 28b extends from the head portion 28a to the rear section 30 of the conduit, which includes a fluid outlet 30a which is adapted for connection to a wand, hose or other such ducting part of a cleaning appliance which includes a dirt and dust separating apparatus and a motor-driven fan unit for drawing dirt-bearing fluid (in this case air) into the floor tool.

In more detail, the head portion 28a has a substantially cylindrical outer surface 32 which extends along a longitudinal axis that is substantially co-linear with the first axis Ai, and is open at each end to define first and second circular connecting ports 34 which are journalled between respective arch-shaped stanchions 36 of the manifold 20. The head portion 28a is therefore free to rotate about its longitudinal axis about the stanchions 36.

A sealing member 38 is provided between each outwardly facing port 34 of the head portion and its adjoining portion of the manifold 20, (stanchions 36) to form a substantially air-tight seal between them. Each port 34 of the head portion 28a therefore provides a respective entry point through which fluid can enter the conduit 6 from the main body 4. Each port 34 is thus substantially circular, and is substantially orthogonal to the longitudinal axis of the head portion 28a, and therefore the first axis Ai, which passes centrally through each port 34. As a result, in use fluid passes into the head

portion 28a through the ports 34 in opposing directions. The neck portion 28b extends away in a direction substantially orthogonal to the longitudinal axis of the head portion 28b at a position substantially midway between the ports 34 and, in this embodiment, is integral with the head portion 28a. Consequently, as fluid passes through the head portion 28a from one of the ports 34 and into the neck portion 28b, the fluid flow changes direction by around 90°.

The rear section 30 of the conduit 6 is connected to the neck portion 28b of the front section 28 for pivotal movement relative thereto about a second axis $A_2$ which is angled to the first axis $A_1$. In this embodiment the second axis $A_2$ is orthogonal to the first axis Ai, and is inclined to the longitudinal axis L of the rear section 30, illustrated in Figure 2, in this embodiment by an angle of around 65°.

The connection between the front and rear sections 28, 30 of the conduit 6 is achieved by connecting a fluid outlet 40 of the front section 28 to a fluid inlet 42 of the rear section 30 of the conduit 6. The fluid outlet 40 of the front section 28 is substantially cylindrical, and is angled downwardly (as illustrated in Figure 2) towards a floor surface when the conduit is in the reclined position illustrated in Figure 2. The fluid inlet 42 of the rear section 30 is also substantially cylindrical and is received within the fluid outlet 40 of the front section 28 so that their longitudinal axes are substantially co-linear with the second axis $A_2$. Furthermore, the engagement between the fluid outlet 40 and the fluid inlet 42 is such that and the fluid inlet 42 is rotatable relative to the fluid outlet 40 about the second axis $A_2$. It should be appreciated that although not shown in the Figures, a sealing member is located between the inner surface of the fluid inlet and the outer surface of the fluid outlet to guard against fluid loss from the interface.

By virtue of this conduit configuration, rotational movement of the rear section 30 about its longitudinal axis L causes the floor tool 20 to swing angularly in a plane that is parallel to the surface to be cleaned. The floor tool 2 is therefore particularly manoeuvrable since it can readily be rotated through 90°, for example, in order to be slid into narrow passages.

Figures 4 and 5 show cut away views of the floor tool along two of the intermediate conduits 24, 26 and it can be seen that inner ends of the intermediate conduits cooperate in such a way to define a transverse fluid flow channel 41 that carries air flow from the suction nozzles 10, 12 to the connecting conduit 6 along a respect interior flow passage 27. Although only one of the front intermediate conduits 24 and one of the rear intermediate conduits 26 on the left hand side of the floor tool 2 (when viewing the floor tool from the front) are shown in these Figures, it should be noted that the structural details of the right hand intermediate conduits 24, 26 are identical so they will not be described here.

The front intermediate conduit 24 or 'arm' extends upwardly from a surface of an upper housing 44 of the front suction nozzle 10, turns through substantially 90° and runs parallel with the plane of the supporting member 8 towards the manifold 20. At its end distal from the suction nozzle 10, the connecting arm 24 terminates in a cylindrical portion 46 that extends transversely to the arm 24.

The cylindrical portion 46 has a closed outer end (not shown in Figures 4 and 5) and an open inner rim portion 48 that engages with the stanchion 36 of the supporting member 8 sandwiching a further sealing ring member 49 therebetween. The other connecting arm 24 of the front suction nozzle includes an identical cylindrical portion, also having a rim portion such that the two rim portions effectively 'clamp' against the stanchions 36 of the supporting member in the manner of a knuckle joint thus enabling the connecting arms 24, 26 to pivot with respect to the stanchions.

Turning to the rear intermediate conduit 26 or 'arm' that connects between the rear suction nozzle 12 and the manifold 20, this also includes an inner end that defines a generally semi-circular sleeve portion 50 which is shaped to complement the outer surface of the cylindrical portion 46 of the front arm 24 so that the sleeve portion 50 is able to ride over the surface of the cylindrical portion 46. A sealing layer 51 is provided on its inner surface to guard against leakage from the interface. The inner end 52 of the

sleeve portion 50 includes a shallow lip (not shown) which fits in a complementary annular groove (also not shown) provided on the rim 48 of the cylindrical portion 46 which acts to hold the sleeve portion 50 securely on the manifold 20. An outer part of the sleeve portion 50 includes a circular end cap 53 (shown in Figures 1 to 3) which engages with the outer end part of the cylindrical portion 46 of the first connecting arm 24. In this way, the rear arm 26 is able to pivot with respect to the front arm 24.

It will be appreciated from the above explanation that the inner ends of the front and rear intermediate conduits, or arms, cooperate to define the manifold 20, at least in part. In particular, the cylindrical portion of the front arm 24 defines the majority of the fluid flow passageway of the manifold 20 but is provided with a port 54 which registers with the interior passageway of the rear arm 26 when the arms are in the lowered position in order to allow air to flow through the cylindrical portion 46 and into the intermediate conduit 26. Such a configuration enables a particularly elegant construction of the pivoting intermediate conduits 24, 26 with respect to the support member 8, although the skilled person will appreciate that other configurations could achieve the same pivoting movement. For example each of the front and rear conduits 24, 26 could each be provided with a cylindrical inner section which are positionable side-by-side in order to create a fluid manifold, one section having a face seal against the other section.

Alternatively, although in this embodiment it has been described that the connecting arms define the manifold itself, it should be appreciated that this need not be the case and the front and rear connecting arms 24, 26 may be separate components from the parts that define the manifold.

As has been mentioned above, the pivoting action of the front and rear arms 24, 26 enables a cleaning sheet to be secured to the supporting member 8. As is shown clearly in Figures 4 and 5, each of the front and rear arms 24, 26 includes a protuberance in the form of a knob 60 that depends from the underside of a respective arm 24, 26. Each knob 60 is shaped so as to be received in a corresponding circular recess 62 on the upper surface 22 of the supporting member 8 when the arms 24, 26 are in the lowered

position. In this way, a cleaning sheet is able to be wrapped around the supporting member 8 and, with the arms in the raised position, ends of the cleaning sheet may be held against the upper surface 22 of the supporting member 8. Lowering the arms forces the knobs 60 to protrude into their respective recesses 62 so that the cleaning sheet is held securely in position and this action also holds the cleaning sheet taught against the underside of the supporting member 8 to guard against wrinkling or puckering which facilitates the cleaning of the floor surface. In Figures 4 and 5, a cleaning sheet 63 is depicted as a dotted line and is shown wrapped around the supporting plate 8 with portions pushed into the recesses. In Figure 5, the knobs 60 are shown pushed into the recesses 62 thereby securing the cleaning sheet 63.

In addition to the wiping facility provided by the supporting member, the suction nozzles 10, 12 remove loose debris from the floor surface, and the configuration of the suction nozzles 10, 12 provides particularly strong debris pickup performance, as will now be explained.

Figure 6 shows the underside of the suction nozzles in general, and the front suction nozzle 12 enlarged. It will be appreciated that the configuration of each of the front and rear suction nozzles 10, 12 is substantially identical and so, although only the front suction nozzle 10 will be described in detail here, the description also applies to the rear suction nozzle 12.

The housing 44 of the suction nozzle 10 is rectangular and includes a downwardly depending strip-like floor engaging member 70 that defines a substantially continuous rectangular skirt around the outer periphery of the housing 44. A further floor engaging member or 'dividing wall' 72 extends transversely between long edges of the skirt 70 approximately mid-way between the two ends of the housing 44 and therefore divides the suction nozzle 10 into first suction chamber 74 and a second suction chamber 76, located side by side.

The outer peripheral skirt/wall 70 of the suction chambers 74, 76, and also the dividing wall 72 are, in this embodiment, thin strips of flexible material, for example rubber, that extend about the suction chambers and between the suction chambers. For convenience of manufacture, the outer peripheral skirt 70 is made of separate strip sections: two strip sections 70a, 70b for the respective front and rear parts of the skirt 70 and two side sections 70c, 70d. As can be seen in Figures 4 and 5, the strips 70, are held in recesses 77 on the underside of the housing 44. However, the entire skirt could be made from a single strip, such as a continuous band of material or, alternatively, it should be appreciated that the surface engaging members may also take the form of a continuous row of bristles. At this point it should be noted that the rear section, or 'portion', 70b of the skirt is positioned so as to be directly adjacent a long edge of the support member 8. The front portion 70a of the skirt is positioned so as to oppose the rear portion 70b of the skirt, and so can be considered to be remote from the long edge of the support member 8.

Each of the adjacent suction chambers 74, 76 is further provided with an additional floor engaging member 80, also in the form of a rubber strip, that defines an interior wall extending longitudinally within the respective chamber 74, 76 but which terminates short of each end of the chamber, thereby defining a gap 81 each end. In this way, the longitudinal strip 80 divides the interior of the first and second suction chambers 74, 76 into first and second longitudinal suction channels 82, 84 which are fluidly linked by the gaps or 'connecting channels' at either end of the suction chamber. Following the convention used so far, the first suction channel 82 will now be referred to as the front suction channel and the second suction channel 84 will now be referred to as the rear suction channel.

The strip section 70a adjacent the front suction channel 82 is provided with a series of castellations or notches 86 which permits air to flow through these castellations 86 and into the front suction channel 82. Air is able to flow out of the suction chamber 74, 76 through a fluid outlet opening 88 that communicates with the second suction channel

and leads to the connecting conduit 6 via the interior passage 27 of a respective intermediate conduit 24, 26.

The strip section 70b adjacent the rear suction channels 84 is continuous in the sense that it is not provided with castellations and so defines an unbroken edge that is uniform and linear and so is engageable with the floor surface to guard against debris accumulating on the cleaning sheet. Beneficially, this avoids the floor surface being marked as well as extending the life of the cleaning sheet.

In use, with the floor tool 2 located on a floor surface so that all of the strip sections 70a-70d engage the floor surface, the application of suction to the conduit 6 by an associated vacuum cleaner generates two different pressure regions within each suction chamber 74, 76 of each suction nozzle 10, 12. Due to the relatively tight seal formed around the rear suction channels 84 by the rear and side strip sections 70b, 70c, 70d, a relatively high vacuum can be established in the rear suction channels 84. This promotes a relatively high-speed air flow which benefits the entrainment of debris located within crevices in the floor surface into the airflow through the rear suction channels 84. Furthermore, since the rear strip section 70b has a straight and uniform edge, this reduces the likelihood of debris passing under the rear strip section 70b which protects the supporting member 8, and therefore the cleaning sheet, from debris pickup.

The provision of the connecting channels 81 establishes a relatively low vacuum in the front suction channels 82 to enable dust and relatively large debris located on the floor surface to be entrained within a fluid flow drawn into the front suction channels 82 through the relatively large castellations 86. This dirt-bearing fluid flow is then conveyed from the front suction channels 82 through the connecting channels 81, at the sides of the suction chambers 74, 76, to the rear suction channel 84 and then into the opening 88 of the housing 44. From there, the flow is conveyed along the intermediate conduits 24, 26 to the manifold 20 and through the ports 54 into the head portion 28a of the front section 28 of the conduit 6. Optionally, guide surfaces may be provided in the head portion 28a to encourage the fluid to flow into the neck with minimal turbulence.

From the front section 28, the fluid flow passes into the rear section 30 of the conduit 6 and into a wand (not shown) of a vacuum cleaner connected to the fluid outlet 30a of the rear section 30.

As the floor tool is manoeuvred over the floor surface, the flexibility of the strip sections enables the contact with the floor surface, and thus the two different pressure regions within the suction chambers 74, 76, to be maintained over a wide range of orientations of the wand relative to the main body 4. Furthermore, by dividing the suction nozzles 10, 12 into two separate chambers 74, 76, with each of the chambers having respective front and rear suction channels 82, 84, it can be ensured that a high speed fluid flow through the suction chambers is experienced across the whole width of the floor tool 2 which greatly promotes debris entrainment and pickup.

Within the broad concept of the floor tool 2 of the invention, some alternatives have already been explained. Others will now be described below.

A variant of the floor tool 2 is shown in Figure 7 in simplified form. It should be noted that the floor tool 2 is substantially identical to that described with reference to Figures 1 to 6, so the same reference numerals are used to refer to common parts.

In this embodiment each suction chamber 74, 76 is divided into front and rear suction channels 82, 84 as in the previous embodiment by a longitudinal strip portion 100. However, it should be noted that the strip portion 100 in this embodiment defines a shallow V-shape or "chevron", having a vertex that is directly adjacent the front castellated strip section 70a of the suction chamber.

The V-shape of the strip portion 100 provides a tapered front channel 82 which is narrowest at substantially its mid-point, and which widens towards either end. The effect of this is to increase the speed of fluid flow that passes through the castellated front strip section 70a into the centre region of the front suction channel 82 thereby promoting the entrainment of debris into the airflow within the front suction channel 82.

Such shaping of the strip portion 100 therefore makes the most of the vacuum that is applied to the suction channels via the opening 88 by manipulating the speed of the airflow through the suction channels, thus improving debris pickup.

Preferably, the V-shaped strip section 100 defines a relatively shallow interior vertex angle of approximately 170°, although a range of vertex angles of between 150° and 175° would also provide the necessary airflow benefits. Although the V-shaped strip section is shown here with a sharp vertex, it should be appreciated that this need not be the case and that the two angles portions of the strip section 100 could be blended together to form of curved vertex, or be separated by a flattened portion. The key consideration is to narrow the channel 82 in its mid-region in order to increase air flow speed in that region.

As a further enhancement, an additional sealing strip may be provided to extend transversely across the front suction channel 82 between the strip section 70a and the mid-point of the longitudinal strip 80, 100. The additional strip is shown in dotted lines on Figure 7 by reference numeral 101. The effect of this is to guard against debris 'hesitating' in the middle region of the front suction channel, and so this provides a further improvement to pickup performance.

In the embodiments described above, the suction nozzles 10, 12 are separate and distinct elements from the support member 4 and are carried on the ends of the intermediate conduits 24, 26. Advantageously, this permits the nozzles to be pivotably mounted to enable a sheet to be attached to the wipe. The pivotable mounting is not essential, however, and a similar mounting arrangement could be achieved by releasably securing the support member to the suction nozzles.

Furthermore, within the broad concept of the invention as defined by the claims, it is not essential for the suction nozzles to be separate and distinct components from the support member. Instead, a wipe support member could be defined by a block like body, side

portions of which define suction nozzles. By way of explanation, Figures 8 and 9 show perspective and underside views, respectively, of an example of such a floor tool.

Referring to Figure 8, a floor tool 200 similar in configuration to the previous embodiments is shown and includes a main body 202 and a connecting conduit 204 which is pivotably attached to the main body 202. The connecting conduit 204 is the same form as the previous embodiment so will not be described further here.

The main body 202 is block-like in form and includes a wipe support section 205 and a first suction nozzle 206 and a second suction nozzle 208 located along each of the long edges 205a, 205b of the wipe support section. Upper ends 206a, 208a of each of the first and second suction nozzles 206, 208 includes fluid outlets 210 that lead to respective suction channels/conduits 212 that branch off the suction nozzles 206, 208 at an oblique angle and converge at a centrally positioned manifold 214. The connecting conduit 204 is mechanically and fluidly connected to the manifold 214 so that air flow is drawn through the suction nozzles 206, 208, along the suction channels 212 and into the connecting conduit 204, in use.

Recessed sections 216 between the ends of the suction nozzles 206, 208 provide a platform on which ends of a wipe element may be secured by suitable attachment means, such as a clip or plug (not shown), so that the wipe element is stretched along the underside of the support member in the same manner of the previous embodiments.

Turning to Figure 9, which shows the underside of the floor tool of this embodiment, each suction nozzle 206, 208 includes a respective surface engaging member 220, 222 that extends about the nozzle and defines a respective suction chamber 224, 226. As in previous embodiments, the surface engaging members 220, 222 are preferably flexible and may therefore be formed from densely packed bristles or a strip of polymeric material. A strip of polymeric material, for example rubber or PVC, is currently preferred.

In this embodiment, the surface engaging skirt member 220, 222 defines a single suction chamber, as opposed to defining two suction chambers in previous embodiments. However, since each suction chamber is provided with first and second fluid outlets 210, debris pickup is still improved in comparison to a single fluid outlet.

Each of the surface engaging skirt members 220, 222 includes a first portion 220a, 222a which is positioned directly adjacent the support member 205 and a second portion 220b, 222b which is opposed to the first portion 220a, 222a. In other words, it is positioned remotely from the support member 205. In this embodiment, the second portion 220b, 222b is provided with openings along at least a portion of its length, and preferably all of it, as is illustrated in Figure 9, which helps dirt and debris to transition past the front portion of the surface engaging skirt member and into the suction chamber. In contrast, the first portion of the surface engaging skirt member that does not have any openings, and so defines an unbroken edge that is uniform and linear being engageable with the floor surface to guard against debris accumulating on the cleaning sheet.

It should be appreciated that although the openings on the second portion of the surface engaging skirt member are regularly spaced in the form of castellations 223, although this is not essential and the openings may take various forms. What is important is that some way of promoting the admittance of dirt and debris into the suction chamber 224, 226 is provided along the front edge 220b, 222b skirt member, whilst the rear edge of the surface engaging skirt member is formed to prevent dirt and debris passing under it either entering or exiting the suction chamber 224, 226.

The skilled reader will appreciate that the suction chamber configuration explained with reference to Figures 8 and 9 also applies to the floor tool embodiments described in Figures 1 to 7.

Figures 1 to 9 show embodiments of a floor tool in accordance with the invention. However, Figure 10 illustrates the embodiment of the floor tool in Figures 8 and 9 in its

preferred use as forming part of a "stick-vac cleaner" 240, comprising a handheld vacuum cleaner 242 which is carryable in the hand of a user, as shown. An elongate wand 244 is attached to the handheld cleaner 242 which reaches down to the floor tool 200 provided at the end of the wand 244, the floor tool 200 resting on a floor surface in normal use. Note that the floor itself is not explicitly shown in Figure 10, but its presence is implicit.

The handheld vacuum cleaner 242 comprises a motor-driven fan unit (not shown) which is arranged inside a motor casing 246 for drawing air in through an inlet nozzle 248 positioned at the front of the hand held vacuum cleaner 240. The elongate wand 246 is connected to the inlet nozzle 248, and the floor tool 200 is in turn connected to the lower end of the wand 246. In use, dirty air is drawn in through the suction nozzles 206, 208 on the underside of the floor tool 200 and is ducted to the air inlet 248 on the handheld vacuum cleaner 242, through the wand 244. Dirty air that enters the air inlet nozzle 248 passes through a cyclonic separation system 250, where dirt is separated from the air, before the relatively clean air is then exhausted back to the ambient environment via an exhaust 251. The dirt which is separated from the airflow inside the cyclonic separating system 250 is collected in a bin 252 for disposal. The hand held vacuum cleaner 242 is powered by a multi-cell rechargeable battery which is housed in a battery pack 254.

The floor tool 200 is detachable from the wand 244 by means of a catch 256. The wand 244 is in turn detachable from the handheld cleaner 242 by means of a further catch 258. The handheld cleaner 242 can thus be used in isolation as a standalone handheld vacuum cleaner by detaching the wand 244 or, alternatively, the handheld vacuum cleaner 242, wand 244 and floor tool 200 can be used in combination as a hard floor cleaning tool with a suction functionality. The floor tool 200 may also be configured so that it may not be released from the wand 244.

Although the stick-vac of Figure 10 incorporates the floor tool 200 described above with reference to Figures 8 and 9, it should be noted that the floor tool of the previous embodiments may also be incorporated into the stick-vac of Figure 10.

Although the embodiments described above include two suction nozzles, one positioned against each long side of the supporting member, it should be noted that this is not essential and that improved pickup will also be obtained with a single dual chambered suction nozzle located on one side of the supporting member. Alternatively, the second suction nozzle could be a simplified nozzle having a single suction chamber having no dividing walls therein, which would still serve the purpose of protecting its respective side of the cleaning sheet.

The supporting member has been described above as rectangular. However, the skilled person will appreciate that other shapes are also viable. For example the supporting member could also be triangular, diamond-shaped, or even oval, with appropriately modified suction nozzles. Also, although he supporting member has been described as being particularly suitable for use with a non poly-based non-woven cleaning sheet, it should be appreciated that this is not essentially to the invention and it may also be used with other types of wiping members such as woven cleaning cloths. Still alternatively, the supporting member may carry a porous cleaning member such as a sponge pad that is secured on its underside, by a hook-and-loop type fastening system for example, or formed integrally with it.

The skilled person will also appreciate that the form of connecting conduit described with respect to this floor tool is merely optional and, although it confers manoeuvrability benefits, other types of conduit arrangements could be used with the main body of the floor tool.

## CLAIMS

1. A floor tool for a vacuum cleaning appliance, comprising a main body connected to a conduit, the main body comprising:

a supporting member adapted to support a cleaning element;

a suction nozzle adjacent an edge of the supporting member;

wherein the suction nozzle defines a first suction chamber and a second suction chamber adjacent to the first suction chamber, and wherein each suction chamber includes a respective fluid outlet in communication with the conduit.

2. The floor tool of claim 1, wherein the suction nozzle includes a surface engaging skirt member that depends from a surface of the suction nozzle and defines the outer periphery of each of the first and second suction chambers.

3. The floor tool of claim 2, wherein a dividing wall extends between sides of the surface engaging skirt member to define the first and second suction chambers, and depends from a housing of the suction nozzle to the same extent as the surface engaging skirt member.

4. The floor tool of claim 2 or claim 3, wherein the surface engaging skirt member is flexible.

5. The floor tool of claim 2 or claim 3, wherein the dividing wall is flexible.

6. The floor tool of claim 3 or claim 4, wherein the surface engaging skirt and the dividing wall are defined by at least one of a plurality of bristles, a plurality of filaments and at least one strip of flexible material.

7. The floor tool of any one of claims 2 to 6, wherein the first suction chamber and the second suction chamber each comprise an interior wall which partitions the suction

chamber into a first suction channel and a second suction channel, wherein a dirt bearing fluid flow is able to travel from the first suction channel into the second suction channel via at least one intermediate channel.

8. The floor tool of claim 7, wherein the interior wall is flexible.

9. The floor tool of claim 7 or claim 8, wherein the interior wall is shaped such that one of the first or second suction channels is tapered.

10. The floor tool of any one of claims 7 to 9, wherein the fluid outlet is in communication with the second suction channel.

11. The floor tool of any one of claims 2 to 10, wherein the surface engaging skirt member is provided with castellations along one portion wherein an opposed portion of the surface engaging skirt member is uniform along its length.

12. The floor tool of any one of claims 6 to 10, wherein a further floor engaging member extends transversely across the front suction channel between the interior wall and an adjacent portion of the skirt.

13. The floor tool of any one of the preceding claims, wherein each fluid outlet of the nozzle communicates with an intermediate conduit which is coupled to a manifold.

14. The floor tool of claim 13, wherein the or each intermediate conduit is pivotably coupled to the manifold.

15. The floor tool of claim 14, wherein the suction nozzle is pivotable with respect to the supporting member between a first, lowered state, in which the nozzle lies next to an adjacent edge of the supporting member and a second, raised, state in which the suction nozzle pivots upwardly away from the supporting member.

16. The floor tool of claim 15, wherein the or each intermediate conduit is coupled to a cylindrical portion of the manifold by way of a part-cylindrical sleeve.

17. The floor tool of claim 16, wherein the intermediate conduit defines, at least in part, the cylindrical portion of the manifold.

18. The floor tool of any one of claims 13 to 17, wherein the intermediate conduit includes a protruding formation which is engageable with a complementary shaped recess defined by the supporting member such that, when the suction nozzle is in the lowered position, the protruding formation extends into the recess to secure a wipe member to the supporting member.

19. A floor tool for a vacuum cleaning appliance, comprising a main body connected to a conduit, the main body comprising a suction nozzle including a first suction chamber and a second suction chamber adjacent to the first suction chamber, and wherein each suction chamber includes a respective fluid outlet in communication with the conduit, wherein the first suction chamber and the second suction chamber each comprise an interior wall which partitions the suction chamber into a first suction channel and a second suction channel, wherein a dirt bearing fluid flow is able to travel from the first suction channel into the second suction channel via at least one intermediate channel.

20. The floor tool of claim 19, wherein the interior wall is shaped such that one of the first or second suction channels is tapered.

21. The floor tool of claim 19 or claim 20, wherein the suction nozzle includes a surface engaging skirt member that depends from a surface of the suction nozzle and defines the outer periphery of each of the first and second suction chambers.

22. The floor tool of claim 21 or claim 22, wherein a further floor engaging member extends transversely across the first or the second suction channels between the interior wall and an adjacent portion of the surface engaging skirt.

23. The floor tool of claim 21 or claim 22, wherein a dividing wall extends between sides of the surface engaging skirt member to define the first and second suction chambers, and depends from a housing of the suction nozzle to the same extent as the surface engaging skirt member.

24. The floor tool of any one of claims 21 to 23, wherein the surface engaging skirt member and/or the dividing wall are flexible.

25. The floor tool of any one of claims 19 to 24, wherein the fluid outlet is in communication with the second suction channel.

26. A floor tool as hereinbefore described with reference to or as illustrated in the accompanying drawings.

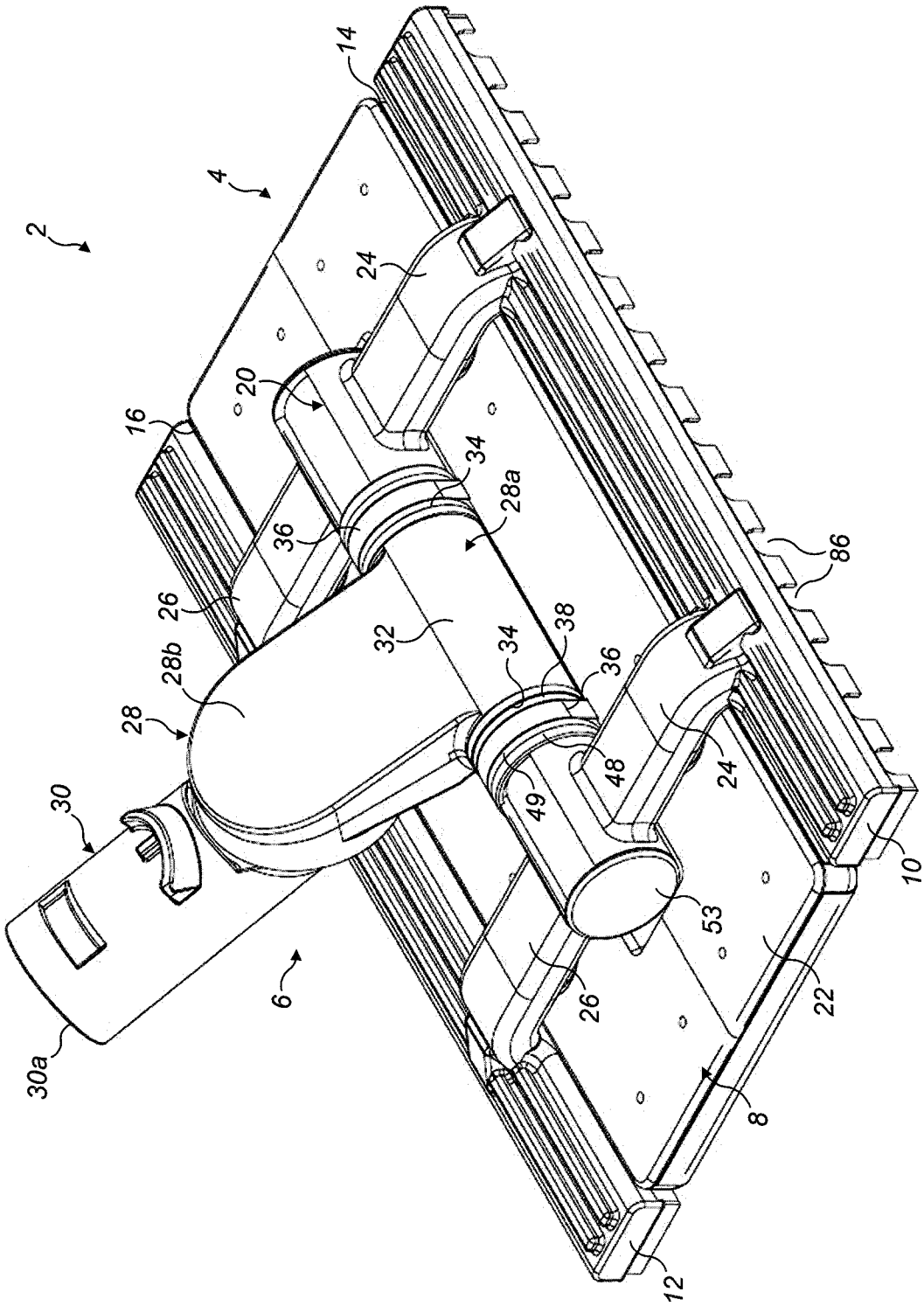



FIG. 1

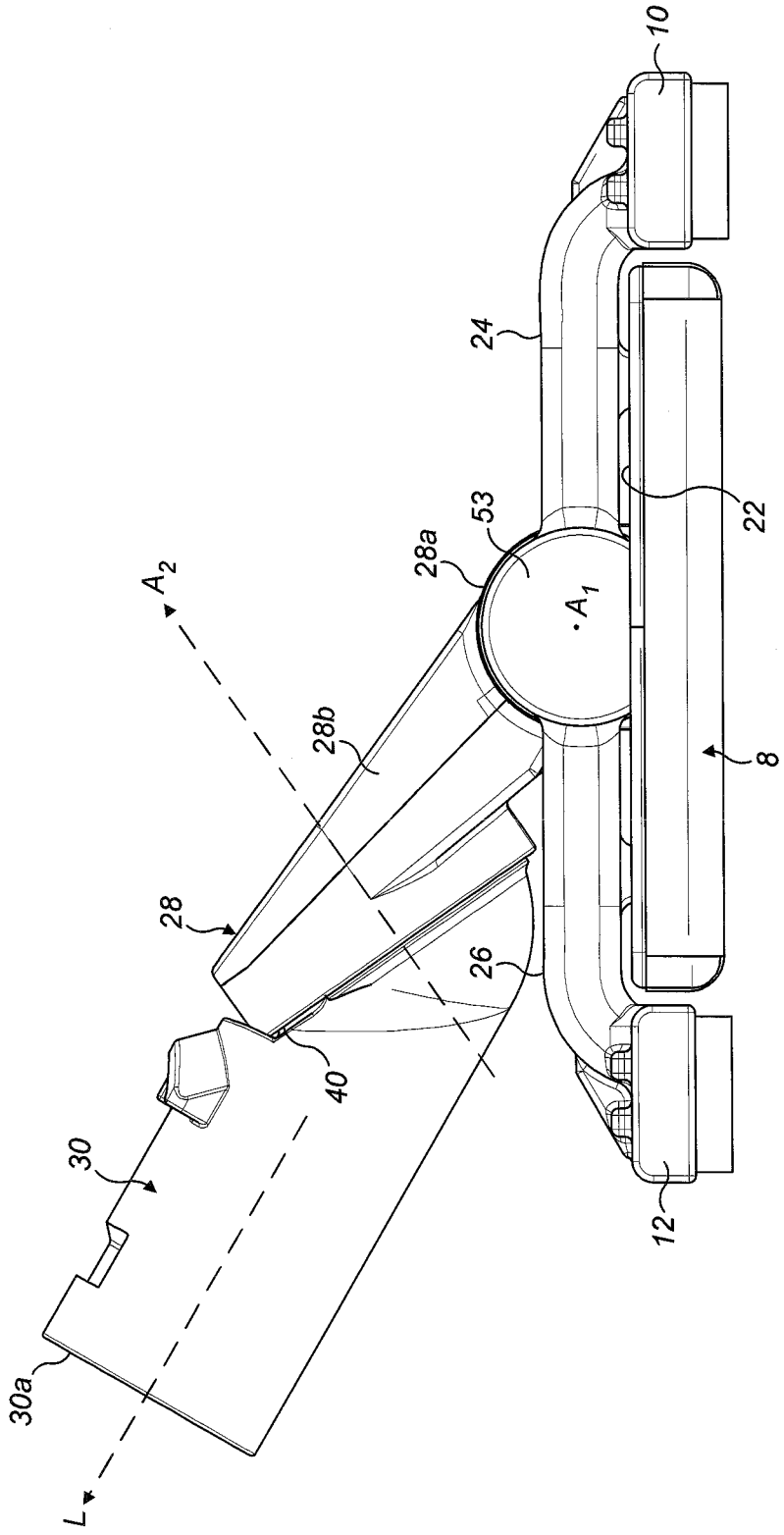



FIG. 2

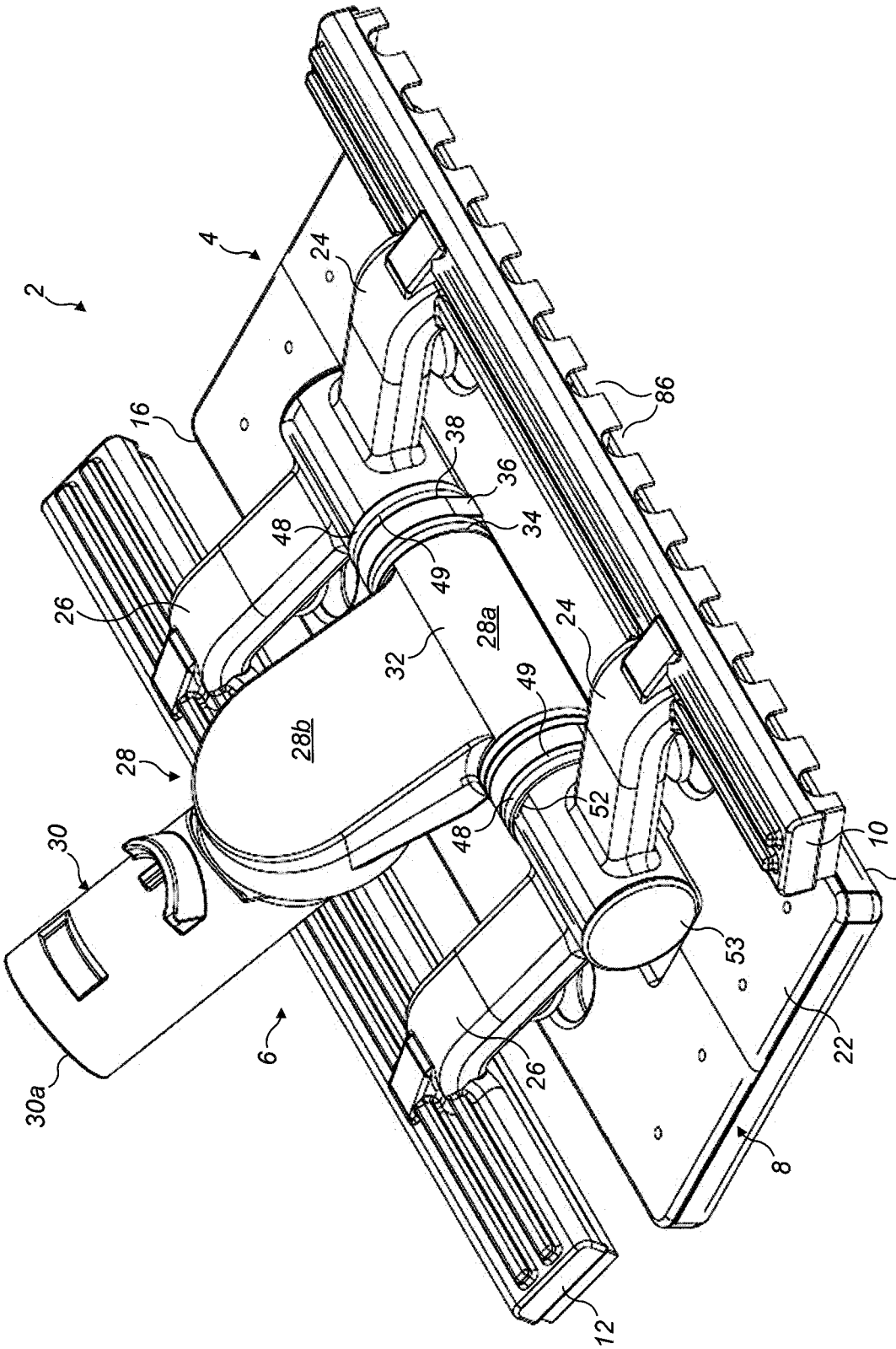
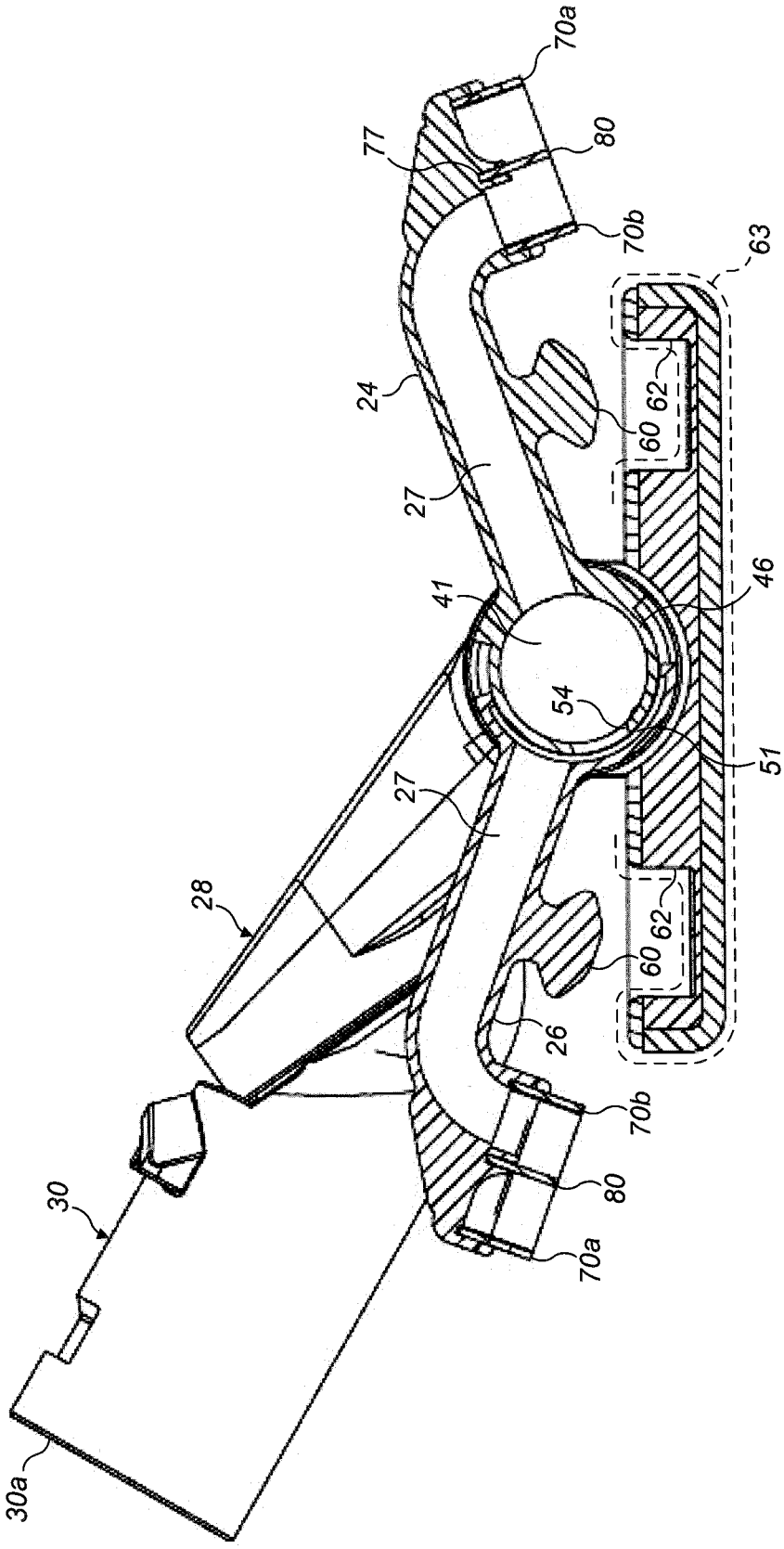



FIG. 3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70b
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30
70a
30a

FIG. 4

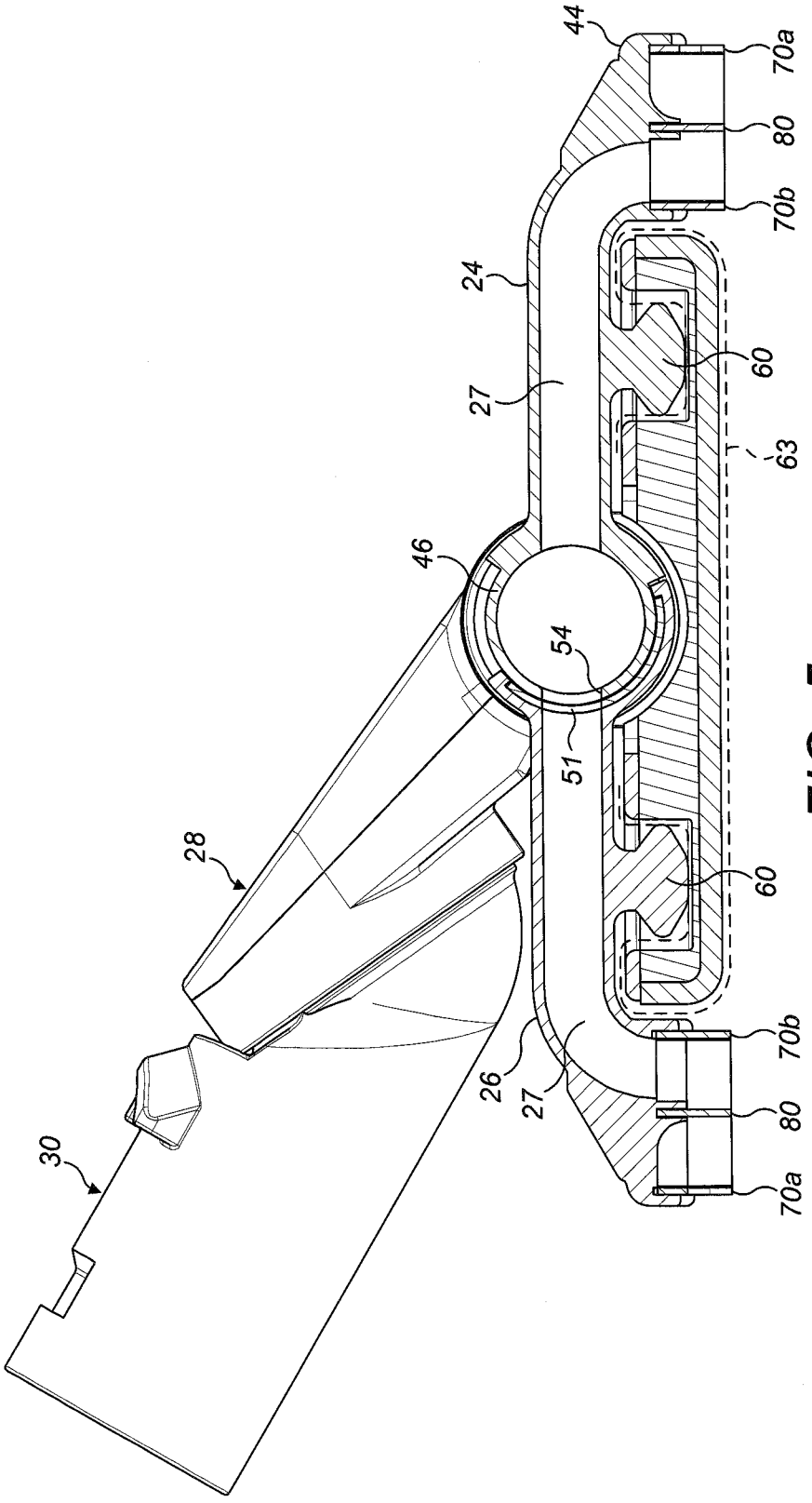


FIG. 5

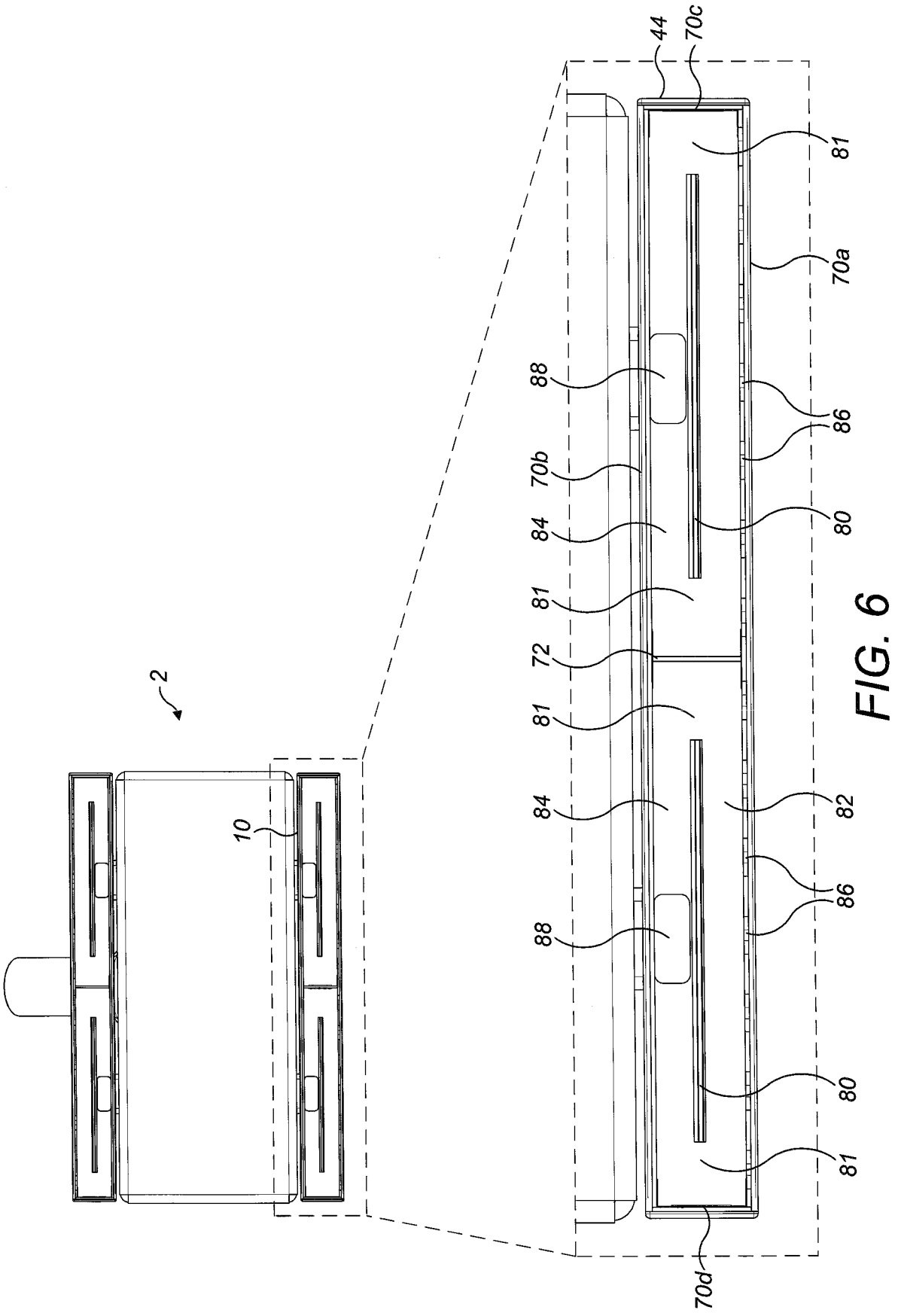


FIG. 6

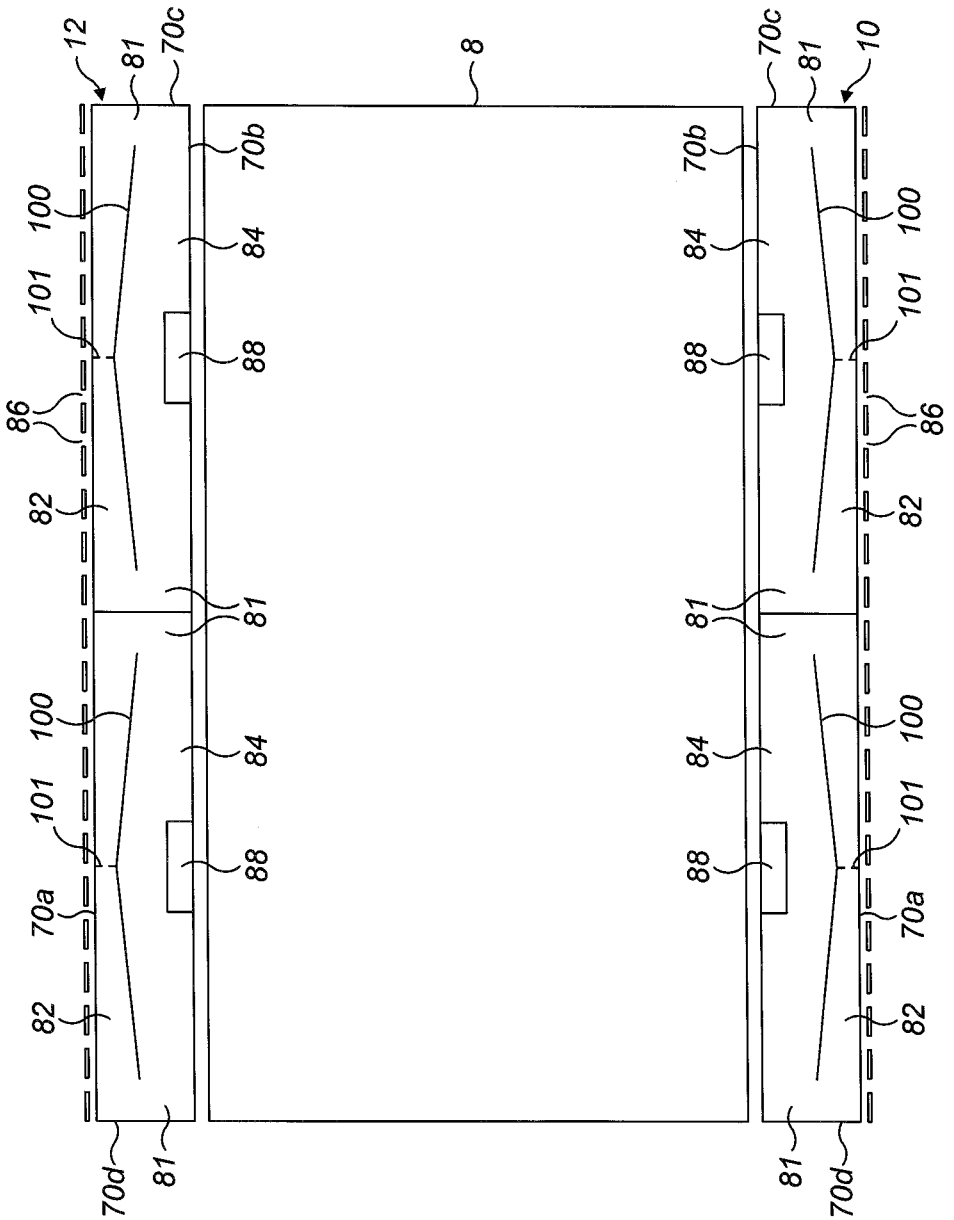
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FIG. 7

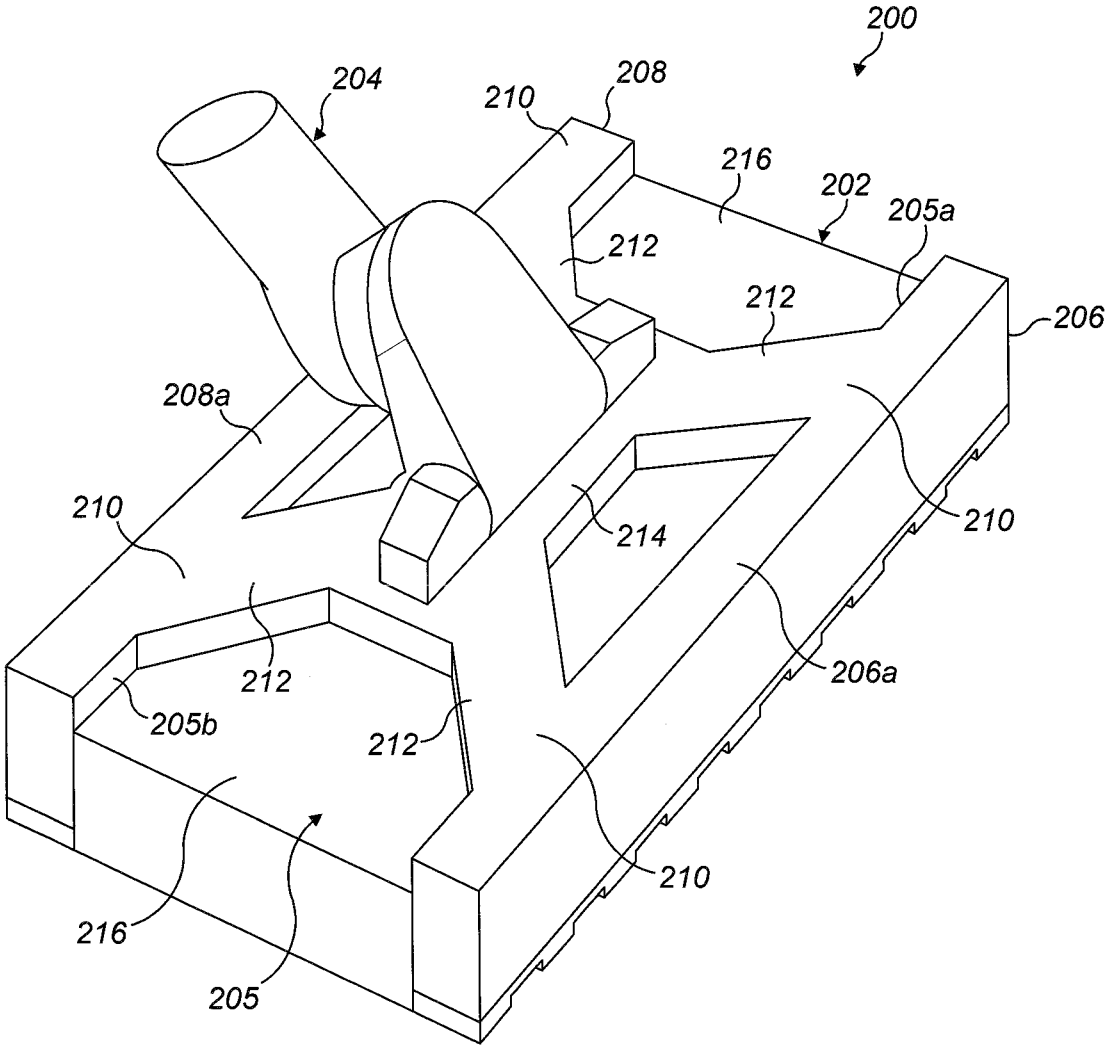
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FIG. 8

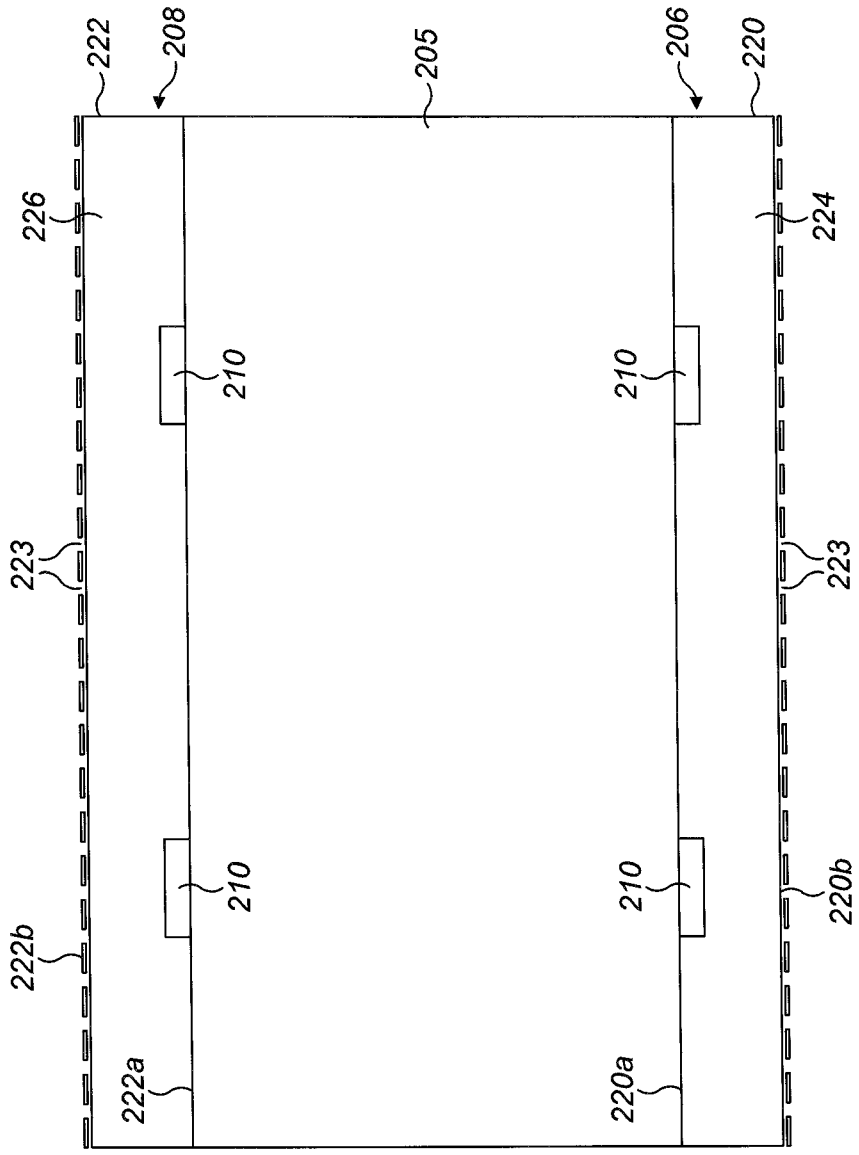
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FIG. 9

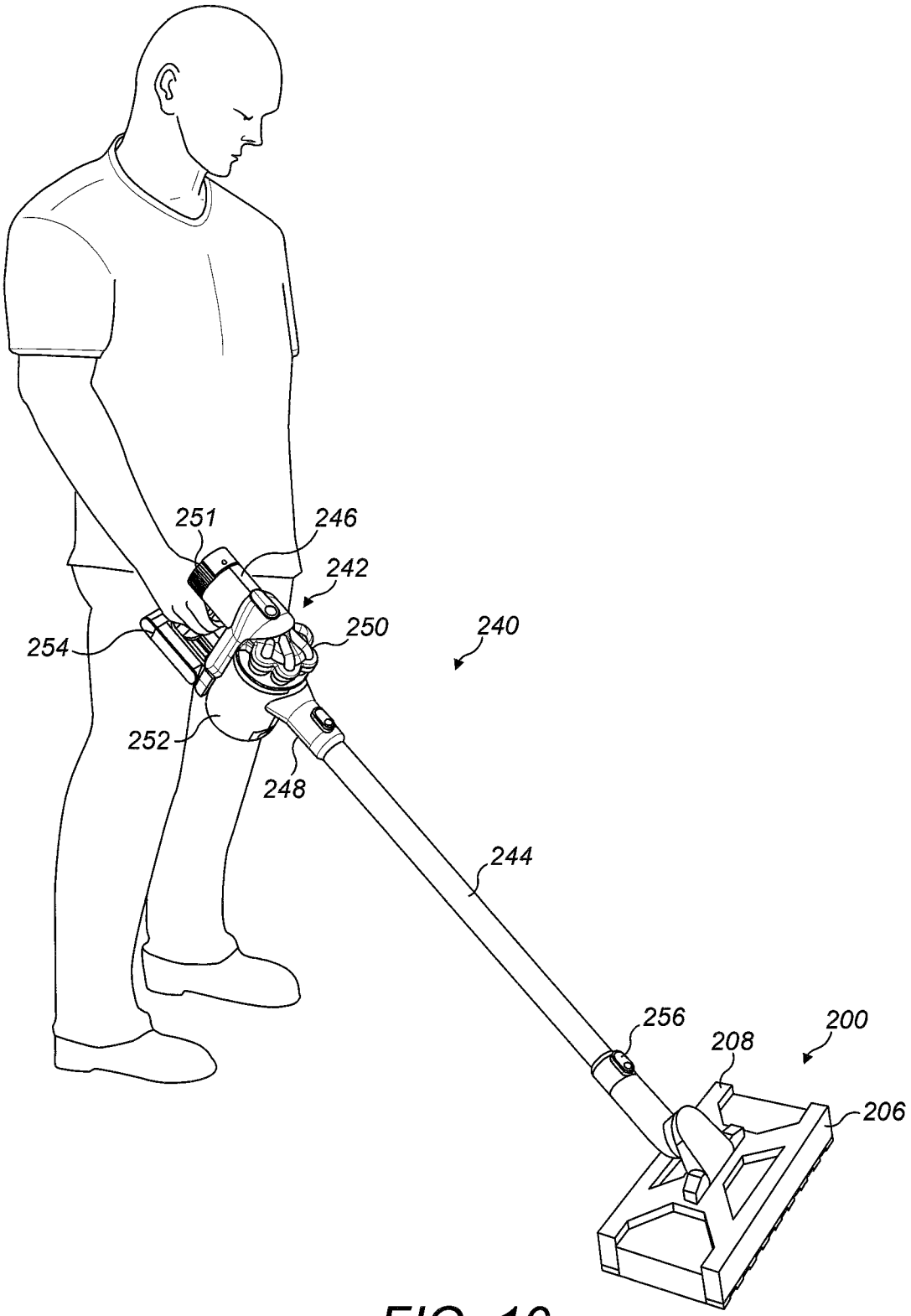


FIG. 10