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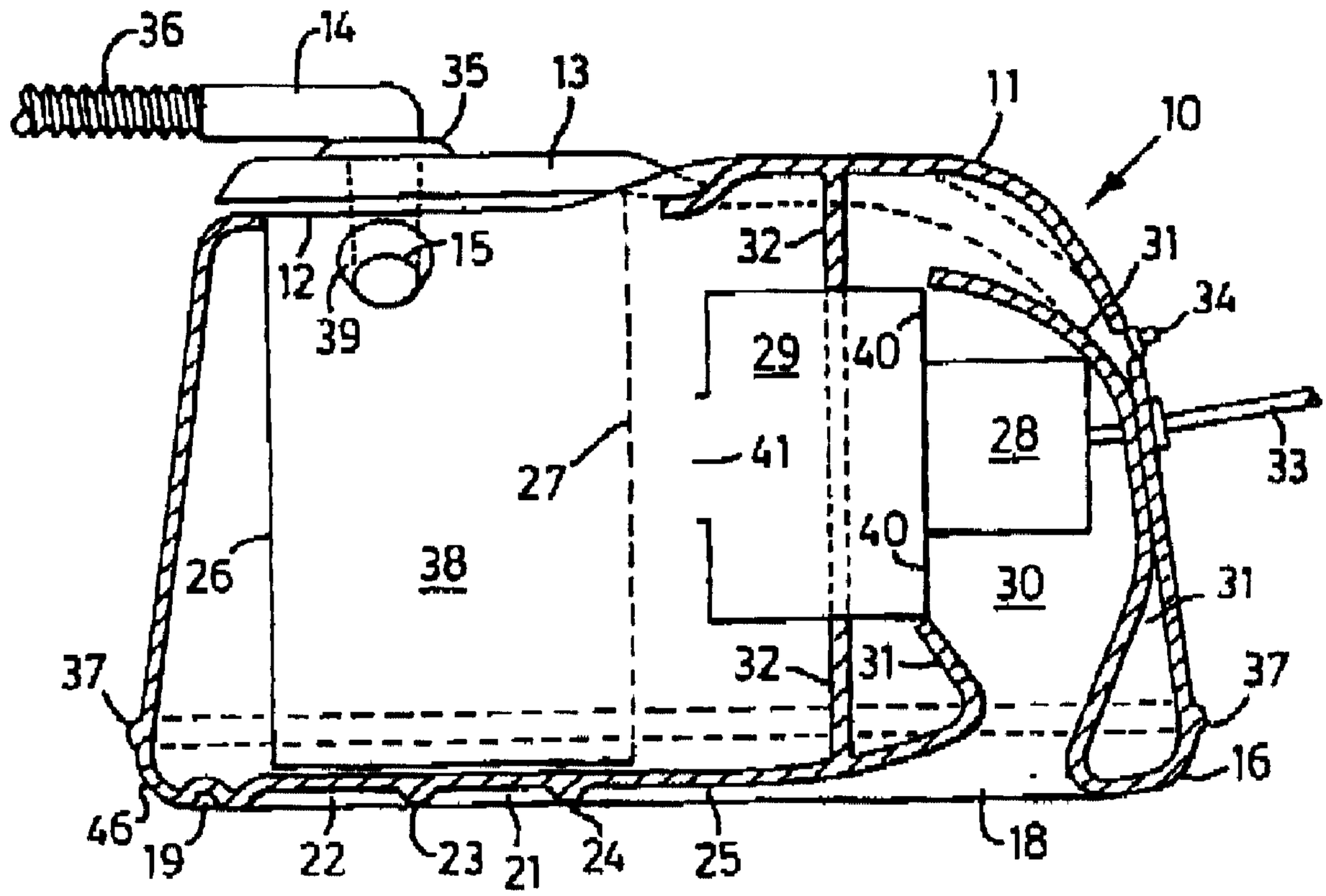
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(54) Titre : ASPIRATEUR HOVER AMELIORE
(54) Title: IMPROVED HOVER VACUUM CLEANER



(57) Abrégé/Abstract:
Herein disclosed is a vacuum cleaner comprising a housing having a filter chamber, an opening to receive one end of a vacuum hose and suction means for establishing a vacuum in the hose to deliver air therein to the filter chamber, an outlet for delivering exhaust air from the filter chamber, the housing having a lower section, the outlet being directed to the lower section, wherein the lower section and the outlet are operable to form a cushion of air beneath the vacuum, the lower section having a peripheral region with a vacuum passage located therein, the passage being in fluid communication with both the peripheral region and the filter chamber, wherein the suction means is operable to establish a vacuum in the vacuum passage.

ABSTRACT

Herein disclosed is a vacuum cleaner comprising a housing having a filter chamber, an opening to receive one end of a vacuum hose and suction means for establishing a vacuum in the hose to deliver air therein to the filter chamber, an outlet for delivering exhaust air from the filter chamber, the housing having a lower section, the outlet being directed to the lower section, wherein the lower section and the outlet are operable to form a cushion of air beneath the vacuum, the lower section having a peripheral region with a vacuum passage located therein, the passage being in fluid communication with both the peripheral region and the filter chamber, wherein the suction means is operable to establish a vacuum in the vacuum passage.

IMPROVED HOVER VACUUM CLEANER

Field of the Invention

The present invention relates to vacuum cleaners, and more particularly to air-supported hover vacuum cleaners.

Background to the Invention

Air-supported vacuum cleaners are known. For example, U.S. Patent 2 751 038 to L.K. Acheson, which issued June 19, 1956 discloses an air-supported vacuum cleaner which has an air space on the underside of the cleaner, which is bounded by the underside of the casing for the cleaner and a peripheral dam or bead. Other air-supported vacuum cleaners are shown in the U.S. Patents 2 780 826 to Coons et al., which issued February 12, 1957, 3, 283, 355 to I. Jepson, which issued November 8, 1966 and U.S. Patent 2 889 570 to J.E. Duff, which issued June 9, 1959. U.S. Patent 2 743 787 to W.G. Seck, which issued May 1, 1956 discloses an air-supported vacuum cleaner which has an air space bounded by the underside of the casing for the cleaner and a peripheral dam. Outside the peripheral dam there is a deflector for preventing air from discharging across the surface of the floor upon which the vacuum cleaner rests or travels, and for directing the escaping air in an upward direction.

One of the problems with previous air-supported vacuum cleaners is a tendency for the vacuum cleaner to rock or judder as a result of uneven flow of air escaping from under the peripheral dam. One solution to this problem is disclosed in U.S. Patent 2 814 064 to J.C. Montgomery, which issued November 26, 1957 which discloses an air-supported vacuum cleaner with a peripheral double dam with an air diffusing channel between the dams. The air escapes from the air space, past the inner of the two dams and thence through the air diffusing channel. Such an arrangement adds to the cost of the vacuum cleaner and introduces complexity to the operation of the vacuum cleaner.

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In one of its aspects, the present invention is directed to a simple but effective air-supported vacuum cleaner which tends to be stable, not subject to juddering and is relatively inexpensive to produce. The invention is also directed to a hover vacuum cleaner with an arrangement which the hover performance tends not to diminish as the filter becomes filled with dust.

Summary of the Invention

The present invention provides a vacuum cleaner comprising:

a casing, an underside to the casing in which the underside has a longitudinal axis, an impeller and drive motor for the impeller, a dust filter, an inlet for dust laden air, an exhaust port in the, a pathway for air to pass from the inlet, through the dust filter and impeller and around the motor, and through the exhaust port;

wherein the underside has dished air chambers, covering a substantial area of the underside, in locations selected from the group consisting of i) at least two dished air chambers on the underside, wherein each dished air chamber straddles the longitudinal axis, and adjacent dished air chambers are separated by a dam which is transverse to the longitudinal axis, and wherein the exhaust port is in direct fluid communication with one of the dished air chambers and the exhaust port straddles the longitudinal axis, ii) a first dished air chamber which straddles the longitudinal axis and an exhaust port which straddles the longitudinal axis, wherein the exhaust port is in direct fluid communication with the first air chamber, and at least one pair of dished air chambers wherein corresponding dished air chambers in each pair are on opposing sides of the longitudinal axis separated by a keel skirt, and wherein the first air chamber and the adjacent pair of dished air chambers are separated by a dam which is transverse to the longitudinal axis, and wherein the adjacent pairs of dished air chambers are separated by a dam which is transverse to the longitudinal axis; and

wherein the underside has a peripheral groove which is in fluid communication with

a member selected from the group consisting of the exhaust port and the air chamber which is in direct fluid communication with the exhaust port, and a combination thereof.

In one embodiment, there are three dished air chambers, each of which straddle the longitudinal axis.

In a further embodiment, there are three dished air chambers, each of which straddles the longitudinal axis, and the air chamber in fluid communication with the exhaust port is an outer chamber.

In another embodiment, the underside of the vacuum has an extension which extends outwardly and upwardly from the peripheral groove, with the extension having an arcuate cross-section.

In yet another embodiment, the vacuum cleaner has a cyclonic action dust filter.

In a further embodiment, the inlet for dust laden air, which leads to the cyclonic action dust filter, has a nozzle which is rotatable about an axis which is parallel to a longitudinal axis for the dust filter.

In another embodiment, the inlet for dust laden air, which leads to the cyclonic action dust filter, has a nozzle which is rotatable so that the nozzle may direct air at any downward angle into the dust filter.

In yet another embodiment, the pathway for air from the impeller to the exhaust port is constrained by walls so that there is a steady flow of air therethrough when the vacuum is in operation.

In another embodiment, the walls are in a partial snail shell shape.

The present invention also provides a hover vacuum cleaner comprising a casing, an underside to the casing, a cyclonic dust filter, hover means on the underside to allow the vacuum cleaner to hover on a bed of air, an inlet to the cyclonic dust filter for dust laden air, an impeller and drive motor for the impeller, an exhaust port in the underside, a pathway for air to pass from the inlet, through the dust filter and impeller and around the motor, and through the exhaust port to the hover means.

In one embodiment, the inlet for dust laden air, which leads to the cyclonic action dust filter, has a nozzle which is rotatable about an axis which is parallel to a longitudinal axis for the dust filter.

In another embodiment, the inlet for dust laden air, which leads to the cyclonic action dust filter, has a nozzle which is rotatable so that the nozzle may direct air at any downward angle into the dust filter.

In yet another embodiment, the pathway for air from the impeller to the exhaust port is constrained by walls so that there is a steady flow of air therethrough when the vacuum is in operation.

In another of its aspects, the present invention provides a vacuum cleaner comprising a housing having a filter chamber, an opening to receive one end of a vacuum hose and suction means for establishing a vacuum in the hose to deliver air therein to the filter chamber, an outlet for delivering exhaust air from the filter chamber, the housing having a lower section, the outlet being directed to the lower section, wherein the lower section and the outlet are operable to form a cushion of air beneath the vacuum, the lower section having a peripheral region with a vacuum passage located therein, the passage being in fluid communication with both the peripheral region and the filter chamber, wherein the suction means is operable to establish a vacuum in the vacuum passage.

In still another of its aspects, the present invention provides a floor cleaning device

comprising a housing having an opening, a filter chamber in fluid communication with the opening and a vacuum means for establishing a region of reduced pressure in the filter chamber, the housing having a lower section which is cooperative with the vacuum means to deliver exhaust air thereto to form a cushion of air, the lower section having a peripheral region including a channel which is in fluid communication with the filter chamber.

Preferably, the housing includes an outer shell, the channel being located inside or outside the outer shell. The channel may include a hose fastened to the outer shell. The housing has an opening to the filter chamber which is releasably sealed by a cover, the cover further including an opening which is coupled with the hose. Alternattively, the conduit is integrally formed with the housing.

In still another of its aspects, the present invetion provides a floor cleaning device comprising a housing having an opening, a filter chamber in fluid communication with the opening and a vacuum means for establishing a region of reduced pressure in the filter chamber, the housing having a lower section which is cooperative with the vacuum means to deliver exhaust air thereto to form a cushion of air, the lower section having a peripheral region including a deflection skirt extending downwardly therefrom.

Preferably, the skirt is formed from a resilient plastic material and may be an open- or closed-cell foam expanded plastics material. Alternatively, the skirt may be formed from other materials such as fibrous, porous, or material. More preferably, the material is electrostatic.

In still another of its aspects, there is provided a method of improving the operation of a hovering vacuum cleaner of the type having a lower section which, in use is spaced from a floor surface by a cushion of air, comprising:

locating a vacuum channel in a peripheral region of hte lower section; and

establishing a relatively low pressure in the vacuum channel in order to capture particles entrained in the cushion of air.

In yet another of its aspects, there is provided a method of improving the operation of a hovering vacuum cleaner of the type having a lower section which, in use is spaced from a floor surface by a cushion of air, by extending a deflection skirt downwardly from the lower section.

In still another of its aspects, the present invention provides a floor cleaning device comprising a vacuum assembly having a filter cavity and a motorized suction unit, a lower portion, the suction unit operable to establish a relatively lower pressure in the filter cavity and a relatively high pressure beneath the lower portion, a first vacuum supply inlet to draw particle laden air from a remote region to the filter chamber and a second vacuum supply inlet to draw particle laden air from a local region to the filter chamber.

Preferably, the the lower portion has a peripheral section, the local region is near peripheral section. If desired, the local region may encircle the peripheral section. In one embodiment, the second vacuum supply inlet is operable to capture at least a portion of particles entrained in air leaving the lower portion.

Preferably, the assembly includes a housing, second vacuum supply inlet is located outside or inside the housing. If desired, the second vacuum supply inlet may be integrally formed with the housing.

Brief Description of the Drawings

Figure 1 is a cross-sectional side view of a vacuum cleaner of the present invention.

Figure 2 is a top view of the vacuum cleaner of Figure 1.

Figure 3 is a bottom view of the vacuum cleaner of Figure 1.

Figure 4 is a view showing the lid, inlet tube and the mouth of an inlet nozzle, also shown in Figure 1.

Figure 5 is a cross-sectional side view of the vacuum cleaner of Figure 1, showing air flows.

Figure 6 is a bottom view of another embodiment of a vacuum cleaner.

Figure 7 is sectional view of another vacuum cleaner.

Figure 8 is a plan view of the cleaner of figure 7.

Detailed Description of Preferred Embodiments

The drawings show a vacuum cleaner 10 which has an upper body casing 11 and a lower body casing 16 joined at joint 37. Upper body casing 11 has an upper opening 12. Opening 12 is for removing and replacing a filter within filter cavity 38. Opening 12 is closed with lid 13. Suction inlet tube 14 is connected to lid 13 by swivel bearing 35. Suction inlet tube 14 leads through lid 13 into filter cavity 38 and terminates in opening 15 in nozzle 39.

Located inside vacuum cleaner 10 is filter cavity 38 which is bounded by a filter container 43 (see Figure 2), which comprises front wall 26 and rear perforated wall 27 (see Figure 1). A filter bag 44 may be inserted into filter cavity, as is known in the art. Also located in upper body casing 11 is motor 28 and impeller 29. Impeller 29 is positioned within vacuum cleaner 10 by means of wall 32, which also serves to ensure that air is drawn by impeller 29 from the filter 44. Impeller 29 has inlet apertures 41 and outlet apertures
40. Outlet apertures lead into chamber 30 which surrounds motor 28. As shown in Figure 1, chamber 30 is bounded by chamber walls 31. Chamber walls 31 allow for direction of a steady flow

of air from outlets 40, past motor 28, to exhaust port 18 in the bottom of lower casing 16. The chamber walls 31 are preferably in the shape of a partial snail shell, as shown in Figure 1. Chamber walls 31 avoid dead spots of air flow as in prior designs, in which air enters a large chamber before exiting through exhaust port 18. The inlet 14 is connected to flexible tube 36, which is connected to a power head (not shown), or other dust receiving tools as is known in the art.

Motor 28 is an electric motor and is electrically powered through electric cord 33, which enters upper body casing 11 through a hole at the rear of the vacuum. Electric motor 28 is controlled by on-off switch 34. The top of body casing 11 has a handle 42.

The underside 17 of lower body casing 16 has three dished air chambers 21, 22 and 25, each of which is symmetrical about, and straddles, longitudinal axis X-X. Air chamber 25 has exhaust port 18 therein. Air chambers 25 and 21 are separated by transverse bar 24. Air chambers 22 and 21 are separated by transverse bar 23. Around the periphery of underside 17 there is a channel 19 which connects with air chamber 25 by connecting passage 20. In the embodiment shown, there is an arcuately shaped extension 46 which curves upwardly to the main part of casing 11. While this is not essential, it has been found to be beneficial in helping the stability of the vacuum cleaner

The placement of the dished air chambers 21, 22 and 25 need not be symmetrical about the longitudinal axis. Indeed, it has been found that at least one of the air chambers by be offset from the longitudinal axis, so that portion of the air chamber on one side of the longitudinal axis is larger than the portion on the opposing side of the longitudinal axis. The reason for this is not known, but in some instances it has been demonstrated to be beneficial.

It is preferable that the ratio of the total area of the dished air chambers to the total area of the underside be at least about 70:100 and preferably from about 75:100 to 95:100.

The inlet tube 14 is connected to lid 13 at a swivel bearing 35, as shown in Figure 4. Inlet tube is in fluid connection with inlet nozzle 39. Inlet nozzle 39 has an opening 15 through which

dust laden air may be directed at an angle into filter cavity 38. In the embodiment shown, inlet nozzle 39 may be swivelled in a 360° arc so that opening 15 may be directed towards any part of the upright wall of filter container 43, e.g. rear wall 27 or front wall 26. Preferably, the filter arrangement is a so-called cyclonic filter. Cyclonic filters are known and have previously been used in conventional vacuum cleaners with wheels.

In operation, when the motor 28 is energized, air 35 is drawn through the vacuum cleaner by means of the impeller 29, which is driven by motor 28. Dust laden air is picked up by a power head or other tool (not shown) and is sucked into filter cavity 38 through flexible tube 36, inlet tube 14 and nozzle 39. Nozzle 39 directs the dust laden air into filter cavity 38 as indicated schematically by arrows A and B in Figure 5.

Cyclonic action of the air permits the dust to drop out of the air flow, before being drawn through filter 44, and into impeller 29 through passageway 41. Air is then expelled by impeller 29 past motor 28 and into chamber 30. In the embodiments shown in the drawings, the chamber 30 is bounded by walls 31, which direct the filtered air past the motor housing and to exhaust port 18. The walls 31 are not essential but have the benefits of preventing stagnation of air in chamber 30, keeping a high airflow over the motor housing and thus keeping the motor cooler than would otherwise be the case. Without walls 31, air tends to be compressed in chamber 30 and the air flow patterns are such that there is a heat build up in chamber 30.

With respect to the dust laden air entering the filter cavity 38, the flow of the air can be controlled by the angles of entry of the air through opening 15, relative to directions parallel and transverse to the longitudinal axis Y-Y (see Figure 5) of the filter cavity 38, and the offset of the opening 15 from the longitudinal axis Y-Y The angle of air flow and positioning of inlet nozzle 39 will affect the air flow pattern, and thus the cyclonic action, in filter cavity 38. The cyclonic action tends to keep the walls of the filter bag 44 from being clogged. As will be appreciated, clogging of the walls of filter bag 44 would lead to a pressure drop and consequent lowering of the rate of air flow into the impeller. A particular advantage of the cyclonic air filter for a hover vacuum is that

there is little lessening of air flow through the filter as the bag becomes filled with dust. Accordingly, the hover action of the vacuum cleaner tends not to be impaired as the filter becomes filled with dust. The cyclonic action of the filter improves the performance of hover vacuum cleaners with hover systems which are not shown in the drawings. For example, a cyclonic filter will improve the performance of hover vacuum cleaners as disclosed in the aforementioned U.S. Patents 2,780,826 to Coons et al., 3,283,355 to I. Jepson and 2,889,570 to J. E. Duff, among others.

Although the drawings show the vacuum cleaner 10 as having a cyclonic action filter system, such a system is not necessary for the operation of one aspect of the invention. It is, however, especially preferred.

The hover action of the vacuum cleaner 10 is effected by air flow from exhaust port 18 across the underside 17, before escaping from the periphery of the underside 17. Without wishing to be held to any theory, Applicant believes that the peripheral channel 19 allows air to be directed in a peripheral "skirt", while the dished air chambers 21 and 22 provide compression pockets at the forward end of the vacuum 10. Without the peripheral channel, there is a tendency for the vacuum cleaner to judder and become unstable. The positioning of dams 23 and 24 between adjacent air chambers is critical to the hovering action of the vacuum cleaner. For example, it has been found that displacement of dam 23 by as little as 3-4 cm along the longitudinal axis X-X is sufficient to alter the air flow patterns so that the vacuum cleaner no longer hovers. Notwithstanding the criticality of the positioning, however, the correct positions for the dams can be found by simple experimentation.

The air flow patterns are shown schematically in Figures 3 and 5. Dust laden air flows through nozzle 39 as indicated by arrow A, before being directed in a vortex pattern B in filter cavity 38. The air then passes through filter bag 44 and into impeller 29 as indicated by arrow C. The impeller then forces the air into air chamber 30 in the direction shown by arrow E and thence through exhaust port 18, some of the air is directed into channel 19 as shown by arrows as shown by arrows M and K. Some of the air is also directed into dished air chamber 25 as shown by arrows F. The

air swirls in chamber 25 as shown by arrows G. Some of this air spills over dams 24 and 23 and swirls in air chambers 21 and 22 as shown by arrows H and J respectively. The air then escapes from the underside 17 as indicated by arrows L. It will be recognized that the patterns shown may not be true representations of the air flow.

It has been found that, apart from the dished air chambers 21, 22 and 25, channel 19 and the periphery of the underside, the remainder of the underside is preferably flat.

Another arrangement of dished air chambers on the underside of the vacuum cleaner may be as shown in Figure 6. As will be apparent, the difference between the underside of Figures 3 and 6 lies in the longitudinal division of dished air chambers 21 and 22 of Figure 3 by a keel skirt. In Figure 6, the keel skirt 45 separates dished air chambers 21a and 21b, and 22a and 22b. Other combinations of dished air chambers, dams and keel skirts may be appropriate in some cases. For example, there may be only one pair of dished air chambers 21a and 21b on opposing sides of longitudinal axis X-X.

The vacuum cleaner may be made using conventional materials. For example the casing, impellar walls and inlet tubing may be made from synthetic thermosetting or thermoplastic polymers, glass fibre reinforced plastic (FRP), metal or other suitable materials.

The vacuum cleaner may also have other features. For example, the electric cord 33 may be automatically retractable into the housing using a spring loaded reel. The filter housing may also have facility for inserting a pouch with fragrant material therein.

The vacuum cleaner of the present invention may be used on many types of floor surface, including carpeted surfaces. The vacuum works well on stairs also, as long as the whole of underside 17 remains on a stair step. If the vacuum cleaner works its way to an edge of the stair step sufficient for part of channel 19 to be unsupported by the stair, then air will be caused to spill at the unsupported part and thus cause the vacuum cleaner to lose its hovering action. In this way there

is less likelihood of the vacuum cleaner from being dislodged from the stair than for conventional wheeled vacuum cleaners.

Referring to figures 7 and 8, wherein, for the sake of consistency, the reference numerals used in the earlier embodiments for like parts will remain the same. In this case, there is provided a floor cleaning device comprising a housing having an opening, a filter chamber in fluid communication with the opening and a vacuum means for establishing a region of reduced pressure in the filter chamber, the housing having a lower section which is cooperative with the vacuum means to deliver exhaust air thereto to form a cushion of air, the lower section having a peripheral region including a channel which is in fluid communication with the filter chamber.

Preferably, the housing includes an outer shell, the channel being located inside or outside the outer shell. The channel may include a hose fastened to the outer shell as shown in dashed lines at 52 in figures 7 and 8. In this case, the channel is joined to the cover 13 by way of a conduit 54, so that the interior of the channel 52 may be placed in a condition of reduced pressure. The channel 52 also has a number of passages shown at 56a through 56d figure 8. The passages 56 positioned in order to draw particles which are entrained in the air flow exiting the from the air cushion, for example as represented by arrows L in figure 3. The size and shape of the passages will depend on the characteristics of the device and its operation. For example, in some cases, the passages may be relatively small as shown by those identified at 56a or may be relatively large as shown by the passage 56c. The passages may have a longitudinal component and a lateral component (relative to the longitudinal axis of the channel itself) as shown by the passage identified at 56d. Alternatively, the passages may be laterally arranged as shown by passages 56e and which may extend up the side of the channel in order to be exposed to the area neighbouring the outside of the housing.

In use, the motor and impeller establish a relatively low pressure condition in the filter cavity or chamber 38 and consequently in the conduit 54 and the channel 52. As exiting air leaves the lower periphery of the housing it passes the passages 56, in such a manner that at least a portion of particles that may be entrained in the exiting air pass into the channel 52 and are directed to the filter

cavity through the conduit 54 and through the lid 13.

This may be beneficial in cases where the device is passed over an area of the floor that has not yet been 'vacuumed', that is in an area where the user has not drawn the floor tool. In these cases, therefore, the dust and other particles which are on (or in) the material of the floor surface may be drawn into the air cushion and then directed out with the exiting air. The dimensions of the channel 52 and the passages may be determined according to a number of factors, including the volume flow rate capacity or power of the motor 28.

The channel 52 is illustrated as a separate hose, although the attachment of the hose to the housing is not shown for the sake of brevity. It will be understood that the channel may be, if desired, integrally formed with the housing either on the exterior of the peripheral region of the housing or on the interior of the peripheral region of the housing. In the latter case, an alternative channel is shown at 58 in figure 7 which is adjacent the previously described channel 19. In still another case, it may be desirable to have both interior and exterior channels.

In still another of its aspects, the present invention provides a floor cleaning device comprising a housing having an opening, a filter chamber in fluid communication with the opening and a vacuum means for establishing a region of reduced pressure in the filter chamber, the housing having a lower section which is cooperative with the vacuum means to deliver exhaust air thereto to form a cushion of air, the lower section having a peripheral region including a deflection skirt extending downwardly therefrom.

Preferably, the skirt is formed from a resilient plastic material and may be an open- or closed-cell foam expanded plastics material. Alternatively, the skirt may be formed from other materials such as fibrous, porous, or material. More preferably, the material is electrostatic. An example of the skirt is shown in dashed lines at 60 in figure 5. The characteristics of this skirt will also depend on several factors. It may have a number of openings as represented for example at 62, or it may be slit 62b in a number of locations in order to allow the exiting air to leave the device. In still another

alternative, the depth of the skirt may be selected according to the height of the air cushion in use, whereby there is a gap (shown, for example at G in figure 5) to allow the exiting air to leave the device while providing a sufficient contact surface for the skirt to attract and retain particles entrained in the exiting air. Desirably, the skirt may be removable to be cleaned or replaced by a new skirt.

Example:

A hover vacuum cleaner was constructed substantially to the shape and design shown in Figures 3 and 5. The length direction given hereinafter is in the direction of longitudinal axis X-X and the width is transverse to the length. The exhaust port had a length of 3.8 cm and a width of 10.2 cm. Dished air chamber 25, which emanated from exhaust port 18 had a length of 15.2 cm, a width of 11.4 cm and a depth of 0.5 cm. Dished air chamber 21 had a length of 3.8 cm, a width of 11.4 cm. and a depth of about 0.65 cm. Dished air chamber 22 had a length of 5.1 cm, a width of about 11.4 cm and a depth of about 0.65 cm. Exhaust port 18 and dished air chambers 25 and 21 were centred about longitudinal axis X-X and dished air chamber 22 was offset by about 0.95 cm. Dams 23 and 24 were about 0.95 cm between adjacent dished air chambers and the edges of dams 23 and 24 sloped into the adjacent dished air chambers to provide for smooth air flow over the dams. The ratio of the total area of the dished air chambers to the area of the underside was about 80:100.

In operation, the vacuum cleaner moved smoothly over carpeted and tiled floors while dust was being vacuumed from the floors.

CLAIMS:

1. A vacuum cleaner comprising a housing having a filter chamber, an opening to receive one end of a vacuum hose and suction means for establishing a vacuum in the hose to deliver air therein to said filter chamber, an outlet for delivering exhaust air from said filter chamber, said housing having a lower section, said outlet being directed to said lower section, wherein said lower section and said outlet are operable to form a cushion of air beneath said vacuum, said lower section having a peripheral region with a vacuum passage located therein, said passage being in fluid communication with both said peripheral region and said filter chamber, wherein said suction means is operable to establish a vacuum in said vacuum passage.

2. A floor cleaning device comprising a housing having an opening, a filter chamber in fluid communication with said opening and a vacuum means for establishing a region of reduced pressure in said filter chamber, said housing having a lower section which is cooperative with said vacuum means to deliver exhaust air thereto to form a cushion of air, said lower section having a peripheral region including a channel which is in fluid communication with said filter chamber.

3. A device as defined in claim 2 wherein said housing includes an outer shell, said channel being located inside or outside said outer shell.

4. A device as defined in claim 3 wherein said channel includes a hose fastened to said outer shell.

5. A device as defined in claim 4 wherein said housing has an opening to said filter chamber which is releasably sealed by a cover, said cover further including an opening which is coupled with said hose.

6. A device as defined in claim 3 wherein said conduit is integrally formed with said housing.

7. A floor cleaning device comprising a housing having an opening, a filter chamber in fluid communication with said opening and a vacuum means for establishing a region of reduced pressure in said filter chamber, said housing having a lower section which is cooperative with said vacuum means to deliver exhaust air thereto to form a cushion of air, said lower section having a peripheral region including a deflection skirt extending downwardly therefrom.

8. A device as defined in claim 7 wherein said skirt is formed from a resilient plastic material.

9. A device as defined in claim 8 wherein the material is an open or closed cell foam expanded plastics material.

10. A device a defined in claim 7 wherein said skirt is formed from a fibrous, porous, or material.

11. A device as defied in claims 8 or 9 wherein the material is electrostatic.

12. A method of improving the operation of a hovering vacuum cleaner of the type having a lower section which, in use is spaced from a floor surface by a cushion of air, comprising:

locating a vacuum channel in a peripheral region of hte lower section; and

establishing a relatively low pressure in the vacuum channel in order to capture particles entrained in the cushion of air.

13. A method of improving the operation of a hovering vacuum cleaner of the type having a lower section which, in use is spaced from a floor surface by a cushion of air, by extending a deflection skirt downwardly from the lower section.

14. A floor cleaning device comprising a vacuum assembly having a filter cavity and a motorized suction unit, a lower portion, said suction unit operable to establish a relatively lower pressure in said filter cavity and a relatively high pressure beneath said lower portion, a first vacuum supply inlet to draw particle laden air from a remote region to said filter chamber and a second vacuum supply inlet to draw particle laden air from a local region to said filter chamber.

15. A device as defined in claim 14 wherein said lower portion has a peripheral section, said local region is near peripheral section.

16. A device as defied in claim 15 wherein said local region encircles said peripheral section.

17. A device as defied in claim 16 wherein said second vacuum supply inlet is operable to capture at least a portion of particles entrained in air leaving said lower portion.

18. A device as defined in claim 17 wherein said assembly includes a housing, second vacuum supply inlet is located outside or inside said housing.

19. A device as defined in claim 18 wherein said second vacuum supply inlet is integrally formed with said housing.

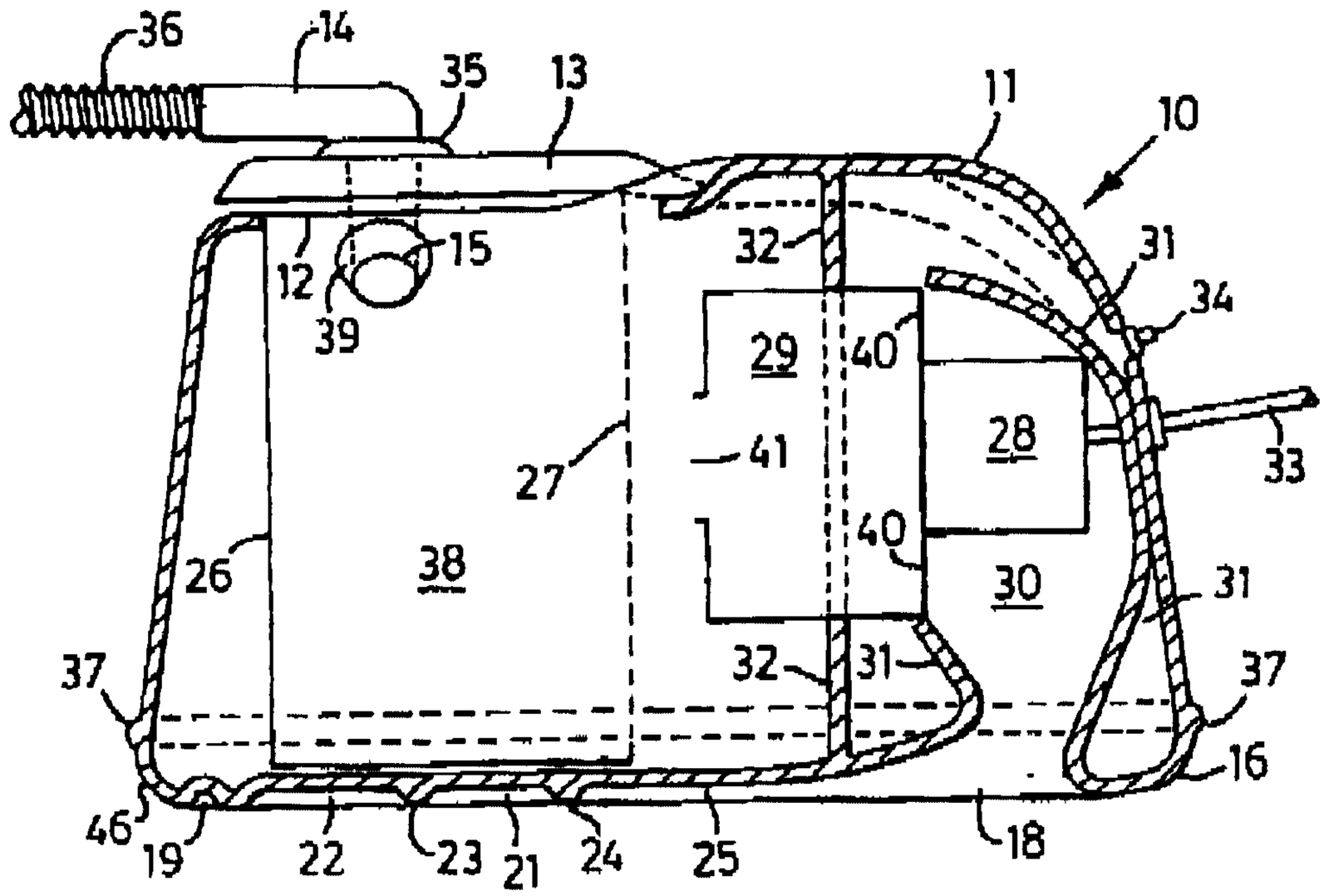

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FIG. 1

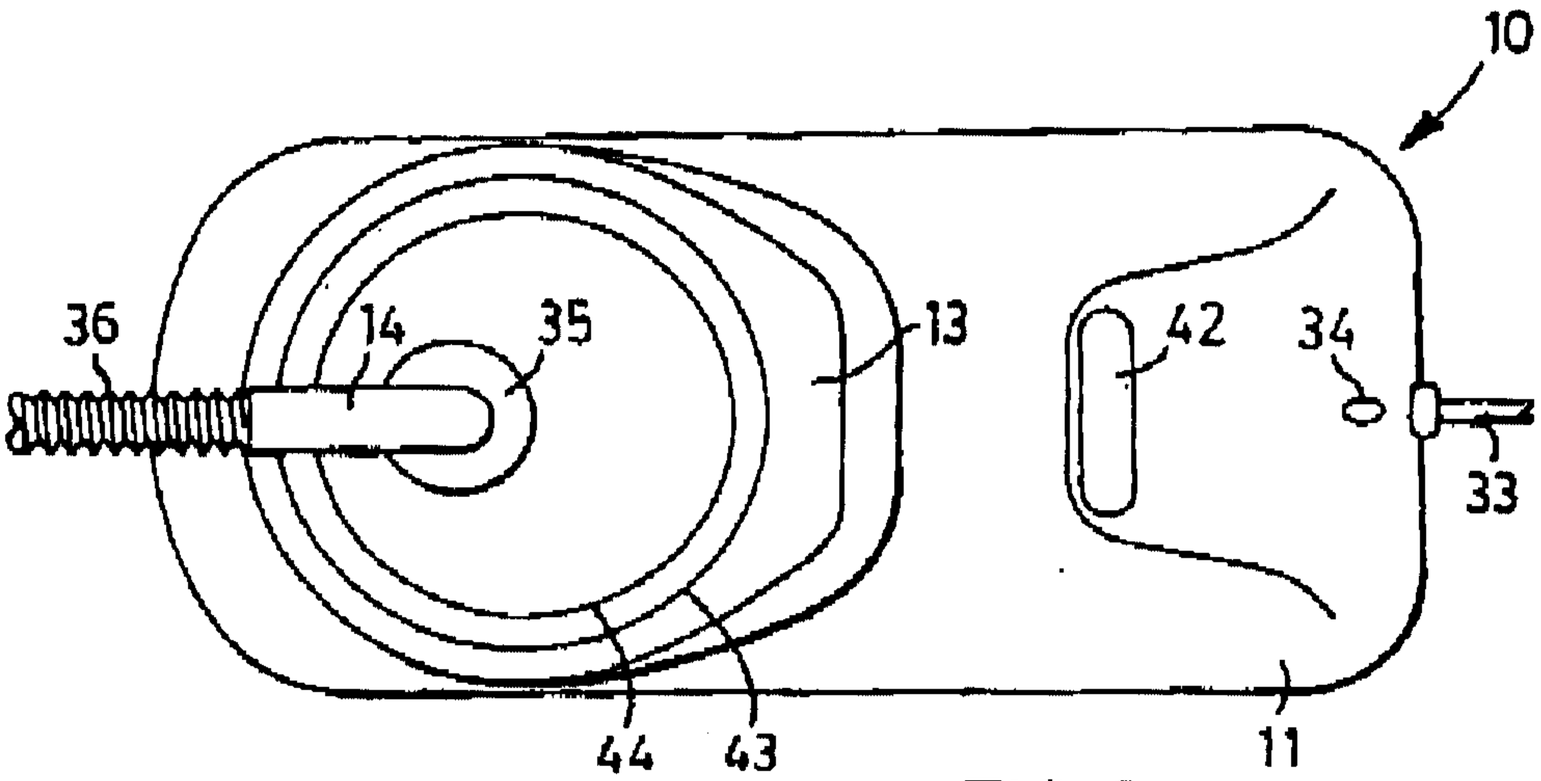

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FIG. 2

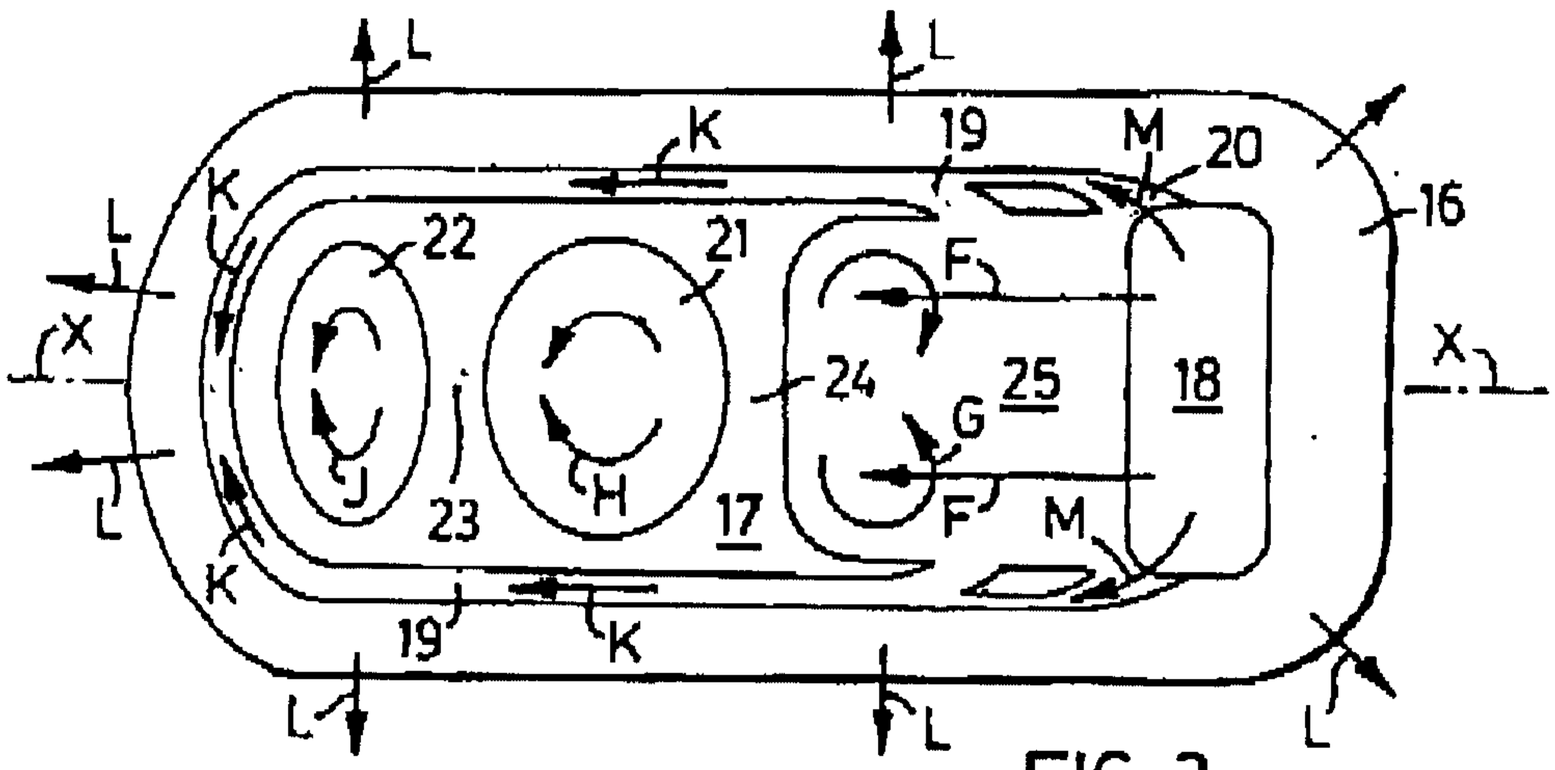

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FIG. 3

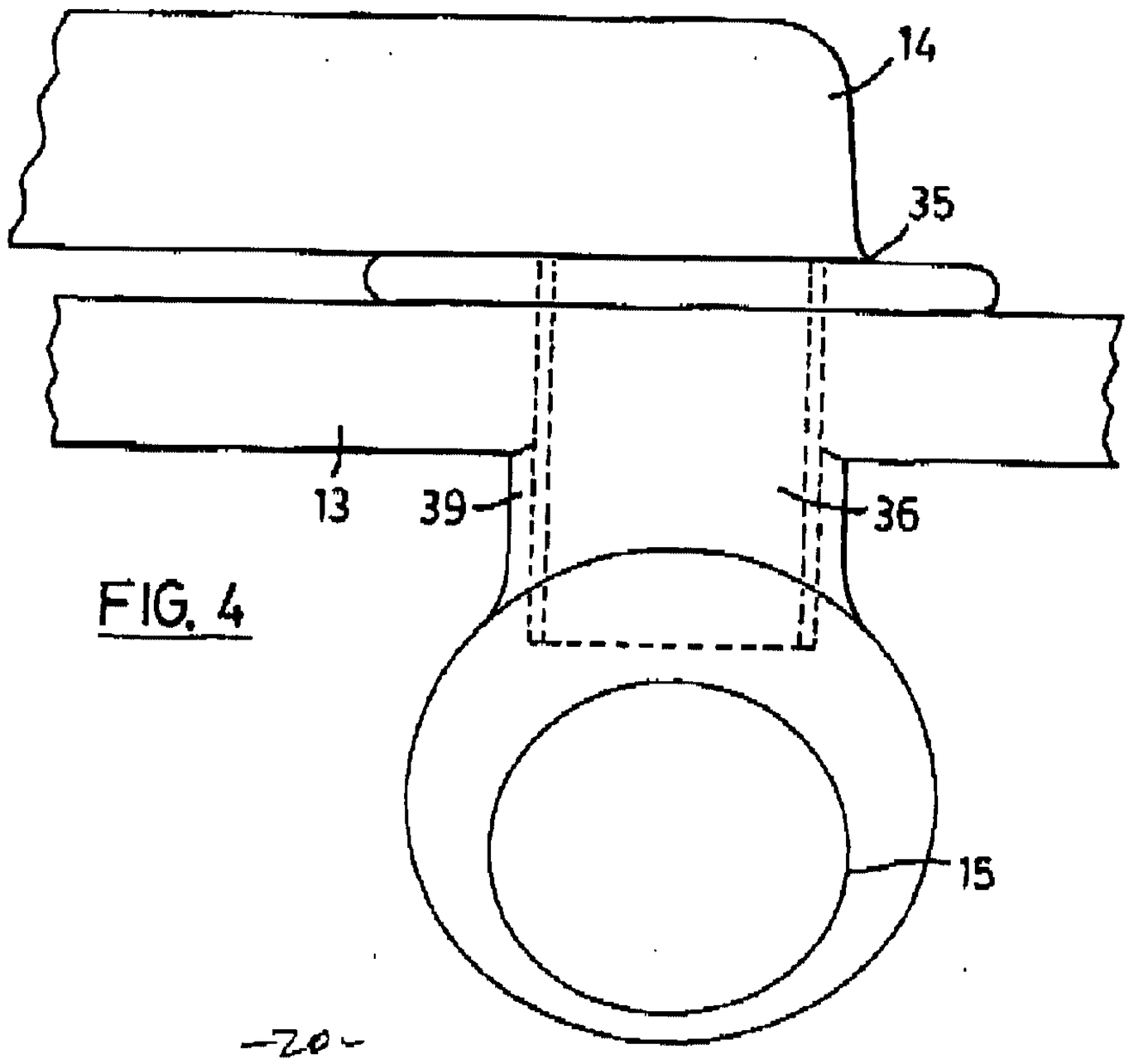

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FIG. 4

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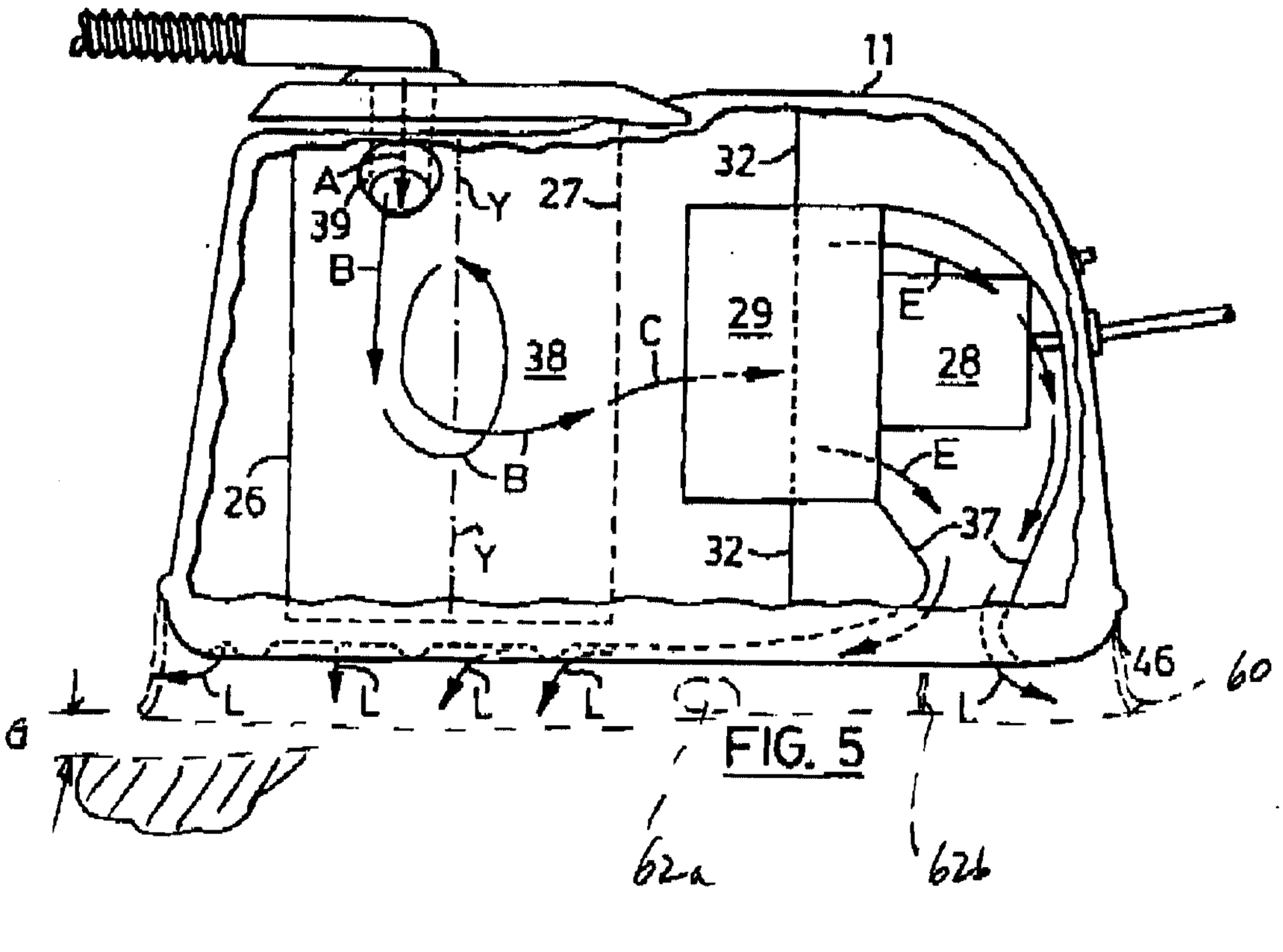


FIG. 5

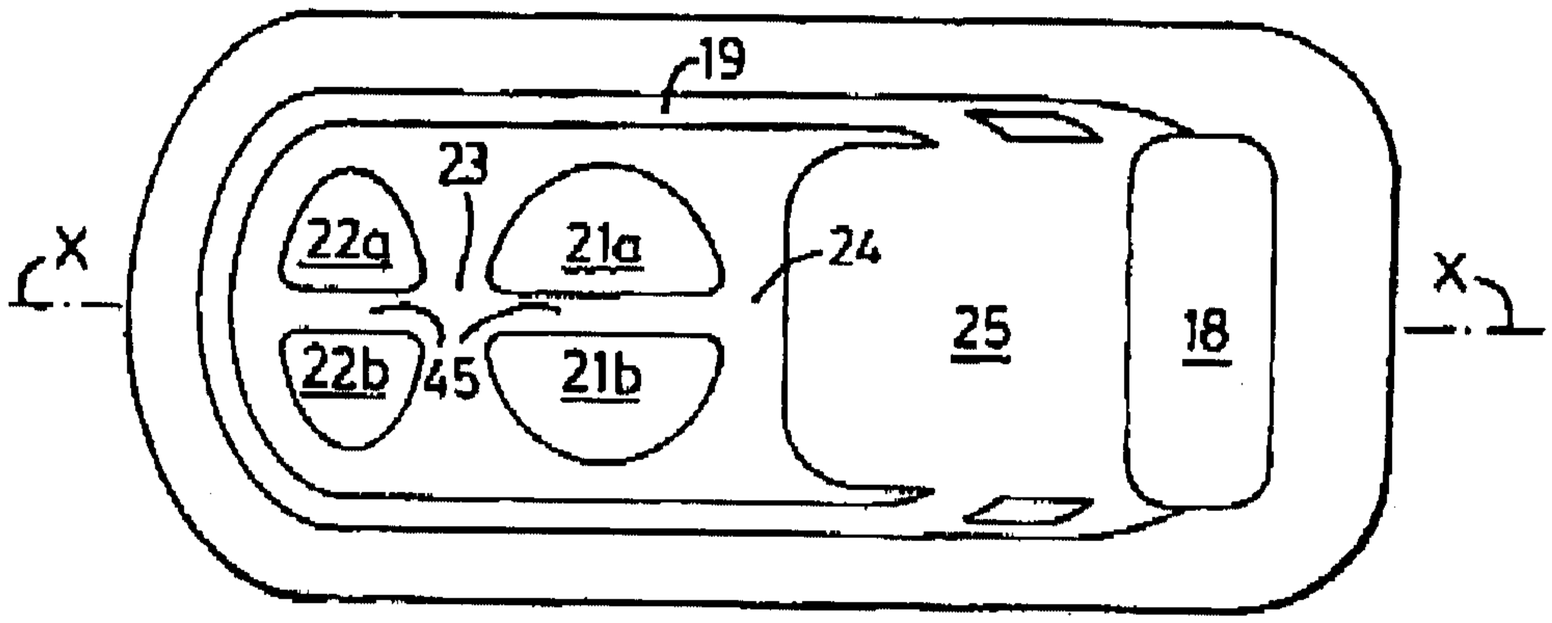


FIG. 6

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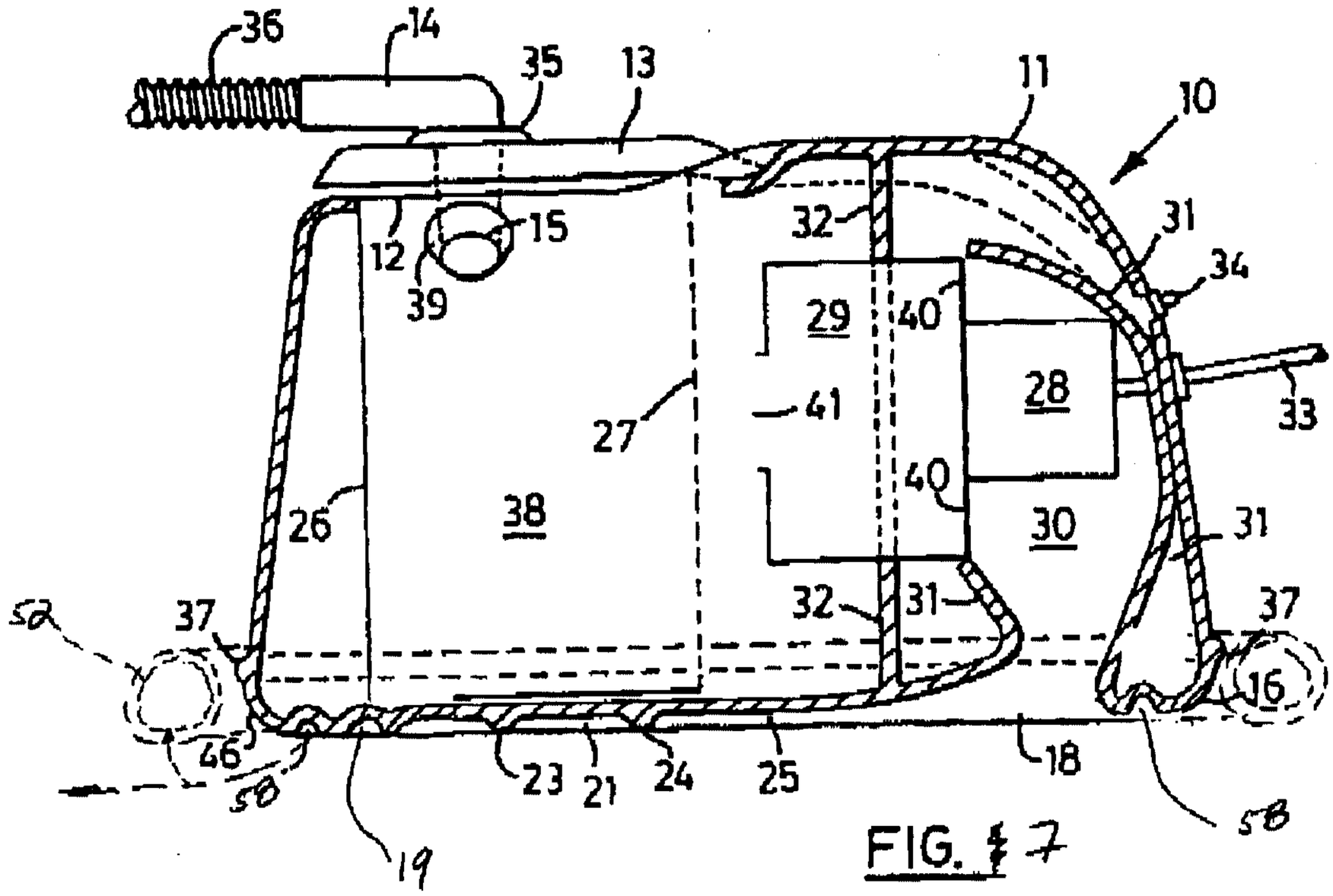


FIG. 7

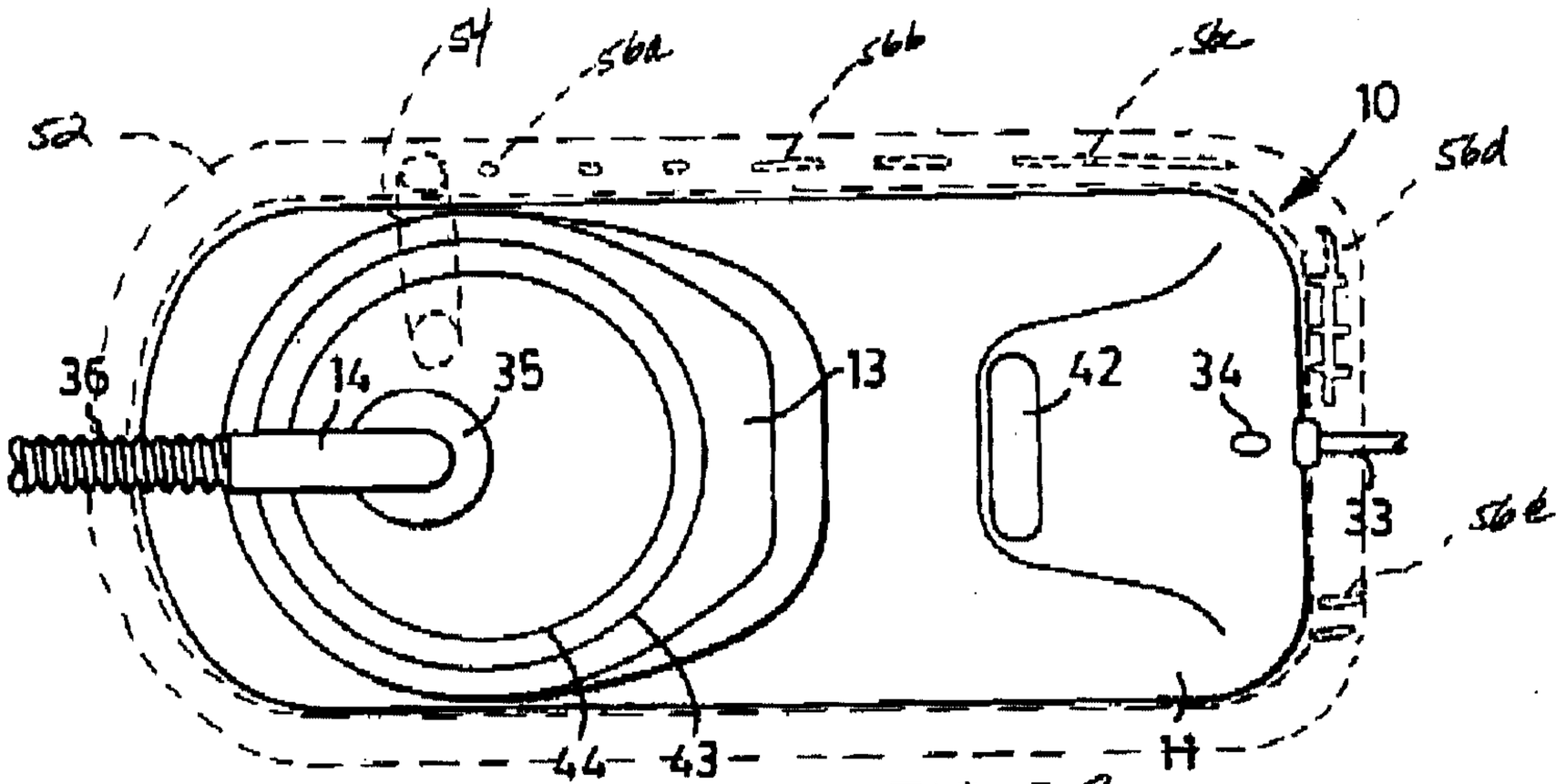
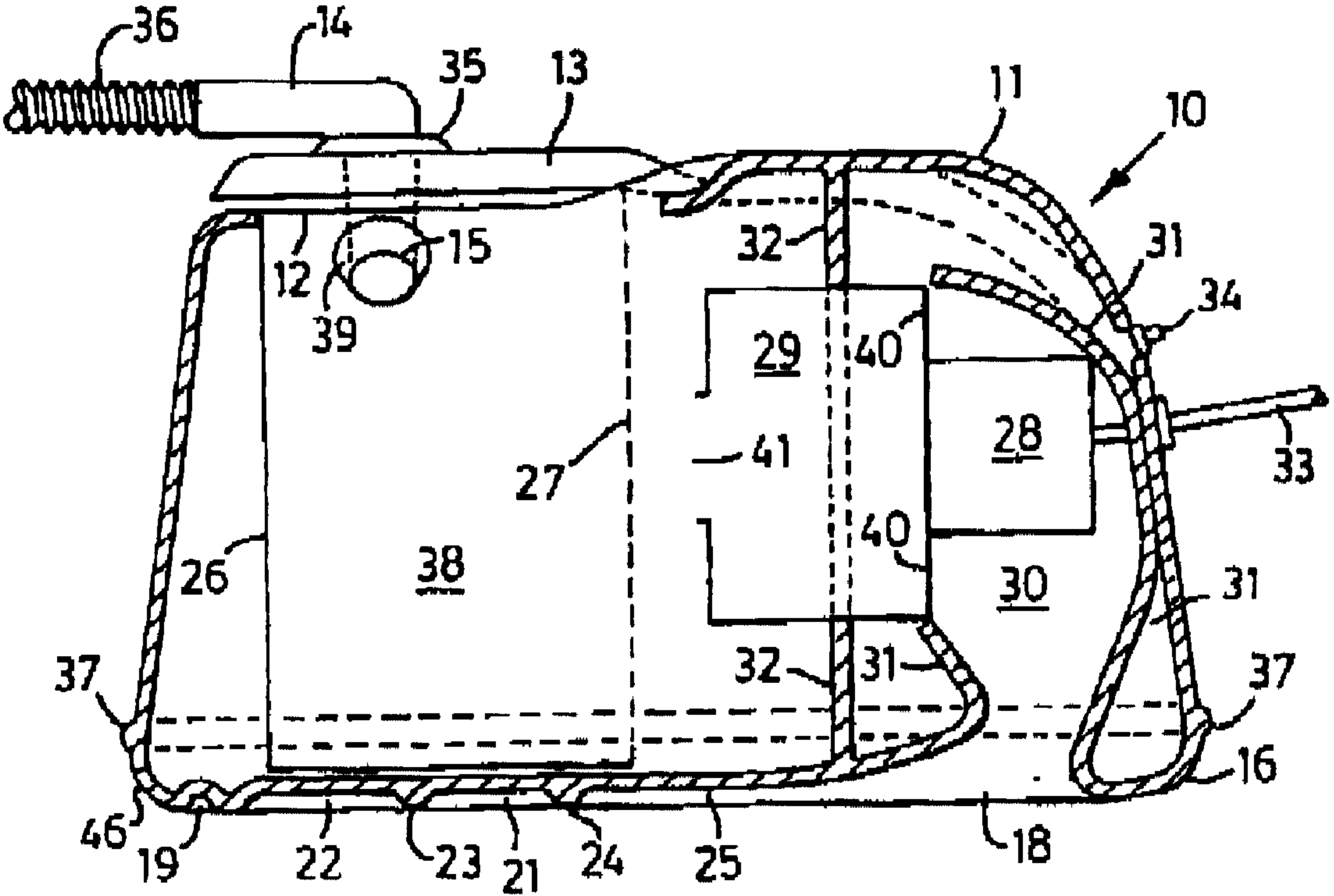


FIG. 8

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