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**A47L 9/02** (2006.01)(72) Inventors: **Daniel William Carter**, West Midlands (GB); **Jennifer Kathryn Marsden**, West Midlands (GB); **May Wilson**, West Midlands (GB); **Ben Smith**, West Midlands (GB)(52) **U.S. Cl.**  
CPC ..... **A47L 9/02** (2013.01)(57) **ABSTRACT**

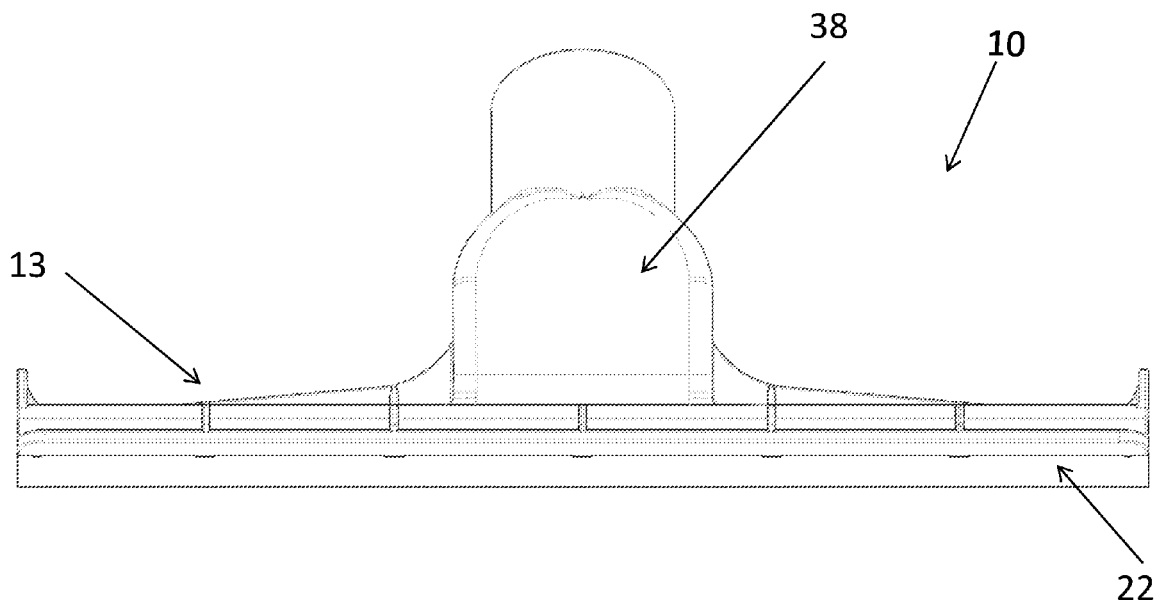
A floor tool for an apparatus for cleaning a floor surface. The floor tool including a floor facing surface having a floor facing inlet for receiving dirty air, an outlet aperture for communication with the suction source, and a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air. The floor tool further including a sealing member for engaging with a floor surface during use, which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface. During use, the or a substantial portion of the weight of the floor tool is borne/carried by the sealing member.

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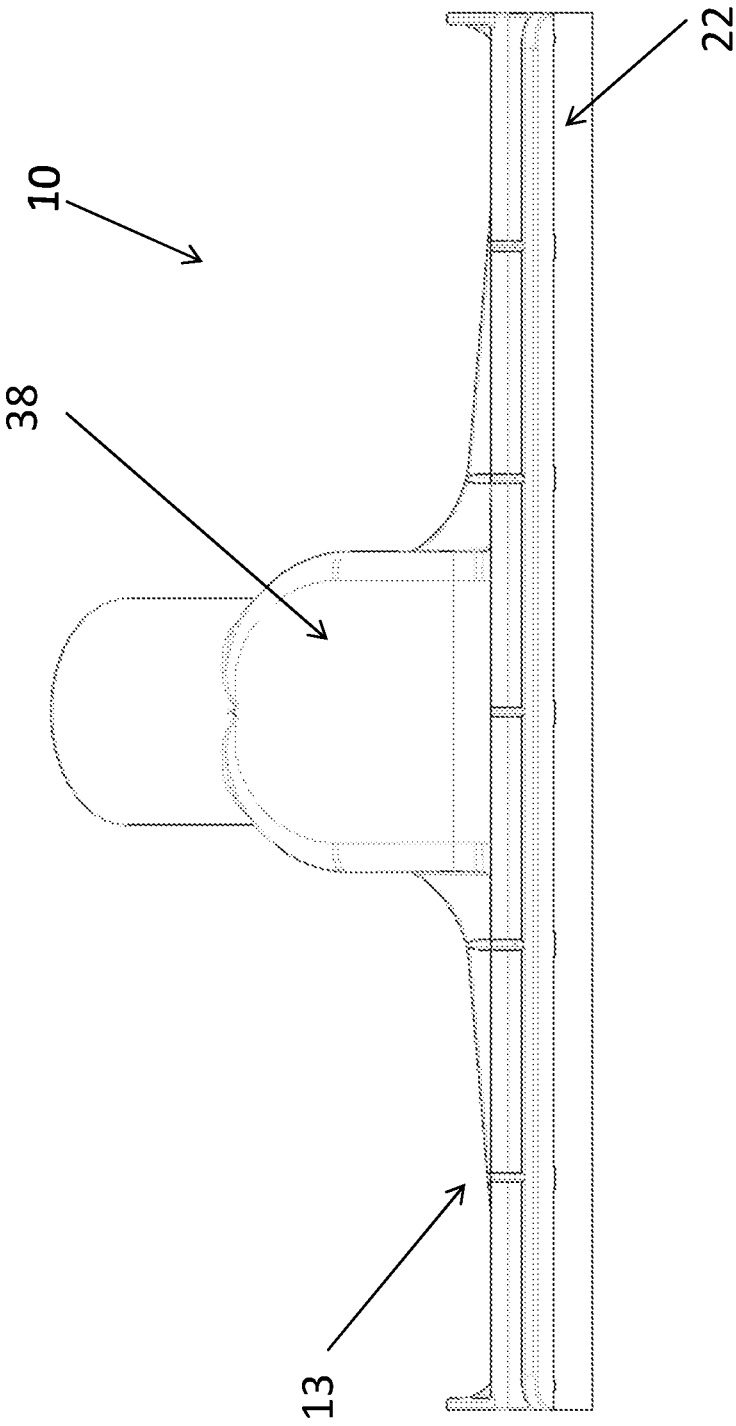


Figure 1

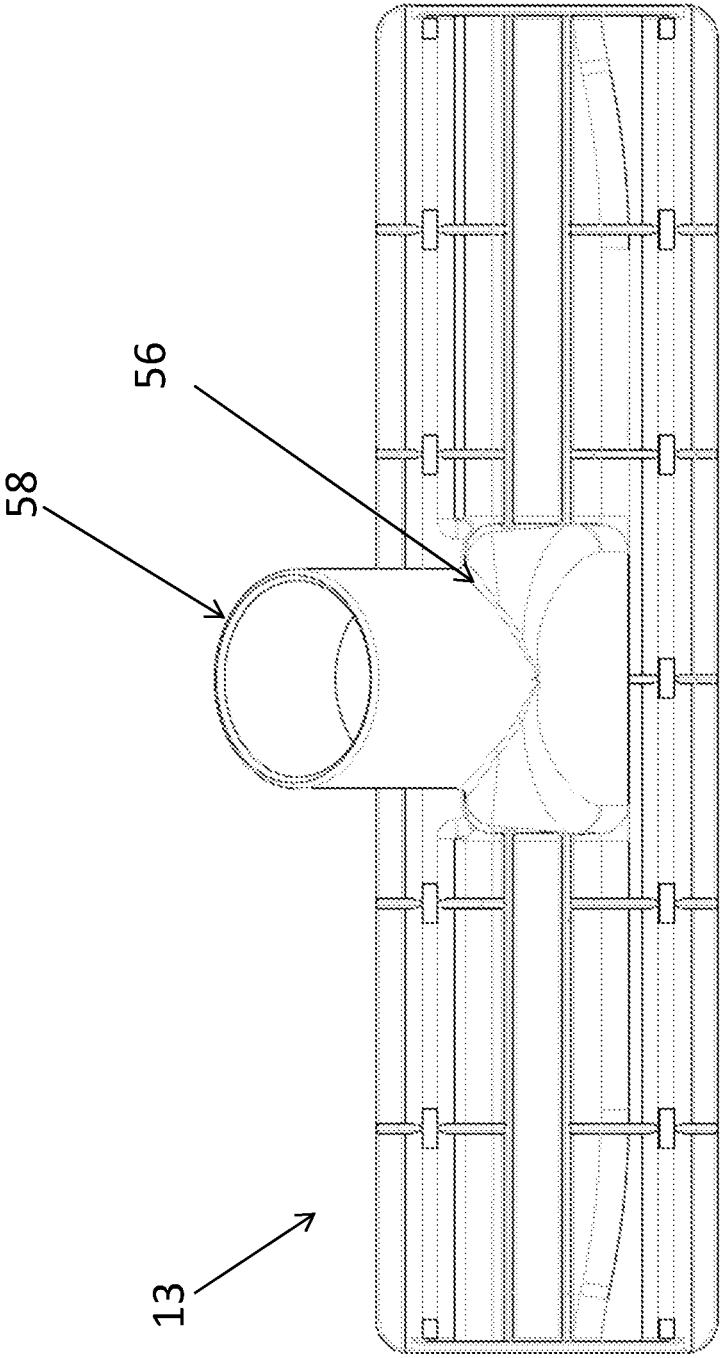


Figure 2

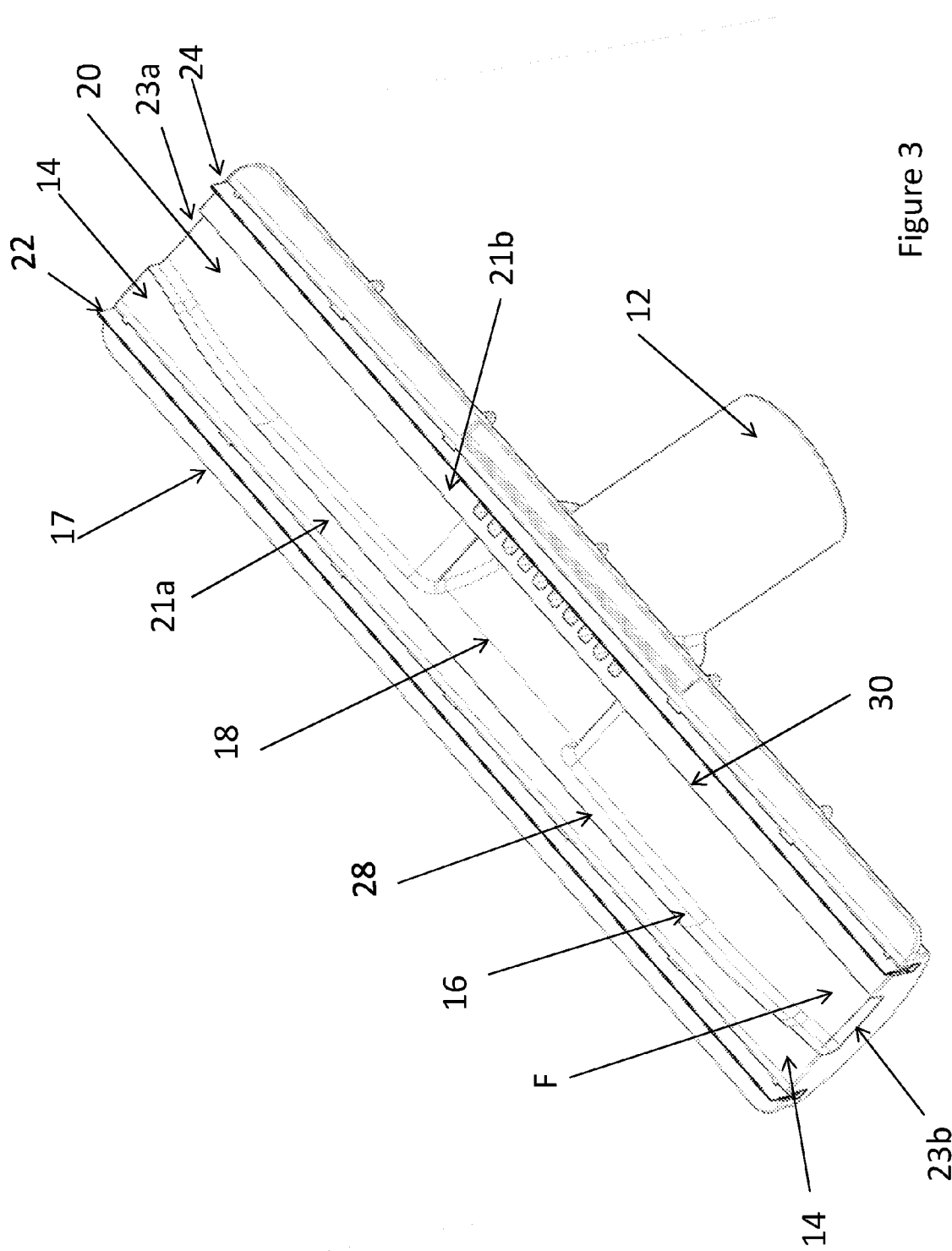


Figure 3

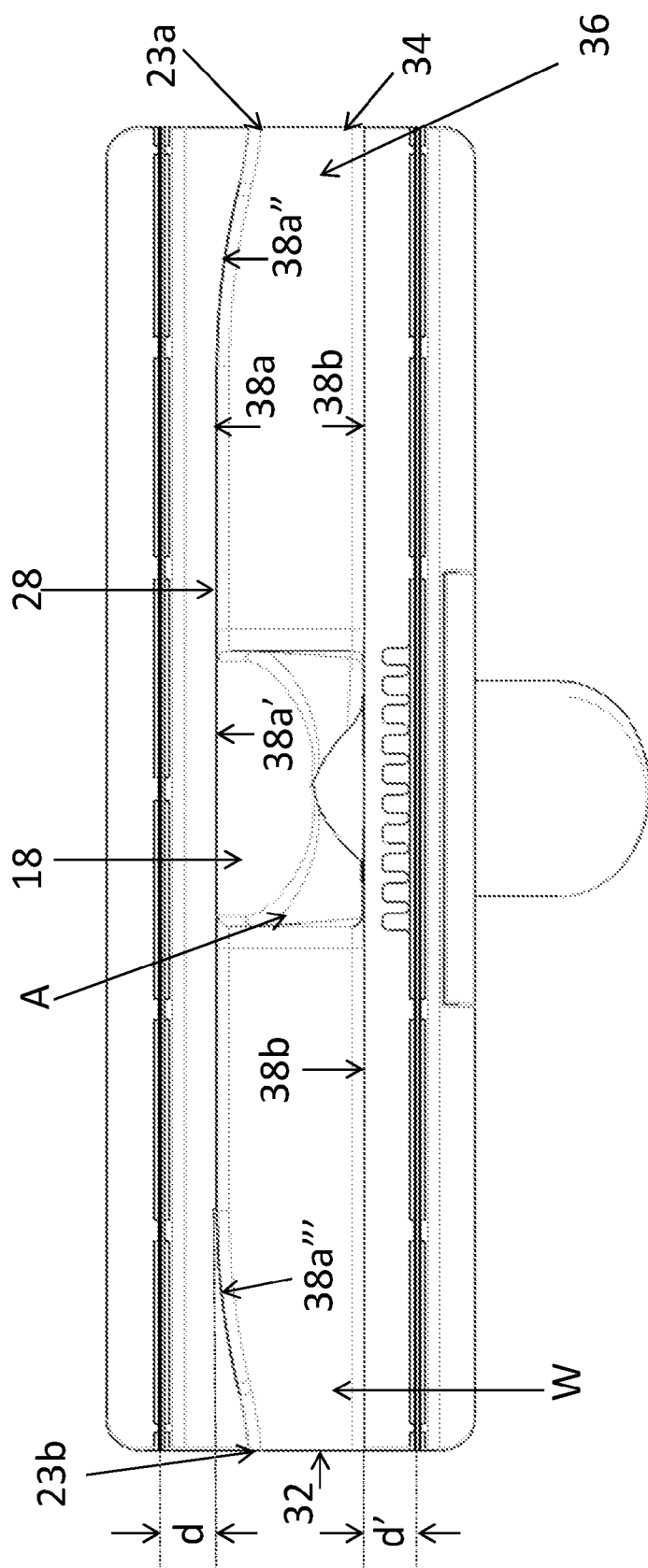


Figure 4

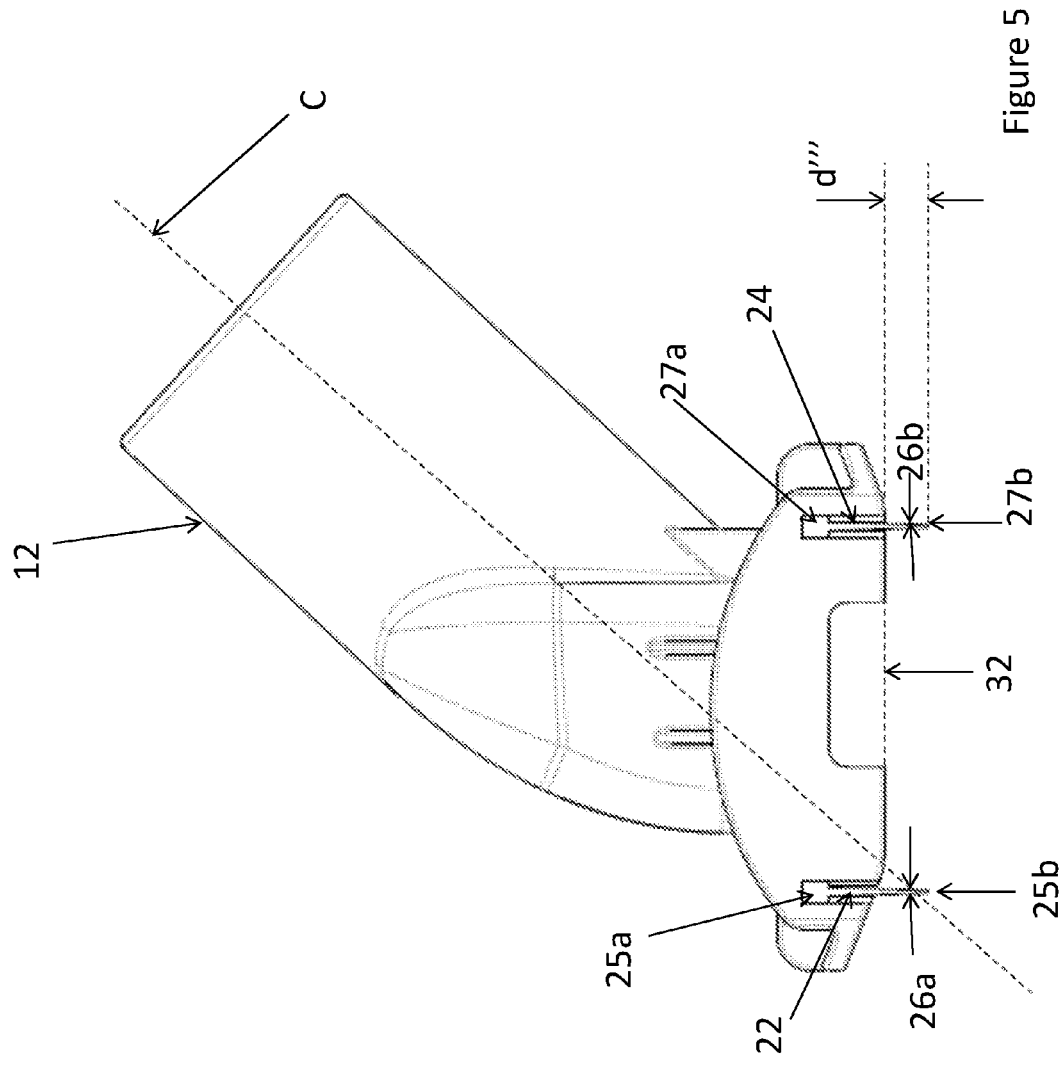


Figure 5

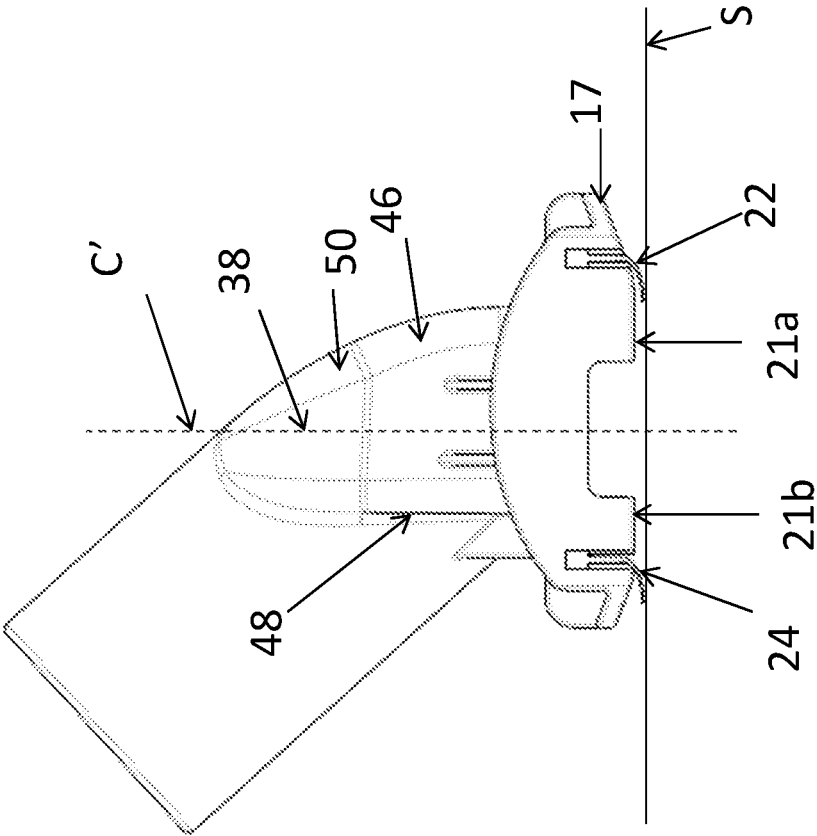


Figure 6a

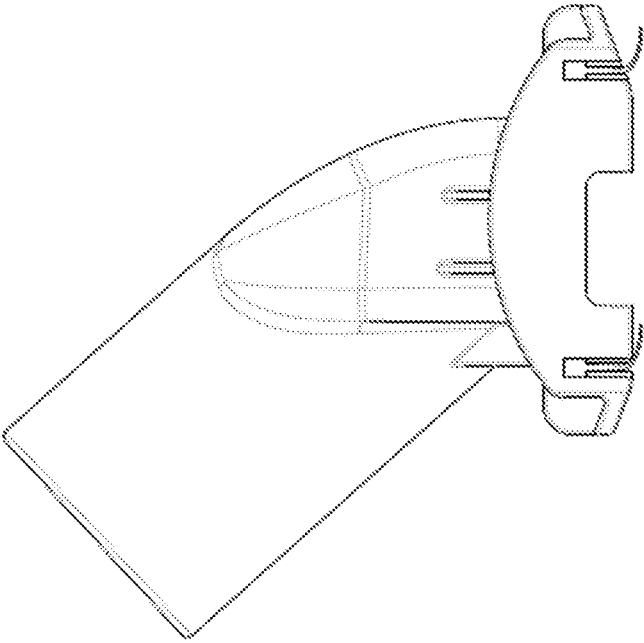


Figure 6b

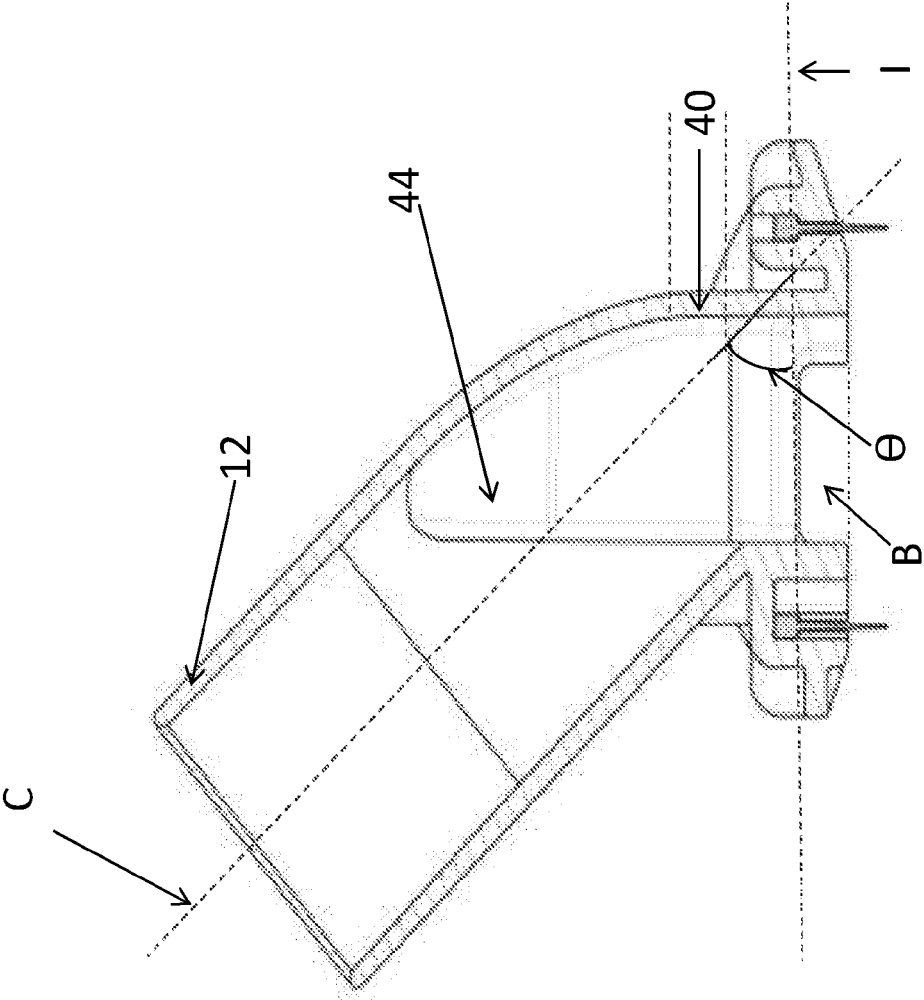


Figure 7





**FLOOR TOOL****CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This application is a U.S. National Phase of International Patent Application No. PCT/GB2015/052805, filed Sep. 28, 2015, which claims priority to UK Patent Application No. 1417996.4, the entire contents of which are all hereby incorporated by referenced herein.

**BACKGROUND**

[0002] This invention relates to a floor tool for an apparatus for cleaning a floor surface and/or such an apparatus including the floor tool. In particular, this invention relates to an apparatus which utilises a source of suction to draw dirt and/or debris from a floor surface being cleaned for storage in a dirt chamber or bag for emptying by a user. Such apparatus are typically known as “vacuum cleaners”.

[0003] The performance of vacuum cleaners is judged on a number of parameters which includes how efficient a cleaner is in extracting dirt/debris for a given suction power.

[0004] Known vacuum cleaners have a floor tool with a floor facing surface which includes an inlet through which dirt/debris entrained air enters the tool and flows towards the dirt chamber. The configuration of a floor tool can impact on suction air flow path and the amount of dirt/debris which will be entrained in the air during operation of a vacuum cleaner. It is desirable to provide a floor tool with an optimised configuration which will improve the efficiency/performance of a vacuum cleaner.

**SUMMARY**

[0005] According to a first aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0006] a floor facing surface having a floor facing inlet for receiving dirty air;

[0007] an outlet aperture for communication with the suction source;

[0008] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and

[0009] a sealing member for engaging with a floor surface during use,

[0010] which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface,

[0011] wherein, during use, the or a substantial portion of the weight of the floor tool is borne/carried by the sealing member.

[0012] According to a second aspect of the invention we provided a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0013] a floor facing surface having a floor facing inlet for receiving dirty air;

[0014] an outlet aperture for communication with the suction source;

[0015] a passage in fluid communication with the outlet aperture, which passage extends laterally across the

floor facing surface and terminates at respective lateral inlets for receiving dirty air; and

[0016] a sealing member for engaging with a floor surface during use,

[0017] which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface,

[0018] wherein the sealing member provides a primary engagement or primary support of the floor tool on the floor surface.

[0019] According to a third aspect of the present invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0020] a floor facing surface having a floor facing inlet for receiving dirty air;

[0021] an outlet aperture for communication with the suction source;

[0022] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and

[0023] a sealing member for engaging with a floor surface during use,

[0024] which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface,

[0025] wherein the sealing member spaces the floor facing inlet from the floor surface.

[0026] According to a fourth aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0027] a floor facing surface having a floor facing inlet for receiving dirty air;

[0028] an outlet aperture for communication with the suction source;

[0029] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and

[0030] a sealing member for engaging with a floor surface during use,

[0031] which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface,

[0032] wherein the lateral inlets and/or portions of the passage adjacent thereto are free of substantial restrictions to the flow of air therethrough and/or therepast.

[0033] According to a fifth aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0034] a floor facing surface having a floor facing inlet for receiving dirty air;

[0035] an outlet aperture for communication with the suction source having a cross-sectional area A;

[0036] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral

inlets for receiving dirty air, wherein one or both of the lateral inlets has a cross-sectional area B; and

[0037] wherein the ratio of area A to area B (A:B) is in the range of 12:1 and 8:1.

[0038] According to a sixth aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0039] a floor facing surface having a floor facing inlet for receiving dirty air; and

[0040] an outlet aperture for communication with the suction source via a conduit having a longitudinal axis,

[0041] wherein the longitudinal axis of the conduit is inclined at an angle of between 45 and 55 degrees with respect to a plane containing the floor facing inlet.

[0042] According to a seventh aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0043] a floor facing surface having a floor facing inlet for receiving dirty air;

[0044] an outlet aperture for communication with the suction source; and

[0045] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface, wherein the passage includes a wall which includes the outlet aperture;

[0046] wherein a surface area of the wall and/or a cross-sectional area of the floor facing inlet is between 3800 mm<sup>2</sup> and 4800 mm<sup>2</sup>.

[0047] According to an eighth aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0048] a floor facing surface having a floor facing inlet for receiving dirty air;

[0049] an outlet aperture for communication with the suction source; and

[0050] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface, wherein the passage includes a wall which includes the outlet aperture,

[0051] wherein a volume of the passage is between 46000 mm<sup>3</sup> and 50000 mm<sup>3</sup>.

[0052] According to a ninth aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0053] a floor facing surface having a floor facing inlet for receiving dirty air;

[0054] an outlet aperture for communication with the suction source;

[0055] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface; and

[0056] a conduit in communication with the outlet aperture, wherein

[0057] the conduit includes a portion adjacent the outlet aperture and extending upwardly therefrom, and

[0058] wherein the upwardly extending portion has a substantially constant cross-sectional area.

[0059] According to a tenth aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0060] a floor facing surface having a floor facing inlet for receiving dirty air;

[0061] an outlet aperture for communication with the suction source;

[0062] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface; and

[0063] a conduit in communication with the outlet aperture, wherein the conduit includes a portion adjacent the outlet aperture and extending upwardly therefrom, and wherein the upwardly extending portion has a substantially constant cross-sectional area.

[0064] According to an eleventh aspect of the invention we provide a floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

[0065] a floor facing surface having a floor facing inlet for receiving dirty air;

[0066] an outlet aperture for communication with the suction source via a conduit having a longitudinal axis, wherein the conduit provides a releasable connection to the apparatus;

[0067] a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and

[0068] wherein the floor tool is formed as a one piece component or unitary component.

[0069] Further features of the first to eleventh aspects of the invention are set out in the dependent claims thereto which are appended hereto.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0070] FIG. 1 is a front view of a floor tool for connection with an apparatus for cleaning a floor surface in accordance with the present invention;

[0071] FIG. 2 is a plan view of the floor tool of FIG. 1;

[0072] FIG. 3 is a bottom perspective view of the floor tool of FIG. 1;

[0073] FIG. 4 is a bottom view of the floor tool of FIG. 1;

[0074] FIG. 5 is a side view of the floor tool of FIG. 1 when not in use;

[0075] FIG. 6a is a side view of the floor tool of FIG. 1 in a first state during use;

[0076] FIG. 6b is a side view of the floor tool of FIG. 1 in a second state during use;

[0077] FIG. 7 is a cross-sectional side view of the floor tool of FIG. 1; and

[0078] FIG. 8 is a cross-section front view of the floor tool of FIG. 1;

#### DETAILED DESCRIPTION

[0079] With reference to the figures, these show an embodiment of a floor tool 10 embodying various aspects of the invention. The floor tool 10 is for an apparatus (not shown) for cleaning a floor surface. The apparatus includes a source of suction and a wand/hose for connection with the floor tool 10 to provide suction thereto. The user would

move the floor tool 10 over a floor surface S to be cleaned by pushing and pulling the wand back and forth.

[0080] In some embodiments the floor tool may include a housing 13. The floor tool 10 includes a floor facing surface 14 having a floor facing inlet 16 for receiving dirty air and an outlet aperture 18. The floor tool 10 has a conduit 12 having a longitudinal axis C which communicates with the outlet aperture 18 and provides communication therefrom to the suction source. The floor tool 10 has a further conduit 38 in communication with the conduit 12. The outlet aperture 18 is connectable to a wand or hose of an apparatus to provide a flow path from the suction source to the inlet 16.

[0081] The floor facing surface 14 includes a passage 20 in fluid communication with the outlet aperture 18. The passage 20 extends laterally across the floor facing surface 14 and terminates at respective lateral inlets 23a, 23b for receiving dirty air. The floor facing surface 14 includes a planar portion 21a and a planar portion 21b which are positioned forwardly and rearwardly of the passage 20 respectively.

[0082] Floor tool 10 includes a pair of sealing members 22, 24 for engaging with a floor surface S during use. The sealing members 22, 24 may be made from a rubber material or other synthetic material.

[0083] Sealing member 22 is positioned forwardly of the passage 20, closer to a forwardly leading edge 17 of the housing 13 than sealing member 24 which is positioned rearwardly of the passage 20. The sealing members 22, 24 are spaced apart from one another in a direction transverse to the normal direction of movement of the floor tool 10.

[0084] In this embodiment, the sealing members 22, 24 are identical and certain features of the sealing members 22, 24 will be described with reference to the sealing member 22 only. In envisaged embodiments, the sealing members 22, 24 may not be identical and only one of the sealing members may have one or more of the features described hereinafter.

[0085] Sealing member 22, 24 extends away from the floor facing surface 14 and blocks a flow of air towards the passage 20 when it is engaged with a floor surface S. Sealing member 22, 24 is substantially elongate and extends laterally across the floor tool 10. Sealing member 22, 24 extends across the floor tool 10 the same distance as the passage 20. The thickness 26a, 26b of the sealing member 22, 24 decreases as it extends away from the floor facing surface 14.

[0086] Sealing member 22, 24 includes a base portion 25a, 27a for engagement with the housing 13 and a distal portion 25b, 27b for engagement with the floor surface S. In embodiments, the base portion 25a, 27a is received in a recess defined in the floor facing surface 14 of the housing 13. The base portion 25a, 27a may be fixed to the remainder of the floor tool 10 through the use of adhesive or welding or other methods known in the art. In embodiments, the base portion 25a, 27a may be attached by other methods that do not require a recess in the housing 13. In embodiments, the base portion 25a, 27a is connected with the housing 13 such that it cannot be moved with respect to the floor facing surface 14.

[0087] Operation of the floor tool 10 will be described with reference to FIGS. 6a and 6b which show the floor tool 10 in first and second states of use respectively.

[0088] During use, the user will normally repeatedly move the floor tool 10 along a hard floor surface S, forwardly in the direction of the forwardly leading edge of the housing

(shown in FIG. 6a) and rearwardly in the opposite direction (shown in FIG. 6b). It will be seen that the sealing members 22, 24 move and deform when they are engaged with the floor surface S and the floor tool 10 is moved along the floor surface S.

[0089] In the first state, sealing member 22 extends into the planar region 21a forward of the passage 20 and sealing member 24 extends away from the planar region 21b rearward of the passage 20. A substantial portion of each sealing member 22, 24 (at least the distal end thereof) lies in a plane substantially parallel with the floor surface S when the sealing member 22, 24 is engaged with the floor surface S. Each sealing member 22 thus blocks the flow of air towards the passage through its engagement with the floor surface S.

[0090] In the second state, the sealing members 22, 24 extend in the opposite direction to the first state, i.e. the sealing member 22 extends away from the planar region 21a forward of the passage 20 and sealing member 24 extends into the planar region 21b rearward of the passage 20.

[0091] It will be seen that in both states, the sealing members 22, 24 prevent the flow of air towards the passage. Air is therefore predominantly drawn into the passage 20 through the lateral inlets 23a, 23b. This is in comparison to known floor tools where a substantial amount of the air drawn into the passage 20 will be drawn from air forward or rearward of the floor tool 10. It has been found that the invention provides a significant increase in uptake of dirt/debris from a floor surface being cleaned in comparison to known floor tools.

[0092] It will be seen that during use the or a substantial portion of the weight of the floor tool 10 is borne/carried by the sealing members 22, 24. The sealing members provide the only or sole engagement or support of the floor tool 10 on the floor surface S. In embodiments, the sealing members 22, 24 provide the primary engagement or primary support of the floor tool 22, 24 on the floor surface S.

[0093] It will also be seen that the sealing members 22, 24 space the floor facing inlet 16 from the floor surface S during use.

[0094] The sealing members 22, 24 provide a substantially fluid-tight seal when they engage with the floor surface S by movement/deformation thereof. The lateral inlets 23a, 23b and/or portions of the passage 20 adjacent thereto are free of substantial restrictions to the flow of air therethrough and/or therepast.

[0095] It has been found that the cleaning performance of the floor tool 10 is unexpectedly improved by adjusting various dimensions/geometric features thereof.

[0096] It has been found advantageous for the sealing member 22, 24 to taper in cross-section as it extends from the base portion 25a, 27a towards the distal portion 25b, 27b, and more preferably for the sealing member 22, 24 to have a generally wedge-shaped cross-section. Further benefits are obtained by having the thickness of the sealing member 22, 24 at the distal portion 25b, 27b being between 0.1 and 0.5 mm, and preferably being 0.3 mm or about 0.3 mm.

[0097] In embodiments, it has been found to improve performance by having the sealing member 22 positioned forwardly of the floor facing inlet 16 positioned further away from a central part of a forward peripheral portion 28 of the floor facing inlet 16 than the distal portion 27b of sealing

member **24** positioned rearwardly of the floor facing inlet **16** is spaced from a central part of a rearward peripheral portion **30**.

[0098] It has been found to be further advantageous for the sealing member **22** positioned forwardly of the floor facing inlet **16** to be spaced at a distance of 9.1 mm or about 9.1 mm from the central part of the forward peripheral portion **28** of the floor facing inlet **16**. Similarly, it has been found that having the sealing member **24** positioned rearwardly of the floor facing inlet **16** spaced at a distance  $d'$  of 8.7 mm or about 8.7 mm from the central part of the rearward peripheral portion **30** of the floor facing inlet **16** is beneficial.

[0099] In embodiments, it has been found that spacing one or both of the sealing members **22**, **24** at a distance which is at least 6.0 mm, or more preferably at least 7.0 mm and even more preferably at least 8.0 mm, from one of the forward or rearward peripheral portions **28**, **30** improves performance.

[0100] In embodiments, it has been found to be beneficial for the distal portion **25b**, **27b** of the sealing member **22**, **24** to be spaced at a distance  $d'''$  of between 3.0 mm and 6.0 mm in a vertical direction from a peripheral portion **32**, **34** of the floor facing inlet **16** which is defined by the lateral inlet **23a**, **23b**. Further advantages have been found if the distal portion **25a**, **27b** extends a distance  $d'''$  of between 4.5 to 5.5 mm and more preferably extends a distance  $d'''$  of 5.0 mm or about 5.0 mm.

[0101] A further aspect of the floor tool **10** will now be described. The conduit **38** is in communication with the outlet aperture **18**. The conduit **38** includes a portion **40** adjacent the outlet aperture **18** which extends upwardly therefrom. The portion **40** has a substantially constant cross-sectional area. In embodiments, the cross-sectional area of the outlet aperture **18** is the same or about the same as the cross-sectional area of the upwardly extending portion **40**. In embodiments those cross-sectional areas may not be the same.

[0102] The upwardly extending portion **40** extends substantially perpendicularly away from the plane **O** containing the outlet aperture **18**. It has been found that improvements in performance are gained if the upwardly extending portion **40** extends a distance  $d'''$  of between 10 mm and 40 mm, preferably between 20 mm and 35 mm and more preferably a distance  $d'''$  of between 25 mm and 30 mm. It is most preferably for the upwardly extending portion **40** to extend a distance  $d'''$  of 27 mm or about 27 mm.

[0103] In more detail, conduit **38** includes first and second opposing lateral internal side walls **42**, **44**, and forwardly and rearwardly opposing upwardly extending internal walls **46**, **48**. The upper portion **50** of the forward internal wall **46** extends towards the rearward internal wall **48**. The forward and rearward internal walls **46**, **48** are connected to one another at respective upper ends thereof.

[0104] The rearward internal wall **48** includes an opening **52** and the conduit **12** has a first end **56** in communication with the opening **52** and a second end **58** for communication with the suction source. The second end **58** provides a releasable connection with a wand or hose of the apparatus insertable therein. Longitudinal axis **C** of the conduit **12** is inclined with respect to a longitudinal axis **C'** of the conduit **38**. Conduit **12** is tubular and has a substantially circular cross-section in the direction it extends away from the opening **52**.

[0105] Upwardly extending portions **60**, **62** of the lateral internal side walls **40**, **42** adjacent the outlet aperture **18** are

substantially parallel to one another and extend a distance of between 10 mm and 40 mm perpendicularly away from the plane **O** containing the outlet aperture. Preferably, the respective upwardly extending portions **60**, **62** extend a distance of between 20 mm and 35 mm, more preferably between 25 mm and 30 mm perpendicularly away from the plane containing the outlet aperture. Most preferably, the respective upwardly extending portions **60**, **62** extend a distance of 27 mm or about 27 mm perpendicularly away from the plane containing the outlet aperture.

[0106] In embodiments, an upper portion of the rearward internal wall **48** or the forward internal wall **46** may extend towards the other of the forward or rearward internal wall **46**, **48** as the said wall extends upwardly. In embodiments, respective upper portions of the forward and rearward internal walls **46**, **48** may extend towards each other as the walls **46**, **48** extend upwardly.

[0107] In embodiments, it has been found that varying the dimensions of the outlet aperture **18** and the lateral inlets **23a**, **23b** can improve performance of the floor tool **10**. The outlet aperture **18** has a cross-sectional area **A** and in this embodiment the aperture is substantially rectangular. In embodiments, the outlet aperture **18** may be a different shape, for example, a circle or an oval. The lateral inlets **23a**, **23b** are identical and each has a cross-sectional area **B**. The inlets **23a**, **23b** are substantially rectangular but in other embodiments one or both of the inlets may not be identical and/or be a different shape, e.g. semi-circular.

[0108] It has been found that selecting the ratio (**A**:**B**) of the cross-sectional areas of the outlet aperture **18** and the lateral inlets **23a**, **23b** to lie in the range of 12:1 and 8:1 is advantageous, and it is more advantageous for the ratio to lie in the range of 11:1 to 9:1. Most preferably the ratio (**A**:**B**) is 10:1 or about 10:1.

[0109] Further advantages have been identified in connection with the configuration of the conduit **12** which provides a releasable connection to a wand or hose of the apparatus. In more detail, having the longitudinal axis **C** of the conduit **12** inclined at an angle  $\Theta$  of between 45 and 55 degrees, preferably between 45 and 50 degrees, and more preferably 48 degrees or about 48 degrees, with respect to a plane **I** containing the floor facing inlet **16**, provides improved performance during use. In this embodiment, the longitudinal axis **C** of the conduit **12** is fixed with respect to the floor facing inlet **16**. In embodiments, the floor tool **10** may be arranged such that the conduit **12** can be moved with respect to the floor facing inlet **16** and the tool **10** includes a device for fixing the position of the conduit **12** with respect to the floor facing inlet **16**.

[0110] Benefits in performance have also been found in connection with another aspect of the floor tool **10**, as will now be described. The passage **20** includes a wall **36** which includes the outlet aperture **18**. In this embodiment, the passage includes forwardly and rearwardly positioned walls **38a**, **38b** which extend upwardly from the wall **36**. The forward wall **38a** has a central part **38a'** which is generally horizontal and has a respective lateral end part **38a''**. **38'''** extending from either end of the central part **38a'**. The lateral end parts **38a''**, **38'''** taper towards the respective lateral inlets **23a**, **23b** as they extend thereto. The rearward wall **38b** is generally horizontal along its entire length. The wall **36** has a surface area **W** and the cross-sectional area of the passage is constant as it extends towards the floor facing inlet **16**. The floor facing inlet **16** has an area **F**.

[0111] In embodiments the shape of the wall **36** may be different, e.g. a rectangle, and/or the cross-sectional area of the passage may vary, e.g. increase, as it extends towards the floor facing inlet **16**. In this embodiment, the depth of the passage gradually decreases as the passage laterally extends from respective peripheral portions of the outlet aperture **18** towards the lateral inlets **23a**, **23b**. In embodiments, the depth of the passage may remain constant or vary in a different way to that of the described embodiments.

[0112] It has been found to be particularly beneficial for the surface area  $W$  of the wall **36** and/or a cross-sectional area  $F$  of the floor facing inlet **16** to be between  $3800 \text{ mm}^2$  and  $4800 \text{ mm}^2$ , preferably between  $4000 \text{ mm}^2$  and  $4500 \text{ mm}^2$ , and most preferably between  $4300 \text{ mm}^2$  and  $4500 \text{ mm}^2$ . Further advantages are obtained if the areas  $W$ ,  $F$  are  $4430 \text{ mm}^2$  or about  $4430 \text{ mm}^2$ .

[0113] The volume of the passage **20** can be optimised so as to further improve performance. In particular, a volume of the passage **20** between  $46000 \text{ mm}^3$  and  $50000 \text{ mm}^3$  is beneficial. Furthermore, a volume of between  $47000 \text{ mm}^3$  and  $49000 \text{ mm}^3$ , preferably  $47500 \text{ mm}^3$  and  $48500 \text{ mm}^3$ . More preferably a volume of  $48000 \text{ mm}^3$  or around  $48000 \text{ mm}^3$ , most preferably  $48078 \text{ mm}^3$  or around  $48078 \text{ mm}^3$  improves performance.

[0114] Suction losses during use of the floor tool **10** have been reduced by making the floor tool **10** as a one piece component or of unitary construction. This may be done by a moulding process or by other process known in the art, such as 3D printing. In embodiments, the sealing members are connected to the remainder of the floor tool after that remainder has been formed. The floor tool **10** is made of a relatively rigid material such as Acrylonitrile Butadiene Styrene (ABS). In embodiments, other materials such as polypropylene, polycarbonate and/or die-cast aluminium may be used.

[0115] It will be appreciated that the features described in relation to the embodiment are necessarily all required in combination in order to provide benefits/advantages to the performance of the floor tool. The skilled person would appreciate that one or more combinations of the described features can be utilised without requiring the other features.

[0116] When used in this specification and claims, the terms “comprises” and “comprising” and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the presence of other features, steps or components.

[0117] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

1. A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air;
- an outlet aperture for communication with the suction source;
- a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and

a sealing member for engaging with a floor surface during use, which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface, wherein, during use, the or a substantial portion of the weight of the floor tool is borne/carried by the sealing member.

2. A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air;
- an outlet aperture for communication with the suction source;
- a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and
- a sealing member for engaging with a floor surface during use, which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface, wherein the sealing member provides a primary engagement or primary support of the floor tool on the floor surface.

3. A floor tool according to claim 2, wherein the sealing member provides the only or sole engagement or support of the floor tool on the floor surface.

4. A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air;
- an outlet aperture for communication with the suction source;
- a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and
- a sealing member for engaging with a floor surface during use, which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface, wherein the sealing member spaces the floor facing inlet from the floor surface.

5. A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air;
- an outlet aperture for communication with the suction source;
- a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and
- a sealing member for engaging with a floor surface during use, which sealing member extends away from the floor facing surface and laterally across the floor facing surface to block a flow of air towards the passage when the floor tool is engaged with a floor surface,

wherein the lateral inlets and/or portions of the passage adjacent thereto are free of substantial restrictions to the flow of air therethrough and/or therepast.

**6.** A floor tool according to any preceding claim, wherein the floor facing inlet includes forwardly and rearwardly positioned peripheral portions and wherein the distance between the sealing member and one of the forward or rearward peripheral portions is at least a distance of 6.0 mm.

**7.** A floor tool according to claim **6**, wherein the distance is at least 7.0 mm, preferably at least 8.0 mm.

**8.** A floor tool according to claim **6** or **7** or **8**, wherein the distance is 9.1 mm or about 9.1 mm, or it is 8.7 mm or about 8.7 mm.

**9.** A floor tool according to any preceding claim, including a further said sealing member, wherein one of the sealing members is positioned forwardly of the floor facing inlet and the other of the sealing members is positioned rearwardly of the floor facing inlet.

**10.** A floor tool according to claim **9** when directly or indirectly dependent on claim **6**, wherein the forward sealing member is positioned further away from the forward peripheral portion of the floor facing inlet than the rearward sealing member is positioned relative to the rearward peripheral portion of the floor facing inlet.

**11.** A floor tool according to claim **9** or **10** when directly or indirectly dependent on claim **6**, wherein the forward sealing member is spaced at a distance of 9.1 mm or about 9.1 mm from the forward peripheral portion of the floor facing inlet.

**12.** A floor tool according to claim **9**, **10** or **11** when directly or indirectly dependent on claim **6**, wherein the rearward sealing member is spaced at a distance of 8.7 mm or about 8.7 mm from the rearward peripheral portion of the floor facing inlet.

**13.** A floor tool according to any preceding claim, wherein a substantial portion of the sealing member(s) lies in a plane substantially parallel with a floor surface when the sealing member(s) is engaged with the floor surface.

**14.** A floor tool according to any preceding claim, wherein a distal portion of the sealing member(s) is spaced at a distance of between 3.0 mm and 6.0 mm in a vertical direction from a peripheral portion of the floor facing inlet.

**15.** A floor tool according to claim **14**, wherein said peripheral portion is defined by one of the lateral inlets.

**16.** A floor tool according to claim **14** or **15**, wherein the sealing member(s) extends a distance of between 4.5 to 5.5 mm.

**17.** A floor tool according to claim **16**, wherein the sealing member(s) extends a distance of 5.0 mm or about 5.0 mm.

**18.** A floor tool according to any preceding claim, wherein the sealing member(s) includes:

- a base portion connected to a housing; and
- a distal portion for engagement with a floor surface, wherein the sealing member tapers in cross-section as it extends from the base portion towards the distal portion.

**19.** A floor tool according to any preceding claim, wherein the sealing member(s) is generally wedge-shaped in cross-section.

**20.** A floor tool according to claim **19**, wherein the thickness of the sealing member at the distal portion is between 0.1 and 0.5 mm, and preferably is 0.3 mm or about 0.3 mm.

**21.** A floor tool according to any preceding claim, wherein the sealing member(s) moves or deforms when engaged with a floor surface.

**22.** A floor tool according to any preceding claim, wherein the sealing member(s) extends across the floor tool the same distance or about the same distance as the passage.

**23.** A floor tool according to any preceding claim, wherein the sealing member(s) is generally elongate.

**24.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air;
- an outlet aperture for communication with the suction source having a cross-sectional area A;

a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air, wherein one or both of the lateral inlets has a cross-sectional area B; and

wherein the ratio of area A to area B (A:B) is in the range of 12:1 and 8:1.

**25.** A floor tool according to claim **24**, wherein the ratio is in the range of 11:1 to 9:1.

**26.** A floor tool according to claim **25**, wherein the ratio is 10:1 or about 10:1.

**27.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air; and
- an outlet aperture for communication with the suction source via a conduit having a longitudinal axis, wherein the longitudinal axis of the conduit is inclined at an angle of between 45 and 55 degrees with respect to a plane containing the floor facing inlet.

**28.** A floor tool according to claim **27**, wherein the longitudinal axis of the conduit is fixed or can be fixed with respect to the floor facing inlet.

**29.** A floor tool according to claim **27** or **28**, wherein the angle is between 45 and 50 degrees.

**30.** A floor tool according to claim **27**, **28** or **29**, wherein the angle is 48 degrees or about 48 degrees.

**31.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

- a floor facing surface having a floor facing inlet for receiving dirty air;
- an outlet aperture for communication with the suction source; and

a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface, wherein the passage includes a wall which includes the outlet aperture;

wherein a surface area of the wall and/or a cross-sectional area of the floor facing inlet is between 3800 mm<sup>2</sup> and 4800 mm<sup>2</sup>.

**32.** A floor tool according to claim **31**, wherein the areas are between 4000 mm<sup>2</sup> and 4500 mm<sup>2</sup>.

**33.** A floor tool according to claim **32**, wherein the areas are between 4300 mm<sup>2</sup> and 4500 mm<sup>2</sup>.

**34.** A floor tool according to claim **33**, wherein the areas are 4430 mm<sup>2</sup> or about 4430 mm<sup>2</sup>.

**35.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

a floor facing surface having a floor facing inlet for receiving dirty air;

an outlet aperture for communication with the suction source; and

a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface, wherein the passage includes a wall which includes the outlet aperture,

wherein a volume of the passage is between 46000 mm<sup>3</sup> and 50000 mm<sup>3</sup>.

**36.** A floor tool according to claim 35, wherein the volume is between 47000 mm<sup>3</sup> and 49000 mm<sup>3</sup>.

**37.** A floor tool according to claim 35 or 36, wherein the volume is between 47500 mm<sup>3</sup> and 48500 mm<sup>3</sup>.

**38.** A floor tool according to claim 35, 36 or 37, wherein the volume is 48000 mm<sup>3</sup> or around 48000 mm<sup>3</sup>, preferably 48078 mm<sup>3</sup> or around 48078 mm<sup>3</sup>.

**39.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

a floor facing surface having a floor facing inlet for receiving dirty air;

an outlet aperture for communication with the suction source;

a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface; and

a conduit in communication with the outlet aperture, wherein

the conduit includes a portion adjacent the outlet aperture and extending upwardly therefrom, and

wherein the upwardly extending portion has a substantially constant cross-sectional area.

**40.** A floor tool according to claim 39, wherein the cross-sectional area of the outlet aperture is the same or about the same as the cross-sectional area of the upwardly extending portion.

**41.** A floor tool according to claim 39 or 40, wherein the upwardly extending portion extends substantially perpendicularly away from the plane containing the outlet aperture.

**42.** A floor tool according to claim 39, 40 or 41, wherein the upwardly extending portion extends a distance of between 10 and 40 mm.

**43.** A floor tool according to claim 42, wherein the upwardly extending portion extends a distance of between 20 and 35 mm.

**44.** A floor tool according to claim 43, wherein the upwardly extending portion extends a distance of between 25 and 30 mm.

**45.** A floor tool according to claim 44, wherein the upwardly extending portion extends a distance of 27 mm or about 27 mm.

**46.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

a floor facing surface having a floor facing inlet for receiving dirty air;

an outlet aperture for communication with the suction source;

a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface; and

a conduit in communication with the outlet aperture, wherein the conduit includes:

first and second opposing lateral internal side walls; and forwardly and rearwardly opposing upwardly extending internal walls,

wherein at least an upper portion of the forward or rearward internal wall extends towards the other of the forward or rearward internal wall as said wall extends upwardly.

**47.** A floor tool according to claim 46, wherein the upper portion of the forward internal wall extends towards the rearward internal wall.

**48.** A floor tool according to claim 46 or 47, wherein the rearward internal wall includes an opening in communication with the suction source.

**49.** A floor tool according to claim 48 including a further conduit having first end in communication with the opening and a second end for communication with the suction source.

**50.** A floor tool according to claim 49, wherein the further conduit has a substantially circular cross-section in the direction it extends away from the opening.

**51.** A floor tool according to claim 49 or 50, wherein the further conduit has a longitudinal axis which is inclined with respect to a longitudinal axis of the conduit.

**52.** A floor tool according to claim 49, 50 or 51, wherein the second end provides a releasable connection with the apparatus.

**53.** A floor tool according to any one of claims 46 to 52, wherein the forward and rearward internal walls are connected to one another at respective upper ends thereof.

**54.** A floor tool according to any one of claims 46 to 53, wherein respective upwardly extending portions of the lateral internal side walls adjacent the outlet aperture are substantially parallel to one another.

**55.** A floor tool according to claim 54, wherein the respective upwardly extending portions of the lateral internal side walls adjacent the outlet aperture extend a distance of between 10 mm and 40 mm perpendicularly away from the plane containing the outlet aperture.

**56.** A floor tool according to claim 54, wherein the respective upwardly extending portions of the lateral internal side walls adjacent the outlet aperture portions extend a distance of between 20 mm and 35 mm perpendicularly away from the plane containing the outlet aperture.

**57.** A floor tool according to claim 55, wherein the respective upwardly extending portions of the lateral internal side walls adjacent the outlet aperture portions extend a distance of between 25 mm and 30 mm perpendicularly away from the plane containing the outlet aperture.

**58.** A floor tool according to claim 56, wherein the respective upwardly extending portions of the lateral internal side walls adjacent the outlet aperture portions extend a distance of 27 mm or about 27 mm perpendicularly away from the plane containing the outlet aperture.

**59.** A floor tool for an apparatus for cleaning a floor surface, said apparatus including a source of suction, the floor tool including:

a floor facing surface having a floor facing inlet for receiving dirty air;



an outlet aperture for communication with the suction source via a conduit having a longitudinal axis, wherein the conduit provides a releasable connection to the apparatus;

a passage in fluid communication with the outlet aperture, which passage extends laterally across the floor facing surface and terminates at respective lateral inlets for receiving dirty air; and  
wherein the floor tool is formed as a one piece component or unitary component.

**60.** A floor tool according to claim 1 and/or any of claims 6 to 23 (1) including one or more or all of the features as set out in any one of the claims:—

- (i) 2 and/or any one of claims 6 to 23 (2); and/or
- (ii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iii) 4 and/or any one of claims 6 to 23 (4); and/or
- (iv) 5 and/or any one of claims 6 to 23 (5); and/or
- (v) 24 to 26 (6); and/or
- (vi) 27 to 30 (7); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**61.** A floor tool according to claim 2 and/or any of claims 6 to 23 (2) including one or more or all of the features as set out in any one of the claims:—

- (i) 2 and/or any one of claims 6 to 23 (1); and/or
- (ii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iii) 4 and/or any one of claims 6 to 23 (4); and/or
- (iv) 5 and/or any one of claims 6 to 23 (5); and/or
- (v) 24 to 26 (6); and/or
- (vi) 27 to 30 (7); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**62.** A floor tool according to claim 3 and/or any of claims 6 to 23 (3) including one or more or all of the features as set out in any one of the claims:—

- (i) 2 and/or any one of claims 6 to 23 (1); and/or
- (ii) 3 and/or any one of claims 6 to 23 (2); and/or
- (iii) 4 and/or any one of claims 6 to 23 (4); and/or
- (iv) 5 and/or any one of claims 6 to 23 (5); and/or
- (v) 24 to 26 (6); and/or
- (vi) 27 to 30 (7); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**63.** A floor tool according to claim 4 and/or any of claims 6 to 23 (4) including one or more or all of the features as set out in any one of the claims:—

- (i) 1 and/or any one of claims 6 to 23 (1); and/or
- (ii) 2 and/or any one of claims 6 to 23 (2); and/or
- (iii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iv) 5 and/or any one of claims 6 to 23 (5); and/or
- (v) 24 to 26 (6); and/or
- (vi) 27 to 30 (7); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or

(x) 46 to 58 (11); and/or

(xi) 59 (12).

**64.** A floor tool according to claim 5 and/or any of claims 6 to 23 (5) including one or more or all of the features as set out in any one of the claims:—

- (i) 1 and/or any one of claims 6 to 23 (1); and/or
- (ii) 2 and/or any one of claims 6 to 23 (2); and/or
- (iii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iv) 4 and/or any one of claims 6 to 23 (4); and/or
- (v) 24 to 26 (6); and/or
- (vi) 27 to 30 (7); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**65.** A floor tool according to any one of claims 24 to 26 (6) including one or more or all of the features as set out in any one of the claims:—

- (i) 1 and/or any one of claims 6 to 23 (1); and/or
- (ii) 2 and/or any one of claims 6 to 23 (2); and/or
- (iii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iv) 4 and/or any one of claims 6 to 23 (4); and/or
- (v) 5 and/or any one of claims 6 to 23 (5); and/or
- (vi) 27 to 30 (7); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**66.** A floor tool according to any one of claims 27 to 30 (7) including one or more or all of the features as set out in any one of the claims:—

- (i) 1 and/or any one of claims 6 to 23 (1); and/or
- (ii) 2 and/or any one of claims 6 to 23 (2); and/or
- (iii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iv) 4 and/or any one of claims 6 to 23 (4); and/or
- (v) 5 and/or any one of claims 6 to 23 (5); and/or
- (vi) 24 to 26 (6); and/or
- (vii) 31 to 34 (8); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**67.** A floor tool according to any one of claims 31 to 34 (8) including one or more or all of the features as set out in any one of the claims:—

- (i) 1 and/or any one of claims 6 to 23 (1); and/or
- (ii) 2 and/or any one of claims 6 to 23 (2); and/or
- (iii) 3 and/or any one of claims 6 to 23 (3); and/or
- (iv) 4 and/or any one of claims 6 to 23 (4); and/or
- (v) 5 and/or any one of claims 6 to 23 (5); and/or
- (vi) 24 to 26 (6); and/or
- (vii) 27 to 30 (7); and/or
- (viii) 35 to 38 (9); and/or
- (ix) 39 to 45 (10); and/or
- (x) 46 to 58 (11); and/or
- (xi) 59 (12).

**68.** A floor tool according to any one of claims 35 to 38 (9) including one or more or all of the features as set out in any one of the claims:—

- (i) 1 and/or any one of claims 6 to 23 (1); and/or
- (ii) 2 and/or any one of claims 6 to 23 (2); and/or
- (iii) 3 and/or any one of claims 6 to 23 (3); and/or

- (iv) **4** and/or any one of claims **6** to **23** (**4**); and/or
- (v) **5** and/or any one of claims **6** to **23** (**5**); and/or
- (vi) **24** to **26** (**6**); and/or
- (vii) **27** to **30** (**7**); and/or
- (viii) **31** to **34** (**8**); and/or
- (ix) **39** to **45** (**10**); and/or
- (x) **46** to **58** (**11**); and/or
- (xi) **59** (**12**).

**69.** A floor tool according to any one of claims **39** to **45** (**10**) including one or more or all of the features as set out in any one of the claims:—

- (i) **1** and/or any one of claims **6** to **23** (**1**); and/or
- (ii) **2** and/or any one of claims **6** to **23** (**2**); and/or
- (iii) **3** and/or any one of claims **6** to **23** (**3**); and/or
- (iv) **4** and/or any one of claims **6** to **23** (**4**); and/or
- (v) **5** and/or any one of claims **6** to **23** (**5**); and/or
- (vi) **24** to **26** (**6**); and/or
- (vii) **27** to **30** (**7**); and/or
- (viii) **31** to **34** (**8**); and/or
- (ix) **39** to **45** (**9**); and/or
- (x) **46** to **58** (**11**); and/or
- (xi) **59** (**12**).

**70.** A floor tool according to any one of claims **46** to **58** (**11**) including one or more or all of the features as set out in any one of the claims:—

- (i) **1** and/or any one of claims **6** to **23** (**1**); and/or
- (ii) **2** and/or any one of claims **6** to **23** (**2**); and/or
- (iii) **3** and/or any one of claims **6** to **23** (**3**); and/or
- (iv) **4** and/or any one of claims **6** to **23** (**4**); and/or
- (v) **5** and/or any one of claims **6** to **23** (**5**); and/or

- (vi) **24** to **26** (**6**); and/or
- (vii) **27** to **30** (**7**); and/or
- (viii) **31** to **34** (**8**); and/or
- (ix) **35** to **38** (**9**); and/or
- (x) **39** to **45** (**10**); and/or
- (xi) **59** (**12**).

**71.** A floor tool according to claim **59** (**12**) including one or more or all of the features as set out in any one of the claims:—

- (i) **1** and/or any one of claims **6** to **23** (**1**); and/or
- (ii) **2** and/or any one of claims **6** to **23** (**2**); and/or
- (iii) **3** and/or any one of claims **6** to **23** (**3**); and/or
- (iv) **4** and/or any one of claims **6** to **23** (**4**); and/or
- (v) **5** and/or any one of claims **6** to **23** (**5**); and/or
- (vi) **24** to **26** (**6**); and/or
- (vii) **27** to **30** (**7**); and/or
- (viii) **31** to **34** (**8**); and/or
- (ix) **35** to **38** (**9**); and/or
- (x) **39** to **45** (**10**); and/or
- (xi) **46** to **58** (**11**).

**72.** A floor tool according to any one of the preceding claims, wherein the floor tool is a dry floor tool.

**73.** An apparatus for cleaning a floor surface including a floor tool according to any one of the preceding claims.

**74.** A floor tool and/or apparatus substantially as hereinbefore described with to and as shown in the accompanying drawings.

**75.** Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

\* \* \* \* \*