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**(54)** **VACUUM CLEANING HEAD**
**STAUBSAUGERKOPF**
**TÊTE D'ASPIRATEUR**

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US-B1- 6 421 875

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Description

[0001] The present invention relates to vacuum cleaning devices and in particular, though not exclusively, to a vacuum cleaning head with increased pick-up at low power.

[0002] Vacuum cleaning devices for cleaning floors work on the principle that air is drawn through the cleaner and dust receptacle using a 'draw' created by an impeller fan driven by an electric motor. The air is expelled via one or more filters to prevent small dust particles being emitted, with the collected dust and debris being retained in the dust receptacle.

[0003] There are two basic designs of vacuum cleaning devices, those where the motor is in the cleaning head, sometimes referred to as upright, and those where the motor and cleaning head are separated by a hose, commonly referred to as cylinder. In an upright vacuum cleaner, the motor is used to provide both the suction, or draw, and to power beaters, brushes or rollers to mechanically assist in bringing the debris up into the suction path by agitating the floor surface. These upright vacuum cleaners can be particularly heavy and it is known that they cause physical damage to carpet fibres shortening the lifespan of a carpet. Upright vacuum cleaners are also not suitable for use in small tight spaces such as under furniture or on staircases. To overcome this, a hose is supplied to which vacuum attachments in the form of nozzles are attached. This arrangement operates in the same way as the cylinder vacuum cleaner, where the motor is separated from the cleaning head by a hose. The motor is then solely used for suction of debris up the hose. With the hose being a few metres in length, the cleaning head requires to make contact with the surface being vacuumed to efficiently pick-up debris.

[0004] A standard prior art cleaning head for connection to a hose is rectangular in shape with a rectangular suction port, extending only 10-20 mm laterally, located at the centre of the bottom face. The rectangular suction port enters a conduit which ends at a connection to the hose. This connection to the hose may be rotatable to assist manoeuvrability of the head as, typically, the hose is a rigid cylindrical tube. Horizontal channels are formed from the rectangular suction port to the sides of the head to direct debris to the suction port and to provide an air flow to the suction port when the head is in contact with the floor so that the head can move across the floor. At the front and back edges of the head are arranged brushes and/or scrapers to assist in lifting debris from a carpet. These brushes are articulated so that they can be moved up and down relative to the head for selective use depending on the floor surface being vacuumed.

[0005] There are a number of disadvantages with this prior art cleaning head. The head will only pick-up debris immediately below the suction port and thus only a small area of floor is cleaned on each stroke of the head. The horizontal channels do not assist this as they are too shallow and draw air from the sides of the device perpendicular to the direction of cleaning with no leading edge air flow or suction present. The arrangement of brushes prevents air flow in the cleaning direction. The articulated brushes also mean that the head is composed of multiple parts resulting in a suction conduit which switches dramatically from a rectangular cross-section to a circular cross-section. These sudden changes in the cross-section of the conduit together with the dogleg path to the hose, cause the suction flow to fragment and reduce in air speed. This reduces the amount of debris which can be carried in the suction flow and consequently the head is inefficient at cleaning.

[0006] To overcome these disadvantages manufacturers have increased the power of the motor to increase suction. One disadvantage in increasing power is that the head becomes more difficult to manoeuvre across the floor as the increased suction across the small suction port will want to lift the carpet at the suction port. The horizontal channels seek to alleviate this, but if made too large, the desired increase in suction is lost.

[0007] A further disadvantage in increasing power is the effect on the environment by the increased energy consumption. Indeed, there are currently proposals to provide an EU directive to ecodesign vacuum cleaners whereby the maximum power will be reduced from the current 2000 watts to 900 watts. Manufacturers are already concerned about the drop in efficiency and performance this will have on vacuum cleaners.

[0008] There is thus a need for a cleaning head which provides more efficient pick-up at lower motor power.

[0009] It is believed that heads which encourage laminar flow can give increased pick-up as the higher air speed through the head has a greater capacity to carry a load of particles. US 6,421,875 describes a cleaning head which is aerodynamically designed to increase efficiency based on creating a region in the vacuum head which produces high-speed laminar flow for particulate pickup, another area which provides for vortex formation, and another area which pulls air and particulates from the vortex region and forms them into a laminar flow air pattern. The head has an elongated, generally rectangular vacuum chamber comprising: a front side and an opposite spaced apart rear side, each side with a top edge and a bottom portion having a generally flattened floor contacting bottom edge, in which the bottom portion defines a number of air bypass channels for restricting a flow of air into the vacuum chamber, with the channels being generally perpendicular to the sides and those arranged in each side being offset to those on the opposite side; a right side and an opposite spaced apart left side, each side with a top edge and a bottom portion having a generally flattened floor contacting bottom edge, and attached to the front side and the rear side; and a top cover portion which attaches to the top edges of the sides, which defines a tube receiving orifice for connection to the hose, the portion having curved faces from each edge to form the vacuum chamber. In use, draw from the motor creates a negative pressure in the vacuum chamber, air...
The combination of laminar air flow with air by-passing orifice path for air from the vacuum chamber to the tube receiving orifice. The combination of laminar air flow with air bypass channels and the resulting multiple vortices in the vacuum chamber by the offset alignment of the front and rear air bypass channels and the laminar flow top cover portion provides an aerodynamically unobstructed path for air from the vacuum chamber to the tube receiving orifice.

[0010] The combination of laminar air flow with air bypass channels and the resulting multiple vortices in the head, claim to produce a loss of less than 3% in airflow through the head compared to efficiency losses of 13% to 30% in the prior art cleaning heads.

[0011] There are a number of disadvantages with this proposed cleaning head. The curved faces from the front, rear, left and right sides provide a conduit which is rectangular in cross section through the vacuum chamber to the tube receiving orifice, which will have a circular cross section. This will create a fragmented vortex in the chamber which will slow the air speed down and effectively allow debris to 'fall out' of the air flow. The tube receiving orifice is arranged to be parallel with the floor contacting bottom edge and vertically above the rear edge. Thus the airflow will have to turn through approximately 90 degrees which again detrimentally reduces the speed. Though intended to combine three regions of air flow in the head, these regions are likely to interfere with each other creating regions of zero airflow where debris will 'fall-out' and not be drawn to the hose. Additionally, creating a high speed laminar flow requires a high suction or draw. This cleaning head is therefore likely to be designed to operate at maximum motor power i.e. 2000 watts and will thus be much less successful at lower power.

[0012] It is therefore an object of the present invention to provide a vacuum cleaning head which mitigates at least some of the disadvantages of prior art vacuum cleaning heads.

[0013] It is a further object of the present invention to provide a vacuum cleaning head which improves the efficiency of debris pick-up at low power.

[0014] US 2003/131440 discloses a vacuum cleaner which is useful for understanding the invention.

[0015] According to the present invention there is provided a vacuum cleaning head according to claim 1.

[0016] In this way, a vortex is created in an expanded region of an uninterrupted airflow, this increases the air speed and consequently the pick-up.

[0017] Preferably the conduit is substantially circular in cross-section. The contoured wall provides curved or gentle slopes through the conduit rather than straight or flat surfaces and in particular no acute angles.

[0018] Preferably, the changes in the cross-sectional area of the conduit are undulations in the wall which may be considered as being convex in nature with a concave chamber there between.

[0019] In this way, the substantially uninterrupted, single contoured walled continuous passageway ensures that the air flow is not fragmented and that the vortex creates the greatest increase in air speed.

[0020] Preferably, the cleaning head has a substantially planar bottom face for contacting a surface to be cleaned. More preferably the bottom face is rectangular. In this way, the vacuum cleaning head has dimensions similar to the prior art cleaning heads with a front, rear, left side and right side edges. Additionally, the cleaning head can be swept across a floor or carpet in the same manner as prior art devices.

[0021] The body includes a window at a front edge. A window allows air to be drawn in to the conduit to create the air flow through the head. Advantageously the window has a length being a majority of a length of the front edge. The window is formed by removing a portion of the front edge so that the window is bounded on three sides by the body and on a fourth side, by the surface to be cleaned. In this way, the window can be considered as a cut-away or channel. By creating the window at the floor level, the air will be drawn in through the carpet pile and aid in debris collection.

[0022] Preferably the inlet has a width at the bottom face which is approximately equal to the length of the window. The width of the inlet may be greater than the length of the window. In this way, the cleaning head can draw in air and debris across the majority of the width of the cleaning head.

[0023] Advantageously, the window forms a portion of the inlet. In this way, the window becomes part of the conduit and one end of the substantially uninterrupted, single contoured walled continuous passageway. More preferably, the passageway is substantially centrally located in the body.

[0024] Preferably, the inlet is an elongate oval at the bottom face, having left and right portions extending towards the left and right sides respectively. Preferably the left and right portions are substantially part circular in cross-section to maintain the substantially uninterrupted, single contoured walled continuous passageway of the conduit. In this way, the air flow is not fragmented at the inlet.

[0025] Advantageously, a wall of each portion undulates to provide a region with a decreased cross-sectional area. In this way, a restriction is provided in the conduit which assists in creating further opportunity to increase air speed in the conduit.

[0026] Preferably, there are provided one or more air inlet control ports in the body. An air inlet control port provides an aperture or channel in the body to allow air to enter the conduit other than through the window. In an embodiment there are arranged two air inlet control ports at the right and left edges of the cleaning head. The air inlet control ports may be channels on the bottom face between a side edge and the conduit respectively. Alternatively, the air inlet control ports may be apertures in the body arranged towards the side edges.

[0027] The apertures are preferably countersunk on each side with the diameter of the aperture controlling air speed through the air inlet control port. Such air inlet...
control ports allow the head to be manoeuvred across a
floor surface without wanting to 'stick' to the surface by
controlling the down force.

Optionally there may be further vortex expansion
chambers in the conduit. In this way the conduit can
be considered as a tubular pathway with undulating walls
to provide selective restrictions at which vortexes may
be created to increase the air speed and hence the draw
or suction through the cleaning head.

Preferably, the outlet is arranged at approxi-
mately sixty degrees to the bottom face. In this way, the
hose will be located at thirty degrees to the surface being
cleaned which is the preferred position of hoses on cleaning
heads of the prior art. This ensures that the cleaning
head of the present invention can be retrofitted to existing
vacuum cleaners and used in an identical manner as is
currently practised.

Preferably, the inlet has a length, perpendicular
to its width, which is a majority of half the width of the
bottom face between the front and rear edges. More pref-
erably the inlet is arranged near the front edge, with the
outlet arranged to lie above the rear edge. In this way,
the conduit will not be subjected to a ninety degree turn
in direction between the inlet and outlet, thus reducing
the chance of a drop in air speed.

In an alternative embodiment, the head in-
cludes a gimbal joint at the outlet. This provides rotation
of the hose at the outlet. Advantageously, the gimbal joint
includes vortex expansion chamber. In this way, air
speed can be increased at the joint as compared to prior
art arrangements wherein the air speed is decreased at
the joint due to the dogleg arrangement.

Embodiments of the present invention will now
be described, by way of example only, with reference to
the following drawings of which:

Figure 1 is a perspective view of a vacuum cleaning
head according to an embodiment of the present inven-
tion;

Figure 2 is a cross-sectional view through a vacuum
cleaning head according to an embodiment of the present inven-
tion;

Figure 3 is a bottom view of a vacuum cleaning head
according to an embodiment of the present inven-
tion;

Figure 4 is a front view of a vacuum cleaning head
according to an embodiment of the present inven-
tion;

Figure 5 is an alternative cross-sectional view of a
vacuum cleaning head according to a further em-
bedment of the present invention; and

Figure 6 is an illustration of a gimbal joint for use in
the vacuum cleaning head of the present invention.

Reference is made to Figures 1 to 4 of the draw-
ings which illustrate a vacuum cleaning head, generally
indicated by reference numeral 10, according to an em-
bedment of the present invention. Head 10 has a body
12 with a conduit 14 located therethrough between an
inlet 16 and an outlet 18. The conduit includes a primary
vortex chamber 20.

Body 12 is a single piece unit. The head 10 can
be moulded from a toughened plastics material. This
makes the head 10 relatively cheap to produce and du-
rable as it has no moving parts. Body 12 has a generally
rectangular footprint as for the prior art cleaning heads.
This rectangular base 22 provides a front edge 24, rear
dge 26, right side edge 28 and left side edge 30. The
base also has a bottom face 32 which is substantially
planar and smooth excepting the space for the inlet 16.

Extending through the body 12 is a conduit 14.
Conduit 14 is a tubular passageway 34 without obstruc-
tions, tight corners or other interruptions to its continuous
smooth wall 36. The conduit 14 is substantially circular
in cross-section, but can become oval or elliptical with
variations to the cross-sectional area appearing as un-
dulations to the wall 36. The wall 36 may be considered
as contoured with curved or gentle slopes. Thus at small-
er cross-sectional areas, the passageway 34 will be re-
stricted with the wall 36 appearing to be convex around
the circumference as compared to other larger cross-
sectional areas appearing as concave.

The conduit 14 extends from an inlet 16 adja-
cent to the bottom face 32 to an outlet 18 on a top face
38 towards the rear side of the body 12. Within the conduit
14 is a primary vortex chamber 40. Chamber 40 is created
by forming a section of the passageway 34 with a larger
cross-sectional area, giving a convex or bulbous section,
between two restrictions 42,44. The restrictions have a
smaller cross-sectional area, perpendicular to the direc-
tion of the passageway, than the chamber 40, which they
effectively bound. While one expansion chamber 40 is
shown in the Figures, it will be apparent that more than
one chamber 40 could be incorporated, if desired.

In order to draw air into the conduit 14, a window
46 is supplied in the body 12 at the front edge 24. Window
46 is created by removing a portion of the front edge so
that a channel 48 is formed at the front edge 24. This
provides a passageway for air to enter the head 10, at
the surface being cleaned. It is noted that the channel 48
is long and thin with a width over a majority of the front
dge 24 of the head 10. As the window 46 provides a
front facing inlet for air to be drawn in this allows cleaning
over the full width of the head 10. The walls of the channel
48 are contoured to provide smooth curves being also
moulded in the body 12.

Behind the window 46, in the base 22, is pro-
vided the inlet 16. Inlet 16 is substantially oval, being
elargated with a front side meeting the window 46, a rear
side 50, narrower than half the depth of base 22, and left
and right sides 52,54 being curved. The inlet 16 has a
width between left 52 and right 54 sides at the bottom
face 32 which is greater than the width of the window 46 and extends over almost the entire width of the base 22 of the head 10.

[0039] As the conduit 14 is substantially circular in cross-section, the inlet 16 provides two horizontally arranged channels 56,58 between each side 50,52 respectively, and the centre of the inlet 16, leading through the conduit 14. Each channel 56,58 is open to the floor with a part circular wall when viewed from the side. The ends 60,62 of the horizontal channels 56,58 have a spherically shaped wall to maintain the smooth contoured surface of the conduit 14 throughout the body 12. Thus the conduit, through its entire length to the bottom face 32 provides an oval or circular cross-section.

[0040] At the left and right sides 52,54 of the inlet 16 are arranged air inlet control ports 64,66. These may be considered as down force control passages. Each port 64,66 at each end 52,54 is a channel providing a passage for air from the right and left side edges 28,30 to the inlet 16 and consequently the conduit 14. In this embodiment the ports are shaped like the window 46, with a side of the channel being represented by the surface to be cleaned. Each port has smooth walls which are contoured to the inlet 16.

[0041] Each horizontal channel 56,58 may have a uniform cross-sectional area along a majority of its length before opening into the conduit 14 circular cross-sectional area. In this embodiment, there is a restriction 68,70 in each channel 56,58 respectively. The restriction is as described with reference to the restrictions 42,44 at the primary vortex chamber 40, being an undulation in the wall of each channel which causes a reduction in the cross-sectional area of the part circular wall over a length of the channel 56,58.

[0042] The outlet 18, when viewed in the arrangement of Figure 2, is located at approximately sixty degrees to the bottom face 32. The outlet 18 sits vertically above the rear edge 26 and with the inlet 16 being towards the front edge 24, the depth of the head 10 is selected to ensure that the conduit 14 does not make any dogleg turns. At the outlet the conduit 14 will be of circular cross-section and sized to fit a regular hose of a cylinder or upright vacuum cleaner.

[0043] In use, the vacuum cleaning head 10 is fitted to a standard hose at the outlet 18. The hose will be connected to a motor and can preferably be run at low powers such as 800 watts compared to the 2000 watts of present machines. It should be noted that the hose will connect around the outside of the outlet 18, so that the conduit is not stepped into the air flow, which would create a wall upon which fragmentation of the air flow would occur.

[0044] The cleaning head 10 is used in the same manner as the prior art cleaning heads, in which the bottom face 32 contacts the surface to be cleaned such as a floor or carpet. The head 10 is swept back and forth in strokes which maintain contact of the face 32 with the floor surface. Air is drawn into the head 10 via the window 46, from the draw of the motor through the conduit 14.

This draw of air sucks in material immediately in front of the window 46 and across the heads entire width as the air flow is optimised and distributed over the head 10.

[0045] At the chamber 40, the expansion of area for the air to flow into causes a pressure drop which aids in drawing more air into the chamber 40 which effectively speeds up the air flow from the inlet 16 to the outlet 18 in the conduit 14. This increase in air speed can be likened to that occurring in the internal cylinder head structure of motor vehicles where nozzles are fitted. The increased draw is sufficient, even at low motor power, to pull debris from the pile of a carpet while picking up debris which lies in front of the head.

[0046] Primarily it can be considered that the shape of the expansion chamber allows for a large reduction in static pressure (draw) which, by Bernoulli’s theorem, gives an equal rise in dynamic pressure (air speed) as the pressures maintain equilibrium. Thus the shape of the conduit at the chamber gives vortexial speed build-up inside the head.

The air inlet control ports 64,66 also provide an air intake point which is speeded up along the horizontal channels 56,58 by virtue of the restrictions 68,70 therein. This air intake controls the 'grip' which the draw has on the floor surface and hence the manoeuvrability of the head 10 over the floor. Additionally, the horizontal channels 56,58 work with the elongated input 16, to provide lateral pick-up across the entire width of the head 10. As the inlet 16 is both at the front edge 24 via the window and close to the side edges 28,30 by virtue of the inlet 16 dimensions, the head 10 can effectively be used up to walls and skirting boards for pick-up, areas which are traditionally missed in using prior art cleaning heads.

[0047] The cleaning head 10 was tested against a standard manufacturer’s head, of similar dimensions, with the corresponding vacuum cleaner (Hoover Whirlwind ‘300 Airwatts’, Hepa Filter rated to 2000 watts). The test was that specified by the Industry as 60312. On a Wilton type carpet, 24 grams of sand (0 to 250 micron sized) is sprinkled on a test area 700 mm long and the width of the cleaning head. The sand is then rolled into the carpet to embed in the pile and left for 10 minutes to settle. Five timed test strokes are allowed over the test area, with the area having an additional 200mm and 300mm at each end, for acceleration and deceleration of the head being tested. Three sets of strokes were performed and the weight of sand collected was measured to determine the percentage of collection and hence the pick-up.

[0048] The vacuum cleaner was set at its lowest power rating, this being 800 watts. On testing, the manufacturers head provided an average pick-up of 26% over three separate tests as compared to 46% for the head of the present invention as described in Figures 1 to 4. Thus the vacuum cleaning head can operate effectively at power levels of less than 1 kW. Preferably it can operate in the power region of 500 to 700 watts with no less than the pick-up levels of currently commercially available
models. Reference is now made to Figure 5 of the drawings which illustrates a cleaning head, generally indicated by reference numeral 110, according to a further embodiment of the present invention. Like parts to those in Figures 1 to 4, have been given the same reference numeral, with the addition of 100, to aid clarity.

[0049] Head 110 is formed as a single unitary modelled body of contoured surfaces with a conduit 114 passing there through. In this arrangement the primary vortex chamber 120 is located higher on the conduit towards and adjacent to the outlet 118. This does not affect the performance and illustrates that the chamber 120 may be located at any point in the conduit 114. Indeed, if desired more than one chamber can be arranged in the conduit 114. The pick-up through the head 110 is controlled by the ratios between the cross-sectional areas of the restrictions 142,144 and the cross-sectional area and volume of the chamber 120.

[0050] A further feature of the embodiment of Figure 5 is in the air inlet control ports 72,74. These do not open out on the bottom face 132, but instead are apertures through the roof 76 of the horizontal channels 156,158, respectively. Each aperture is countersunk from both the roof 76 and the top face 138 to form a nozzle whose diameter determines the air inlet to each horizontal channel 156,158. The ports 72,74 are located at the ends 160,162 of the horizontal channels 156,158. In this embodiment, there is an end face 78 on the side edge 128,130 to each horizontal channel 156,158. This embodiment illustrates that the air inlet control ports may be arranged at different positions at the ends of the horizontal channels.

[0051] The Figures show embodiments wherein the outlet 18,118 is arranged at a fixed angle with respect to the base 22,122. On some prior art vacuum cleaners the hose is allowed to rotate within the outlet. This can be designed into the present invention. Alternatively a gimbal joint 80 can be used as illustrated in Figure 6. As is known in the art such a joint 60 comprises two cups 84,88 being part spheres in which the lower cup 84 sits within the upper cup 88, with each having the ability to rotate around the other cup. Each cup has a base 82,86 from which a conduit 90,92 extends respectively. The conduits 90,92 join together at a spherical chamber 94 formed by the conduits 84,88. In this way, the lower cup 84 is fixed in position on the head 10, while the upper cup 88 can rotate so that the conduit 90 extending from the upper cup 88 can be adjusted to sit at any chosen angle with respect to the bottom face 32. Thus the head 10,110 of the present invention can provide an adjustable attachment to the hose, the hose being attached to the upper conduit 90, as found in present vacuum cleaning heads.

[0052] In this arrangement with the joint 80, the outlet 18 can be considered to be at the base 82 of the lower cup 84 or at the base 86 of the upper cup 88. In either configuration, the chamber 94 will provide an expansion chamber, in the same manner as chamber 20. Thus this may be arranged as the only expansion chamber, with outlet 18 considered to be at the base 86. Alternatively, this may be a second chamber, with the outlet 18 considered to be at the base 82.

[0053] The principle advantage of the present invention is that it provides a vacuum cleaning head with improved debris pick-up at low power.

[0054] A further advantage of the present invention is that it provides a vacuum cleaning head which operates effectively without brushes or scrapers and thus does not require adjustment to operate on any surface to be cleaned.

[0055] A yet further advantage of the present invention is that it provides a vacuum cleaning head which draws in debris across the entire width of the head.

[0056] It will be appreciated by those skilled in the art that modifications may be made to the invention herein described without departing from the scope thereof. For example, though described with reference to a cylinder vacuum cleaner, the vacuum cleaning head could be used on a hand held device such as those used for cleaning the interior of cars or on wet carpet shampoo devices where water is sucked up with the debris. Additionally, the outer surface of the head can be of any form or arrangement as desired. Brushes and scrapers may also be added, if desired.

Claims

1. A vacuum cleaning head (10,110) comprising:

- a unitary body (12,112) having a conduit (14,114) passing therethrough;
- the conduit being a substantially uninterrupted, single contoured walled continuous passage way (34,134) with a substantially oval inlet (16,116) at a first end leading to a substantially circular outlet (18,118) at a second end;
- the inlet being arranged to face a surface to be cleaned;
- the outlet being arranged for connection of a hose to a motor;
- the conduit including a primary vortex expansion chamber (20,120), the chamber being formed by variations in the cross-sectional area of the conduit between first (42), second (40) and third (44) cross-sectional areas wherein the second is greater than and bounded by the first and third; and

characterised in that:

- the body includes a window (46) at a front edge (24) wherein the window is formed by removing a portion of the front edge so that the window is bounded on three sides by the body and on a fourth side, by the surface to be cleaned.
2. A vacuum cleaning head (10,110) according to claim 1 wherein the conduit (14,114) is substantially circular in cross-section and/or wherein changes in the cross-sectional area of the conduit are formed as one or more undulations in the wall (36) of the conduit.

3. A vacuum cleaning head (10,110) according to any preceding claim wherein the cleaning head has a substantially planar bottom face (32,132) for contacting the surface to be cleaned, optionally wherein the bottom face is rectangular.

4. A vacuum cleaning head (10,110) according to any preceding claim wherein the window (46) has a length being a majority of a length of the front edge (24).

5. A vacuum cleaning head (10,110) according to claim 3 or claim 4 wherein the inlet (16,116) has a width at the bottom face (32,132) which is approximately equal to the length of the window (46) and the window forms a portion of the inlet.

6. A vacuum cleaning head (10,110) according to any preceding claim wherein the passageway (34) is substantially centrally located in the body (12).

7. A vacuum cleaning head (10,110) according to any preceding claim wherein the inlet (16,116) is an elongate oval at the bottom face (32,132), having left and right portions (56,58) extending towards the left and right sides (52,54) respectively, optionally wherein the left and right portions are substantially part circular in cross-section.

8. A vacuum cleaning head (10,110) according to claim 7 wherein a wall of each portion undulates to provide a region (68,70) with a decreased cross-sectional area.

9. A vacuum cleaning head (10,110) according to any preceding claim wherein there are provided one or more air inlet control ports (64,66,72,74) in the body (12).

10. A vacuum cleaning head (10,110) according to claim 9 wherein there are arranged two air inlet control ports (64,66;72,74) at the right and left edges (28,30) of the cleaning head.

11. A vacuum cleaning head (10,110) according to claim 10 wherein the air inlet control ports (64,66) are channels on the bottom face between a side edge (28,30) and the conduit (14) respectively.

12. A vacuum cleaning head (10,110) according to claim 10 wherein the air inlet control ports (72,74) are apertures in the body (12) arranged towards the side edges (28,30).

13. A vacuum cleaning head (10,110) according to any preceding claim wherein there are one or more further vortex expansion chambers in the conduit.

14. A vacuum cleaning head (10,110) according to any one of claims 3 to 13 wherein the outlet (18,118) is arranged at approximately sixty degrees to the bottom face (32,132).

15. A vacuum cleaning head (10,110) according to any preceding claim wherein the head includes a gimbal joint (80) at the outlet (118), optionally wherein the gimbal joint includes vortex expansion chamber (94).

Patentansprüche

1. Staubsaugerkopf (10,110) aufweisend:

   einen einstückigen Körper (12,112) mit einer
dort hindurchlaufenden Leitung (14,114),

wobei die Leitung ein im Wesentlichen ein
ununterbrochener, mit einzelner konturier-
ter Wand versehener kontinuierlicher
Durchgang (34,134) mit einem im Wesent-
lchen ovalen Eingang (16,116) an einem
ersten Ende führend zu einem im Wesent-
lchen kreisförmigen Ausgang (18,118) an
einem zweiten Ende ist,

wobei der Eingang angeordnet ist, um einer
zu reinigenden Oberfläche gegenüberzuzeich-
gen, wobei der Ausgang zum Anschluss eines
Schlauchs an einen Motor angeordnet ist,

wobei die Leitung eine primäre Wirbelle-
expansionskammer (20,120) umfasst, wobei
die Kammer durch Variationen in der Quer-
schnittsfläche der Leitung zwischen erster
(42), zweiter (40) und dritter (44) Quer-
schnittsfläche gebildet wird, wobei die dwei-
te größer als und durch die erste und dritte
begrenzt ist, und
dadurch gekennzeichnet,

   dass: der Körper ein Fenster (46) am vorderen
   Rand (24) umfasst, wobei das Fenster
durch Entfernen eines Teils des vorderen
   Rands gebildet wird, so dass das Fenster
   an drei Seiten durch den Körper und an ei-
   ner vierten Seite durch die zu reinigende
   Oberfläche begrenzt wird.

2. Staubsaugerkopf (10,110) nach Anspruch 1, wobei
die Leitung (14,114) im Wesentlichen kreisförmig im
Querschnitt ist und/oder wobei Änderungen in der


Querschnittsfläche der Leitung als eine oder mehrere Wellen in der Wand (36) der Leitung gebildet werden.

3. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei die Reinigungskopf eine um Wesentlichen ebene Unterseite (32,132) zur Berührung der zu reinigenden Oberfläche hat, optional wobei die Unterseite rechteckig ist.

4. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei das Fenster (46) eine Länge hat, die ein Hauptteil der Länge des vorderen Rands (24) ist.

5. Staubsaugerkopf (10,110) nach Anspruch 3 oder Anspruch 4, wobei der Eingang (16,116) eine Breite an der Unterseite (32,132) hat, die ungefähr der Länge des Fensters (46) entspricht, und das Fenster einen Teil des Eingangs bildet.

6. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei der Durchgang (34) sich im Wesentlichen mittig im Körper (12) befindet.

7. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei der Eingang (16,116) ein längliches Oval an der Unterseite (32,132) ist, das einen linken und rechten, sich jeweils in Richtung auf die linke und rechte Seite (52,54) erstreckenden Abschnitt (56,58) hat, optional wobei der linke und rechte Abschnitt im Wesentlichen teilkreisförmig im Querschnitt sind.

8. Staubsaugerkopf (10,110) nach Anspruch 7, wobei eine Wand von jedem Abschnitt sich wellt, um einen Bereich (68,70) mit verringriger Querschnittsfläche bereitzustellen.

9. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei eines oder mehrere Lufteinlass-Regelungsanschlüsse (64,66,72,74) im Körper (12) vorgesehen sind.

10. Staubsaugerkopf (10,110) nach Anspruch 9, wobei zwei Lufteinlass-Regelungsanschlüsse (64,66,72,74) am rechten und linken Rand (28,30) des Reinigungskopfes angeordnet sind.

11. Staubsaugerkopf (10,110) nach Anspruch 10, wobei die Lufteinlass-Regelungsanschlüsse (64,66) jeweils Kanäle an der Unterseite zwischen einem Seitenrand (28,30) und der Leitung (14) sind.

12. Staubsaugerkopf (10,110) nach Anspruch 10, wobei die Lufteinlass-Regelungsanschlüsse (72,74) Öffnungen im Körper (12) sind, die in Richtung auf die Seitenränder (28,30) angeordnet sind.

13. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei eine oder mehrere Wirbelexpansionskammern in der Leitung vorhanden sind.

14. Staubsaugerkopf (10,110) nach einem der Ansprüche 3 bis 13, wobei der Ausgang (18,118) bei ungefähr sechzig Grad zur Unterseite (32,132) angeordnet ist.

15. Staubsaugerkopf (10,110) nach einem der vorhergehenden Ansprüche, wobei der Kopf eine Kardanverbindung (80) am Ausgang (118) umfasst, optional wobei die Kardanverbindung eine Wirbelexpansionskammer (94) umfasst.

Revendications

1. Tête de nettoyage par aspiration (10, 110) comprenant :

- un corps unitaire (12, 112) ayant un conduit (14, 114) passant à travers celui-ci ;
- le conduit étant un passage continu (34, 134) à paroi à contour unique sensiblement ininterrompu avec une entrée (16, 116) sensiblement ovale à une première extrémité conduisant à une sortie sensiblement circulaire (18, 118) à une seconde extrémité ;
- l’entrée étant agencée pour faire face à une surface à nettoyer ;
- la sortie étant agencée pour la connexion d’un tuyau à un moteur ;
- le conduit comprenant une chambre d’expansion de tourbillonnement primaire (20, 120), la chambre étant formée par des variations dans la surface de coupe transversale du conduit entre la première surface de coupe transversale (42), la deuxième surface de coupe transversale (40) et la troisième surface de coupe transversale (44) dans laquelle la deuxième surface de coupe transversale est supérieure et bornée par la première surface de coupe transversale et la troisième surface de coupe transversale ; et caractérisée en ce que :

le corps comprend une fenêtre (46) au niveau d’un bord avant (24), dans laquelle la fenêtre est formée en enlevant une partie du bord avant de sorte que la fenêtre est délimitée sur trois côtés par le corps et sur un quatrième côté, par la surface à nettoyer.

2. Tête de nettoyage par aspiration (10, 110) selon la revendication 1, dans laquelle le conduit (14, 114) est sensiblement circulaire en coupe transversale et/ou dans laquelle des changements au niveau de
la surface de coupe transversale du conduit sont formées par une ou plusieurs ondulations dans la paroi (36) du conduit.

3. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle la tête de nettoyage comporte une face inférieure sensiblement plane (32, 132) pour mettre en contact la surface à nettoyer, le cas échéant, dans laquelle la face inférieure est rectangulaire.

4. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle la fenêtre (46) a une longueur qui est une majorité d’une longueur du bord avant (24).

5. Tête de nettoyage par aspiration (10, 110) selon la revendication 3 ou la revendication 4, dans laquelle l’entrée (16, 116) a une largeur au niveau de la face inférieure (32, 132) qui est approximativement égale à la longueur de la fenêtre (46) et la fenêtre forme une partie de l’entrée.

6. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle le passage (34) est situé sensiblement au centre du corps (12).

7. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle l’entrée (16, 116) est un ovale allongé à la face inférieure (32, 132), ayant des parties gauche et droite (56, 58) se prolongeant vers les côtés gauche et droit (52, 54), respectivement, et éventuellement dans laquelle les parties gauche et droite ont sensiblement une partie circulaire en coupe transversale.

8. Tête de nettoyage par aspiration (10, 110) selon la revendication 7, dans laquelle une paroi de chaque partie ondulée pour fournir une région (68, 70) avec une surface de coupe transversale réduite.

9. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle on trouve un ou plusieurs orifices de commande d’entrée d’air (64, 66, 72, 74) dans le corps (12).

10. Tête de nettoyage par aspiration (10, 110) selon la revendication 9, dans laquelle sont disposés deux orifices de commande d’entrée d’air (64, 66 ; 72, 74) aux bords droit et gauche (28, 30) de la tête de nettoyage.

11. Tête de nettoyage par aspiration (10, 110) selon la revendication 10, dans laquelle les orifices de commande d’entrée d’air (64, 66) sont des canaux sur

12. Tête de nettoyage par aspiration (10, 110) selon la revendication 10, dans laquelle les orifices de commande d’entrée d’air (72, 74) sont des ouvertures dans le corps (12) disposées en direction des bords latéraux (28, 30).

13. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle il y a une ou plusieurs autres parties ondulées et de direction des bords latéraux (28, 30).

14. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle le passage (34) est situé sensiblement au centre du corps (12).

15. Tête de nettoyage par aspiration (10, 110) selon l’une quelconque des revendications précédentes, dans laquelle le passage (34) est situé sensiblement au centre du corps (12).
REFERENCES CITED IN THE DESCRIPTION

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