

Description

This invention relates generally to vacuum cleaning appliances and more particularly, but not exclusively, to portable electrically operated vacuum appliances intended for domestic use.

Vacuum cleaning appliances of this kind include an electrically driven fan whereby dust, grit and other dirt ingrained in a carpet is removed by suction, the dirt being deposited in a removable container such as a bag.

An upright-type cleaner of the above kind comprising a housing for the fan unit, the housing having a carpet engaging section which may incorporate rotatable brushes. The machine is usually manipulated by a rigid handle pivotally mounted on the casing of the appliance.

A cylinder type machine of the above kind usually comprises a main casing containing a fan unit and having an inlet opening for receiving a flexible hose to which suitable fittings may be attached.

An object of the present invention is to provide a vacuum cleaning appliance which incorporates the advantages of both types of machines and which is so constructed that the machine may be easily and quickly converted from one type to the other as desired. The cleaning appliance of the invention may therefore be used as an upright type machine movable over a carpet to be cleaned by means of its handle which in the preferred embodiments of the invention consists of a rigid tubular pipe member mounted within a flexible hose connected to the casing of the cleaner.

In US-A-1217817 a vacuum cleaning appliance is disclosed which comprises a main casing having an air passageway therein containing a motor driven suction fan unit, and a floor engaging section containing a first inlet for dust laden air and communicating with said passageway, said appliance having a second inlet for dust laden air communicating with said passageway and comprising a socket for detachably receiving a hollow pipe connected with said socket by a flexible tube section. The pipe member, when located in said socket, forms a handle for the appliance, and a valve device is operable to connect the passageway selectively with one or other of the air inlets for converting the appliance from upright to cylinder mode of operation and *vice versa*. In this known arrangement, the valve device is operable manually.

According to one aspect of the present invention, however, there is provided a vacuum cleaning appliance comprising a main casing (10, 11) having an air passageway (48, 51) therein containing a motor-driven suction fan unit (64, 65), and a floor engaging section (17) containing a first inlet for dust laden air and communicating with said passageway, a second inlet (18) for dust laden air communicating with said passageway and comprising a socket 82 for detachably receiving a hollow pipe member (19) connected with said socket (82) by a flexible hose section (21), said

pipe member when located in said socket (82) forming a handle for the appliance, and a valve device (85) operable to connect said passageway (48) selectively with one or other of said air inlets for converting the appliance from upright to cylinder mode of operation and *vice versa*, characterised in that the valve device (85) is operable automatically by the insertion and removal of the hollow pipe member (19) into and from the socket (82) of the second air inlet, said valve device (85) comprising a valve member (87) which is pivotally mounted in the entrance (84) of the socket (82) with the air passageway (48), said valve member (87) being spring urged (89) normally into a position closing that part of said passageway (48) communicating with said first air inlet (46) in said floor engaging section (17), and said valve member (87) being engageable by said hollow pipe member (19) when said pipe member is inserted in said socket (82) whereby said valve member is pivoted thereby to close the entrance (84) of said socket (82) with said air passageway (48).

A further related object of the invention is to improve the separation of the dust, grit and other dirt from the air flow by the use in the appliance of an improved cyclone assembly.

In US-A-2171248 a vacuum cleaning appliance is disclosed which, according to one embodiment, comprises a cleaner head, a main casing connected to the cleaner head by an inlet passageway and a motor casing which contains a motor driven fan unit and is connected with the main casing so that the fan unit is operable to draw dust and other dirt laden air from the cleaner head and through the inlet passageway into the main casing. The main casing contains two cyclone units located in series in the air passageway through the main casing. The cyclone units are frusto-conical in shape and are positioned with the lower and smaller ends open for the removal of extracted dirt which is deposited in a removable chamber located externally of the cyclones in the main casing.

According to a second aspect of the invention, however, there is provided a vacuum cleaning appliance comprising a first cleaner head (27) for engaging a surface to be cleaned, a first casing (11) connected at its lower end to the first cleaner head (17) and containing a motor driven fan unit (64, 65), a second upper casing (10) attached at its lower end to the upper end of said first casing (11) and containing a cyclone assembly for extracting dust and other dirt from an airflow therethrough, an inlet passageway (48) connecting said first cleaner head (17) with the said cyclone assembly in said second casing (10), said motor driven fan unit (64, 65) being operable to draw dust and other dirt laden air through the inlet passageway (48) and into the said cyclone assembly in said second casing (10), and said cyclone assembly comprising a pair of cyclones (22, 23) each of frusto-conical shape and mounted in series in said second casing (10); said appliance being characterised in that it is convertible alternately

into an upright type cleaning appliance and into a cylinder type cleaning appliance, said appliance in its cylinder mode of operation having a second cleaner head comprising a hollow pipe (19) which provides a handle (20) for manoeuvring the appliance in its upright mode of operation, said hollow pipe (19) being mounted in a socket (18) forming an extension of said first lower casing (11), said socket (18) being selectively connectible with said inlet passageway (48) for connecting said second cleaner head with the cyclones (22, 23) in said second upper casing (10), said cyclones (22, 23) being mounted side-by-side in said second casing (10) with each cyclone open at its upper and smaller end, said casing (10) surrounding said cyclones (22, 23) and being spaced therefrom to provide a chamber (32) between the outer surface of each of said cyclones (22, 23) and said outer casing (10) for receiving dirt discharged from the air flow through said cyclones (22, 23) and over the edge of the upper smaller end of each cyclone, and said appliance being provided with means for detaching said second upper casing (10) and said cyclones (22, 23) as a unit from said first lower casing (11) and for separating said second casing (10) from said cyclones (22, 23) after detaching from said first casing (11) for the removal of dirt from said chamber (32).

The features of the invention will now be described by way of example with reference to the accompanying drawings which illustrate a cyclone type vacuum cleaning appliance. In the accompanying drawings:—

Figure 1 is a side elevation of a vacuum cleaning appliance incorporating the features of the invention;

Figure 2 is a section on the line 2—2 of Figure 1 showing details of the handle construction;

Figure 3A is a section through the upper part of the vacuum cleaning appliance taken on the line 3A—3A in Figure 1;

Figure 3B is a section through the lower part of the vacuum cleaning appliance taken on the line 3B—3B in Figure 1;

Figure 4 is a horizontal section through the casing of the vacuum cleaning appliance taken on the line 4—4 in Figure 3A and showing the direction of air flow through the appliance;

Figure 5 is a section taken on the line 5—5 in Figure 4 and showing the valve device controlled by the handle of the appliance for converting it from its upright mode of operation to its cylinder mode of operation and *vice versa*;

Figure 6 is a part sectional view similar to Figure 5 showing the valve device and tubular handle positioned for upright mode of operation of the appliance;

Figure 7 is a similar part section showing the valve device positioned for cylinder mode of operation of the appliance;

Figure 8 is a section on the line 8—8 in Figure 3 showing the carpet engaging section or cleaner head of the appliance;

Figure 9 is a part section on the line 9—9 in Figure 3B showing the ratchet and pawl arrange-

ment for rotating the carpet engaging brushes; and

Figure 10 is a part section similar to Figure 9 but showing the operation of the ratchet and pawl during a reverse movement of the appliance over a carpet.

Referring now to Figure 1 of the drawings, the vacuum cleaning appliance of the invention is shown in its upright mode of operation and it comprises a main casing 10 which is detachably fitted to the top of the casing 11 containing the electric motor and fan unit. The main casing 10 is provided with a rigid U-shaped carrying handle 12 which is connected at its ends to the opposite side portions 13 and 14 of the main casing. The motor casing 11 is fitted at opposite sides with a pair of supporting wheels 15 (see Figure 3B) for the appliance and the casing also includes an on-off push switch 16 for controlling the operation of the electric motor.

A lower cleaner head 7 for engaging a carpet to be cleaned is pivotally mounted on the motor casing 11 so that during use of the appliance the main casing may be pivoted relatively to the cleaner head 7 to allow the passage of the appliance under low furniture such as a bed.

The motor casing 11 is provided with an extension 18 which forms a rigid socket for slidably receiving the lower end of a tubular pipe or wand 19. The pipe 19 at its upper end is fitted with a hand grip 20 and forms a handle for manoeuvring the appliance. The pipe 19 slidably fits within a stretch, retractable flexible hose 21 which is secured at its lower end around the upper open end of the extension 18 of the casing. The arrangement is such that the pipe 19 when fitted in the socket of the extension 18 enables the handle to be used for manoeuvring the appliance as an upright type machine. When the pipe 19 is slidably removed from the socket in the extension 18 the pipe 19 is then used as a cleaner head at the end of the flexible hose 21 thus converting the appliance into a cylinder type machine. The fitting of the pipe 19 in hose 21 and the conversion of the appliance from one mode of operation to the other and *vice versa* will be described hereinafter in greater detail.

Figures 3A and 3B of the drawings when taken in conjunction provide a section through the combined casing, 10 11 and 17 of the appliance.

Referring to Figure 3A this drawing is a section through the main casing 10 which provides a housing for the main cleaner unit which in the preferred embodiment consists of a pair of cyclones 22 and 23 which are located in series in the air flow through the appliance and which operate to remove by centrifugal action the dust and other dirt engrained in the air as will be in hereinafter explained.

The cyclones 22, 23 are located respectively in the communicating portions 13, 14 of the casing 10 and are substantially frusto-conical in shape being open at the upper smaller ends for the discharge of the engrained dust and other dirt. The cyclones 22, 23 at their lower larger ends are

interconnected centrally of the casing so as to provide an intercommunicating passageway 24 (see Figure 4) for the air flow through the appliance. The passageway 24 is bounded by an upper wall 25 between the cyclones and which have a sleeve 26 extending upwardly therefrom providing a support for a hollow control shaft 27. The hollow control shaft 27 is supported at its upper end by a further sleeve 28 which extends downwardly centrally of the junction of the portions 13, 14 or the casing 10. The shaft extends through the sleeve 28 externally of the casing 10 and is provided with a manually operable control knob 29 by which the shaft is movable both slidably and rotatably within the casing 10. The shaft 27 is slidably movable by the knob 29 into a lower position as shown in Figure 3A in which its lower threaded end 30 is in threaded engagement with an upstanding threaded sleeve 31 formed on the upper surface of the motor casing 11. When so engaged by the control knob 29 the casing 10 is held firmly in position on the motor casing 11.

The cyclones 22, 23 are spaced from the casing 10 to form therebetween and externally of the cyclones a dirt receiving chamber 32. The dust and other dirt removed from the air flow by the first cyclone 22 is discharged over the upper edge of the cyclone and falls into the chamber 32 on to the lower floor of the chamber which is provided by a flange 33 extending outwardly of the cyclones. The flange 33 has a downwardly extending skirt portion 34 which seats snugly within the outer rim portion 35 of the main casing 10 so as to seal the chamber 32, the skirt portion 34 and the rim 35 also engaging a sealing ring 36 carried by the motor casing 11.

The cyclone 23 is located downstream of the cyclone 22 and provides a fine or secondary cleaning unit. The cyclone 23 is isolated from the cyclone 22 by forming an independent dust receiving chamber 36 by means of a tubular extension 37 which projects downwardly from the upper end of the portion 14 or the casing 10 so that its lower edge 38 slidably and snugly engages the outer surface of the conical cyclone 23 in its operative position as shown in Figure 3A.

The control knob 29 is rotatable to unscrew the threaded end 30 of the shaft 27 from the threaded sleeve 31 on the motor casing 11. This enables the main casing 10 to be removed from the appliance by means of the U-shaped carrying handle 12. The knob 29 is then operable to move the shaft 27 slidably upwards to engage the threaded end 30 with a threaded portion 40 formed on the sleeve 26. When threadably engaged by rotation of knob 29 a downward force then exerted on the knob 29 and thereby the hollow shaft 27, is operable to separate the cyclones 22, 23 from the casing 10 thus opening the chambers 32 and 36 for the disposal of the extracted dust and dirt.

The casing 10 and the cyclones 22, 23 are reconnected by unscrewing the end of the shaft 27 from the sleeve 40 by rotation of knob 29, and then depressing the knob 29 to engage the screwed end 30 of the shaft 27 with the threaded portion of

the upstanding sleeve 31. Rotation of the knob 29 then threadably engages the shaft and this draws the casing 10 into tight engagement with the flange 34 of the cyclones 22, 23 and also positions the assembly firmly on the motor casing 11.

The carrying handle 12 is retained in position on the domed ends of the portions 13, 14 of the casing 10 by connecting bolts, 41, 42. The connecting bolt 42 on the portion 14 of the casing is elongated to support also an additional inverted cone member 43 located in the mouth of the cyclone 23. The member 43 is intended to assist in the final extraction of the dust and dirt from the air flow during the centrifugal movement of the air in the cyclone and as shown this may also be assisted by inclining the outer edge 44 of the cyclone. The arrangement shown, however, is given by way of example only and other designs and arrangements may be used for the cyclone 23 the function of which is primarily the removal of any fine dust or dirt which may have been retained in the air flow after passage through the first cyclone 22.

The air flow enters the casing 10 containing the cyclones through a flexible 45 which is attached to a short rigid pipe 46 opening into the casing 47 of the lower cleaner head 17. The hose 45 at its upper end is attached to a short rigid pipe 48 which extends through a horizontal plate 49, which plate is attached to and forms the top plate of the motor casing 11. The pipe 48 connects with a curved entry pipe 49' so as to direct the air flow as shown by the arrows into the base of the cyclone 22 in a tangential manner (see also Figures 4 and 5), the air then spiralling up the inner surface of the curved wall of the cyclone to deposit engrained dust and dirt by centrifugal action over the top edge of the cyclone.

The air flow then passes centrally down the cyclone into a pipe 50 formed in the top plate 49 and then enters the transverse passageway 24 in which sleeve 31 is located (see Figure 4). The air flow then enters the lower part of the cyclone 23 also in a tangential manner (see Figure 4) and is again processed in the cyclone so as to remove any further remaining fine dust and dirt.

The air flow then passes centrally down the cyclone 23 to enter a pipe 51 upstanding from the plate 49. The air flow exits from the pipe 51 into the fan and motor chamber 52 of the casing 11, and is then discharged through an aperture 53 into the cleaner head casing 47 from which it discharges into the carpet through an elongated slot 54 (see Figure 8) formed in the casing. In an alternative construction the air flow may discharge directly into the atmosphere from a side slot in the casing.

The plate 49 forming the top plate of the motor casing 11 has an outer peripheral flange 55 which seats in the lip 56 of a housing 57 providing the lower part of the casing 11. The plate 49 is attached to the housing 57 by connecting bolt 58 and nut 59, the bolt extending through a chamber 60 which communicates with the inlet pipe 48 by means of an aperture 61 (see Figure 3B). The

chamber 60 also communicates with sleeve 31 and thereby the interior of the hollow shaft 27. The upper end of the hollow shaft 27 is closed by a plug 62 which is rotatably mounted in the control knob 29. The plug 62 has a skirt portion 63 of varying depth and which is constructed so that as the plug 62 rotates it progressively opens the end of the hollow shaft 27 to atmosphere. In this way the use of the appliance may progressively vent the inlet passageway of the appliance to atmosphere and so vary at will the degree of suction exerted on the carpet being cleaned. This control of the appliance is available whether the appliance is operating in its upright or cylinder mode of operation.

The casing 11 consisting of the top plate 49 and the housing 57 to which it is connected provides firstly the chamber 52 for the motor 64 and the fan 65, and secondly a chamber 66 in which is mounted a spring loaded reel 67 for the electric supply cable 68 of the appliance.

The lower cleaner head casing 47 is elongated in shape and extends across the width of the appliance having a pair of spaced upstanding arms 69 and 70 which are pivotally attached to the casing 11 by means of pivot pin 71 located within slots in the bottom housing 57. The casing 47 is provided with the exit pipe 46 previously mentioned and also formed with a chamber 72 provided by walls 73 upstanding from the casing 47 and which slidably engage the lower wall of the housing 57 around the aperture 53.

The cleaner head casing 47 furthermore has a longitudinal open-sided slot 74 in which is located a rotatable brush unit 75. The brush unit comprises opposite sets of bristles and is mounted on a longitudinal shaft 76 pivotally mounted in the end walls 77 of the casing. The shaft 76 also supports the plates 78 which are toothed and one of which comprises a ratchet which is engaged by a pawl 79 during one direction of rotation of the brush unit.

During forward movement of the appliance as shown in Figure 9 the brush unit 75 rotates freely while in contact with the carpet, but during reverse movement as shown in Figure 10 the pawl 79 engages a ratchet tooth 80 on the corresponding plate 78 so as to prevent reverse movement of the brush unit 75 and which thereby provides a brushing effect to the carpet. During rotation of the brush unit 75 during a forward movement of the appliance, the opposite sets of bristles preferably pass between spaced plates 81 (see particularly Figure 3) so as to remove therefrom any accumulated fluff and other dirt which is then sucked into the appliance through the pipe 46.

As previously mentioned the vacuum cleaning appliance of the invention as shown in the drawings is primarily intended for operation as an upright type cleaner, the appliance being manoeuvred by the handle 20 on the end of the tubular pipe 19 which fits the socket in the extension 18 of the motor casing 11.

The invention however provides that the ap-

pliance may be quickly and simply converted for operation as a cylinder type cleaner and *vice versa*, merely by the removal and insertion of the tubular pipe or wand 19 in the socket of the casing extension 18.

The constructional features which enable this change over are shown more clearly in Figures 5 to 7, of the drawings.

Figure 5 shows the pipe or wand 19 inserted in the extension 18 which provides an open socket 82 for slidably receiving the lower end of the pipe. The socket 82 provides an end seat 83 for the end of the pipe 19, but in its operating mode as an upright cleaner as shown in Figure 5 the end of the pipe is held spaced from the seat 83 by a valve device shown generally by the reference 85.

The valve device 85 controls an aperture 84 in the side wall of the socket 82 which communicates the socket with the inlet pipe 48 of the appliance.

The valve device is pivotally mounted at 86 on the casing and it comprises a valve member 87 normally closing the aperture 84. At the other side of the pivot point 86 the valve device has an open sided housing 88 in which is mounted a compression spring 89 normally urging the valve device in an anticlockwise direction to open the aperture 84. A switch member 90 is also mounted pivotally on the valve device and is movable relatively thereto. The switch member 90 is formed with a bore which contains a compression spring 94 acting against a slidable plunger 93.

When the appliance is in its upright mode of operation the pipe 19 is located as shown in Figure 5 with the corner edge 91 of the switch member 90 engaging a groove 92 in the pipe 19. In this position the valve member 87 has closed the aperture 84 and the plunger 93 has engaged a part of the pivot 86 which is on that side of the pivot line adjacent the housing 88. In this position the switch member 90 is locked into position so that anticlockwise movement of the switch member and valve device is prevented and this retains the pipe 19 firmly in position to act as a handle to manoeuvre the appliance.

In order to convert the appliance to a cylinder type cleaner the pipe 19 is firstly pushed downwardly in the socket 82 into the seat 83 as shown in Figure 6 of the drawings. As the pipe 19 moves downwardly the switch member pivots clockwise relatively to the valve device and this re-engages the plunger 93 on the opposite side of the line from the pivot 86. The plunger 93 now holds the switch member 90 in the position shown in Figure 6 which allows for unrestricted removal of the pipe 19 upwardly from the socket 82.

As the pipe 19 moves upwardly the valve device 85 pivots anti-clockwise under the action of its spring 89 to the position shown in Figure 7. In this position the valve member 87 engages the top edge of the wall of the pipe 48 to allow the plunger to re-engage the opposite side of the line from the pivot point 86 which thus allows anti-clockwise pivotal movement of the switch member 90 relative to the valve device. This sets

the switch member for subsequent engagement with the pipe 19 when the pipe is reinserted in the socket 82 for conversion to the upright mode of operation of the appliance.

In this cylinder mode of operation as shown in Figure 7 the pipe 19 is now connected through the aperture 84 directly with the passageway entering the cleaner unit. The valve member 87 now closes the inlet connection to the cleaner head and by slidably moving the pipe 19 to the end of the surrounding flexible hose 21 the open end of the pipe handle 20 can be used as a cleaner head and may be fitted with various attachments in the conventional manner. The pipe 19 is retained in a sealing tight manner in the outer end of the hose 21 by a cuff 95 which permits sliding of the pipe 19 and the locking therein of the end of the pipe by means of the groove 92.

Referring now to Figure 2 of the drawings the pipe or wand 19 is slidably mounted in hose 21 and at its inner or lower end it is fitted with a fixed sleeve 96. The hose 21 is connected at its lower end to the socket 82 by a cuff 97, the hose having a PVC sleeve 98 bonded to the cuff. The upper end of the hose includes a further PVC sleeve 99 bonded to the cuff 95 which includes a felt or similar seal 100 in sliding contact with pipe 19. In Figure 2 pipe 19 is shown in the inserted or upright mode of operation of the appliance. In the conversion of the appliance to its cylinder mode pipe 19 slides relative to cuff 95 until the upper edge 101 of sleeve 96 engages surface 102 of upper cuff 95. The arrangement prevents the removal of pipe 19 from hose 21 but the bevelled edge 101 enables the hose to be removed if required by force. The arrangement as described is of course applicable to any conventional cylinder type appliance for locating the wand when not in use.

In order to re-convert the appliance for upright mode of operation the pipe 19 is merely reinserted slidably within the short upright tubular casing 82. The manoeuvre is generally facilitated by closing the open end of the pipe handle 20 while the fan is operating, the resulting suction action to straighten the hose 21 which enables the pipe 19 to be slidably moved therein without difficulty.

A particular advantage of the vacuum cleaning appliance of the invention is that no dust bags are required, the dirt being discharged from the appliance by separating the cyclones from the main casing. The use of a cyclone ensures that the dust discharging from the appliance is substantially dust-free and a particular advantage of the use of a cyclone is that during use the dust laden air does not pass through the previously extracted dirt thus avoiding the possible discharge of smells from the removed dirt. Filters are therefore avoided and the use of a cyclone permits the entry into the appliance of articles which would normally cause damage, such as glass and water. The discharge of the dust-free air into the cleaner head helps to dislodge engrained dirt during cleaning and is more efficient than rotating

brushes as the air penetrates more deeply into the pile of the carpet and so dislodges dirt and grit which is firmly engrained in the pile. Furthermore, the discharge of the dust-free air as jets into the carpet effectively muffles the fan which greatly reduces the noise during cleaning.

The present application as originally filed included a reference to European Patent Application Number 80301204.6 (Publication Number 0018197). Matter from the latter application has been incorporated expressis verbis in the present application.

Claims

1. A vacuum cleaning appliance comprising a main casing (10, 11) having an air passageway (48, 51) therein containing a motor-driven suction fan unit (64, 65), and a floor engaging section (17) containing a first inlet for dust laden air and communicating with said passageway, a second inlet (18) for dust laden air communicating with said passageway and comprising a socket (82) for detachably receiving a hollow pipe member (19) connected with said socket (82) by a flexible hose section (21), said pipe member when located in said socket (82) forming a handle for the appliance, and a valve device (85) operable to connect said passageway (48) selectively with one or other of said air inlets for converting the appliance from upright to cylinder mode of operation and *vice versa*, characterised in that the valve device (85) is operable automatically by the insertion and removal of the hollow pipe member (19) into and from the socket (82) of the second air inlet, said valve device (85) comprising a valve member (87) which is pivotally mounted in the entrance (84) of the socket (82) with the air passageway (48), said valve member (87) being spring-urged (89) normally into a position closing that part of said passageway (48) communicating with said first air inlet (46) in said floor engaging section (17), and said valve member (87) being engageable by said hollow pipe member (19) when said pipe member is inserted in said socket (82) whereby said valve member is pivoted thereby to close the entrance (84) of said socket (82) with said air passageway (48).

2. A vacuum cleaning appliance comprising a first cleaner head (17) for engaging a surface to be cleaned, a first casing (11) connected at its lower end to the first cleaner head (17) and containing a motor driven fan unit (64, 65), a second upper casing (10) attached at its lower end to the upper end of said first casing (11) and containing a cyclone assembly for extracting dust and other dirt from an airflow therethrough, an inlet passageway (48) connecting said first cleaner head (17) with the said cyclone assembly in said second casing (10), said motor driven fan unit (64, 65) being operable to draw dust and other dirt laden air through the inlet passageway (48) and into the said cyclone assembly in said second casing (10), and said cyclone assembly comprising a pair of cyclones (22, 23) each of frusto-

the switch member for subsequent engagement with the pipe 19 when the pipe is reinserted in the socket 82 for conversion to the upright mode of operation of the appliance.

In this cylinder mode of operation as shown in Figure 7 the pipe 19 is now connected through the aperture 84 directly with the passageway entering the cleaner unit. The valve member 87 now closes the inlet connection to the cleaner head and by slidably moving the pipe 19 to the end of the surrounding flexible hose 21 the open end of the pipe handle 20 can be used as a cleaner head and may be fitted with various attachments in the conventional manner. The pipe 19 is retained in a sealing tight manner in the outer end of the hose 21 by a cuff 95 which permits sliding of the pipe 19 and the locking therein of the end of the pipe by means of the groove 92.

Referring now to Figure 2 of the drawings the pipe or wand 19 is slidably mounted in hose 21 and at its inner or lower end it is fitted with a fixed sleeve 96. The hose 21 is connected at its lower end to the socket 82 by a cuff 97, the hose having a PVC sleeve 98 bonded to the cuff. The upper end of the hose includes a further PVC sleeve 99 bonded to the cuff 95 which includes a felt or similar seal 100 in sliding contact with pipe 19. In Figure 2 pipe 19 is shown in the inserted or upright mode of operation of the appliance. In the conversion of the appliance to its cylinder mode pipe 19 slides relative to cuff 95 until the upper edge 101 of sleeve 96 engages surface 102 of upper cuff 95. The arrangement prevents the removal of pipe 19 from hose 21 but the bevelled edge 101 enables the hose to be removed if required by force. The arrangement as described is of course applicable to any conventional cylinder type appliance for locating the wand when not in use.

In order to re-convert the appliance for upright mode of operation the pipe 19 is merely reinserted slidably within the short upright tubular casing 82. The manoeuvre is generally facilitated by closing the open end of the pipe handle 20 while the fan is operating, the resulting suction action to straighten the hose 21 which enables the pipe 19 to be slidably moved therein without difficulty.

A particular advantage of the vacuum cleaning appliance of the invention is that no dust bags are required, the dirt being discharged from the appliance by separating the cyclones from the main casing. The use of a cyclone ensures that the dust discharging from the appliance is substantially dust-free and a particular advantage of the use of a cyclone is that during use the dust laden air does not pass through the previously extracted dirt thus avoiding the possible discharge of smells from the removed dirt. Filters are therefore avoided and the use of a cyclone permits the entry into the appliance of articles which would normally cause damage, such as glass and water. The discharge of the dust-free air into the cleaner head helps to dislodge engrained dirt during cleaning and is more efficient than rotating

brushes as the air penetrates more deeply into the pile of the carpet and so dislodges dirt and grit which is firmly engrained in the pile. Furthermore, the discharge of the dust-free air as jets into the carpet effectively muffles the fan which greatly reduces the noise during cleaning.

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2. A vacuum cleaning appliance comprising a first cleaner head (17) for engaging a surface to be cleaned, a first casing (11) connected at its lower end to the first cleaner head (17) and containing a motor driven fan unit (64, 65), a second upper casing (10) attached at its lower end to the upper end of said first casing (11) and containing a cyclone assembly for extracting dust and other dirt from an airflow therethrough, an inlet passageway (48) connecting said first cleaner head (17) with the said cyclone assembly in said second casing (10), said motor driven fan unit (64, 65) being operable to draw dust and other dirt laden air through the inlet passageway (48) and into the said cyclone assembly in said second casing (10), and said cyclone assembly comprising a pair of cyclones (22, 23) each of frusto-



(15)

conical shape and mounted in series in said second casing (10);

said appliance being characterised in that it is convertible alternately into an upright type cleaning appliance and into a cylinder type cleaning appliance, said appliance in its cylinder mode of operation having a second cleaner head comprising a hollow pipe (19) which provides a handle (20) for manoeuvring the appliance in its upright mode of operation, said hollow pipe (19) being mounted in a socket (18) forming an extension of said first lower casing (11), said socket (18) being selectively connectible with said inlet passageway (48) for connecting said second cleaner head with the cyclones (22, 23) in said second upper casing (10), said cyclones (22, 23) being mounted side-by-side in said second casing (10) with each cyclone open at its upper and smaller end, said casing (10) surrounding said cyclones (22, 23) and being spaced therefrom to provide a chamber (32) between the outer surface of each of said cyclones (22, 23) and said outer casing (10) for receiving dirt discharged from the air flow through said cyclones (22, 23) and over the edge of the upper smaller end of each cyclone, and said appliance being provided with means for detaching said second upper casing (10) and said cyclones (22, 23) as a unit from said first lower casing (11) and for separating said second casing (10) from said cyclones (22, 23) after detaching from said first casing (11) for the removal of dirt from said chamber (32).

3. A vacuum cleaning appliance as claimed in claim 2, characterised in that said second upper casing (10) is connected to the first lower casing (11) by a control rod (27) operable externally of the second casing (10) for detaching said second casing (10) and said cyclones (22, 23) from said first casing (11) and for subsequently separating said second casing (10) from the cyclones (22, 23).

4. A vacuum cleaning appliance as claimed in claim 3, characterised in that said control rod (27) comprises a hollow shaft and communicates with the inlet passageway (48) when attached to the first lower casing (11), and said control rod (27) having a knob (62) operable to vent said passageway (48) to atmosphere through said hollow shaft.

5. A vacuum cleaning appliance as claimed in any one of the preceding claims 2 to 4, characterised in that said rigid hollow pipe (19) comprising said second cleaner head is detachably mounted in said socket (18) and is slidably mounted in a flexible hose (21) connected to said lower casing (11).

6. A vacuum cleaning appliance as claimed in claim 5, characterised in that said rigid pipe (19) is slidable relatively to said flexible hose (21) to engage a valve device (85) in said socket (18) controlling said inlet passageway (48), said valve device (85) normally closing the inlet connection with said first cleaner head (17) so as to connect the inlet passageway (48) with said hollow pipe (19).

7. A vacuum cleaning appliance as claimed in

Claim 1, characterised in that the valve member (87) includes a catch device (90) for fixedly engaging said hollow pipe member (19) when inserted in said socket (82) so as to enable said pipe member (19) to act as a handle for the appliance.

8. A vacuum cleaning appliance as claimed in Claim 7, characterised in that said catch device (90) is pivotally mounted in said valve member (87) and is adapted to hold said hollow pipe member (19) with the end of said pipe spaced from the end of said socket (82), and said catch device (90) is releasable by downward movement of said pipe member (19) in said socket (82) to pivot said catch device (90) relative to said valve member (87).

9. A vacuum cleaning appliance as claimed in Claim 1, characterised in that said hollow pipe member (19) is telescopically mounted within the flexible hose (21) section and fits therein when its lower end is located in said socket (82), the upper open end of said hollow pipe member (19) protruding from said hose section and forming a handle (20) for said appliance.

10. A vacuum cleaning appliance as claimed in Claim 1, characterised in that the cleaner head of the floor engaging section (17) includes a rotating brush unit (76) which includes a pawl device (79) preventing rotation of the brush unit during one direction of movement of the appliance.

11. A vacuum cleaning appliance as claimed in Claim 10, characterised in that the bristles (75) of the brush unit (76) pass between spaced plates during rotation so as to remove accumulated dirt.

Patentansprüche

1. Saugreinigungsvorrichtung (Staubsauger), umfassend ein Hauptgehäuse (10, 11) mit einem Luftdurchgang (48, 51), in welchem eine motorgetriebene Sauggebläseeinheit (64, 65) angeordnet ist, und einen Bodenaufлагeteil (17) mit einem ersten, mit dem Durchgang kommunizierenden Einlaß für staubbeladene Luft, einem zweiten, mit dem Durchgang kommunizierenden Einlaß (18) für staubbeladene Luft mit einem Steck-Anschluß(Fassung) (82) zur lösbaren Aufnahme eines hohlen Rohrelements (19), das mit dem Anschluß (82) über einen flexiblen Schlauchabschnitt (21) verbunden ist und das, wenn es in die Aufnahme (82) eingesetzt ist, einen Handgriff für die Vorrichtung bildet, sowie eine Ventileinrichtung (85), die betätigbar ist, um den Durchgang (48) selektiv mit dem einen oder dem anderen Lufteinlaß zu verbinden und damit die Vorrichtung von aufrechter Betriebsart auf Trommelstaubsauger-Betriebsart und umgekehrt umzustellen, dadurch gekennzeichnet, daß die Ventileinrichtung (85) durch Einsetzen und Herausnehmen des hohlen Rohrelements (19) in den bzw. aus dem Anschluß (82) des zweiten Lufteinlasses automatisch betätigbar ist, die Ventileinrichtung (85) ein Ventilielid (87) aufweist, das schwenkbar im Einlauf (84) der Aufnahme (82) zum Luftdurchgang (48) gelagert ist, das Ventilielid (87) durch eine Feder (89) normalerweise in



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eine Stellung vorbelastet ist, in welcher es den mit dem ersten Lufteinlaß (46) im Bodenaufgabeteil (17) kommunizierenden Teil des Durchgangs (48) verschließt, und das Ventilglied (87) vom hohlen Rohrelement (19) erfaßbar bzw. beaufschlagbar ist, wenn dieses Rohrelement in die Aufnahme (82) eingesetzt wird, wobei das Ventilglied verschwenkt wird und dabei den Einlauf (84) zum Luftdurchgang (48) verschließt.

2. Saugreinigungsvorrichtung (Staubsauger) mit einem ersten, mit einer zu reinigenden Fläche in Berührung bringbaren Reinigerkopf (17), einem an seinem unteren Ende mit dem ersten Reinigerkopf (17) verbundenen und eine motorgetriebene Gebläseeinheit (64, 65) enthaltenden ersten Gehäuse (11), einem an seinem unteren Ende mit dem oberen Ende des ersten Gehäuses (11) verbundenen und eine Zyklon(enscheider)anordnung zum Extrahieren von Staub und anderen Verunreinigungen aus einem hindurchströmenden Luftstrom enthaltenden zweiten oberen Gehäuse (10) sowie einem den ersten Reinigerkopf (17) mit der Zyklonanordnung im zweiten Gehäuse (10) verbindenden Einlaßdurchgang (48), wobei die motorgetriebene Gebläseeinheit (64, 65) mit Staub und anderen Verunreinigungen beladene Luft durch den Einlaßdurchgang (48) und in die Zyklonanordnung im zweiten Gehäuse (10) zu saugen vermag und wobei die Zyklonanordnung zwei jeweils kegelstumpfförmige Zyklonenscheider (22, 23) aufweist, die in Reihe miteinander in das zweite Gehäuse (10) eingebaut sind, dadurch gekennzeichnet, daß die Vorrichtung wahlweise zu einem aufrecht stehenden (führbaren Reinigungsgerät und einem Trommeltyp-Reinigungsgerät umrüstbar ist, die Vorrichtung in ihrer Trommel-Betriebsart eine zweiten Reinigerkopf mit einem hohlen Rohr (19) aufweist, der einen Handgriff (20) zum Manövrieren der Vorrichtung in ihrer aufrechten Betriebsart bildet, das hohle Rohr (19) in einer Verlängerung des ersten unteren Gehäuses (11) bildend Steck-Aufnahme (oder Fassung) (18) montiert ist, die Aufnahme (18) selektiv mit dem Einlaßdurchgang (48) zum Verbinden des zweiten Reinigerkopfes mit den Zyklonenscheidern (22, 23) im zweiten oberen Gehäuse (10) verbindbar ist, die Zyklonenscheider (22, 23) im zweiten Gehäuse (10) nebeneinander angeordnet und jeweils an ihrem oberen, schmäleren Ende offen sind, das Gehäuse (10) die Zyklonenscheider (22, 23) mit einem Abstand zu ihnen umschließt, um zwischen der Außenfläche jedes Zyklonenscheiders (22, 23) und dem äußeren Gehäuse (10) eine Kammer (32) zur Aufnahme von Verunreinigungen (des Saugguts) festzulegen, die (das) aus dem Luftstrom durch die Zyklonenscheider (22, 23) und über die Kante des oberen schmäleren Endes jedes Zyklonenscheiders ausgeschieden oder abgetrennt werden (wird), und die Vorrichtung mit Mitteln zum Abnehmen des zweiten oberen Gehäuses (10) und der Zyklonenscheider (22, 23) als Einheit vom ersten unteren Gehäuse (11) und zum Trennen des zweiten Gehäuses (10) von den Zyklonenscheidern (22, 23) nach dem

Abnehmen vom ersten Gehäuse (11) zwecks Entfernung der Verunreinigungen aus der Kammer (32) versehen ist.

3. Saugreinigungsvorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß das zweite obere Gehäuse (10) mit dem ersten unteren Gehäuse (11) über eine von der Außenseite des zweiten Gehäuses (10) her betätigbare Steuerstange (27) zum Lösen oder Abnehmen des zweiten Gehäuses (10) und der Zyklonenscheider (22, 23) vom ersten Gehäuse (11) und zum anschließenden Trennen des zweiten Gehäuses (10) von dem Zyklonenscheidern (22, 23) verbunden ist.

4. Saugreinigungsvorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß die Steuerstange (27) einen hohlen Schaft aufweist und mit dem Einlaßdurchgang (48) kommuniziert, wenn sie am ersten unteren Gehäuse (11) angebracht ist, und die Steuerstange (27) eine Knopf (62) aufweist, der zum Entlüften des Durchgangs (48) zur Außenluft über den hohlen Schaft betätigbar ist.

5. Saugreinigungsvorrichtung nach einem der vorangehenden Ansprüche 2 bis 4, dadurch gekennzeichnet, daß das zweite Reinigerkopf umfassende, starre hohle Rohr (19) lösbar in die Aufnahme (18) eingesetzt und verschiebbar in einem mit dem unteren Gehäuse (11) verbundenen flexiblen oder biegsamen Schlauch (21) geführt ist.

6. Saugreinigungsvorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß das starre Rohr (19) relativ zum flexiblen Schlauch (21) verschiebbar ist, um eine in der Aufnahme (18) angeordnete Ventileinrichtung (85) zum Steuern des Einlaßdurchgangs (48) zu beaufschlagen, wobei die Ventileinrichtung (85) normalerweise die Einlaßverbindung mit dem ersten Reinigerkopf (17) verschließt und damit den Einlaßdurchgang (48) mit dem hohlen Rohr (19) verbindet.

7. Saugreinigungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Ventilglied (87) eine Rast- oder Sperreinrichtung (90) zum festen Einrasten in das hohle Rohrelement (19), wenn dieses in die Aufnahme (82) eingesetzt ist, aufweist, so daß das Rohrelement (19) als Handgriff für die Vorrichtung dienen kann.

8. Saugreinigungsvorrichtung nach Anspruch 7, dadurch gekennzeichnet, daß die Rast- oder Sperreinrichtung (90) im Ventilglied (87) schwenkbar gelagert ist und das hohle Rohrelement (19) mit seinem vom Ende der Aufnahme (82) beabstandeten Ende festzuhalten vermag und die Sperreinrichtung (90) mittels einer Abwärtsverschiebung des Rohrelements (19) in der Aufnahme (82) zum Verschwenken der Sperreinrichtung (90) relativ zum Ventilglied (87) auslösbar ist.

9. Saugreinigungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das hohle Rohrelement (19) im flexiblen Schlauchabschnitt (21) teleskopartig geführt ist und darin sitzt, wenn sich sein unteres Ende in der Aufnahme (82) befindet, und das obere, offene Ende des hohlen Rohrelements (19) aus dem Schlauchabschnitt herausragt



und einen Handgriff (20) für die Vorrichtung bildet.

10. Saugreinigungsvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß der Reinigerkopf des Bodenaufsetzteils (17) eine Drehbürsteneinheit (76) aufweist, die ein Klinkeneinrichtung (79) zur Verhinderung einer Drehung der Bürsteneinheit in der einen Bewegungsrichtung der Vorrichtung enthält.

11. Saugreinigungsvorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß die Borsten (75) der Bürsteneinheit (76) während der Drehung zwischen beabstandeten Platten, um gesammelte Verunreinigungen zu entfernen oder abzustreifen, hindurchlaufen.

Revendications

1. Appareil de nettoyage par aspiration comportant un bâti principal (10, 11) incluant un conduit d'air (48, 51) contenant un bloc ventilateur de suction (64, 65) entraîné par un moteur, et un élément entrant en contact avec le sol (17) contenant une première admission pour l'air chargé de poussière et communiquant avec le conduit, un second admission (18) pour l'air chargé de poussière, laquelle communique avec le conduit et comporte un douille (82) destinée à recevoir de façon détachable un tuyau creux (19) raccordé avec cette douille (82) par un élément de tube flexible (21), lequel tuyau lorsqu'il est placé dans la douille (82), constitue un manche pour l'appareil, et un dispositif à clapet (85) que l'on peut actionner pour raccorder le conduit (48) de façon sélective avec l'une ou l'autre des admissions d'air, pour transformer l'appareil du mode de fonctionnement droit en mode en traîneau et *reciproquement*, caractérisé par la fait que le dispositif à clapet (85) peut être actionné automatiquement par l'introduction et par l'enlèvement du tuyau creux (19) dans et hors de la douille (82) de la deuxième admission d'air, ce dispositif à clapet (85) comportant un clapet (87), qui est monté pivotant à l'entrée (84) de la douille (82) dans le conduit d'air (48), ce clapet (87) étant normalement pressé par un ressort (89) vers une position qui ferme la partie du conduit (48) qui communique avec la première admission d'air (46) dans l'élément entrant en contact avec le sol (17), et ce clapet (87) pouvant être mis en prise par le tuyau creux (19), lorsque ce tuyau creux est introduit dans la douille (82), ce par quoi le clapet pivote pour fermer l'entrée (84) de la douille (82) dans le conduit d'air (48).

2. Appareil de nettoyage par aspiration comportant une première tête de nettoyage (17) destinée à entrer en action avec la surface à nettoyer, un premier bâti (11) raccordé, à son extrémité inférieure, à la première tête de nettoyage (17), et contenant un bloc ventilateur entraîné par un moteur (64, 65), un deuxième bâti supérieur (10) fixé à son extrémité inférieure à l'extrémité supérieure du premier bâti (11) et contenant un ensemble séparateur à cyclone destiné à extraire la poussière et les autres saletés d'un écoulement d'air

qui le traverse, un conduit (48) d'admission raccordant la première tête de dépoussiérage (17) avec l'ensemble séparateur à cyclone situé dans le second bâti (10), le bloc ventilateur entraîné par un moteur (64, 65) pouvant être actionné pour aspirer l'air chargé de poussière et d'autres saletés à travers le conduit d'admission (48), et pour le faire entrer dans l'ensemble séparateur à cyclone situé dans le second bâti (10), et l'ensemble séparateur à cyclone comportant une paire de séparateurs à cyclone (22, 23), chacun ayant une forme en tronc de cône, et étant monté en série dans le second bâti (10), cet appareil étant caractérisé par le fait qu'il est transformable tour à tour en un appareil de nettoyage du type droit et en un appareil de nettoyage du type traîneau, cet appareil, dans son mode de fonctionnement en traîneau, ayant une seconde tête de nettoyage comportant un tuyau (19) qui fournit un manche (20) pour manier l'appareil dans son mode de fonctionnement droit, le tuyau creux (19) étant monté dans une douille (18) qui constitue un prolongement du premier bâti inférieur (11), cette douille (18) pouvant être raccordée sélectivement avec le conduit d'admission (48) pour raccorder la seconde tête de nettoyage avec les séparateurs à cyclone (22, 23) dans le second bâti supérieur (10), les séparateurs à cyclone (22, 23) étant montés côte à côte dans ce second bâti (10), chaque séparateur à cyclone ayant son extrémité la plus petite ouverte et un haut, la bâti (10) entourant les séparateurs à cyclone (22, 23), et en étant espacés de façon à fournir une chambre (32) entre la surface extérieure de chacun de ces séparateurs à cyclone (22, 23) et le bâti extérieur (10), destinée à recevoir les saletés dégagées de l'écoulement d'air qui traverse ces séparateurs à cyclone (22, 23) et qui passe par dessus le bord de l'extrémité la plus petite et la plus haute de chaque séparateur à cyclone, et cet appareil étant muni de moyens destinés à détacher le second bâti supérieur (10) et les séparateurs à cyclone (22, 23), en un bloc, du premier bâti inférieur (11), et destinés à séparer le deuxième bâti (10) des séparateurs à cyclone (22, 23), après les avoir détachés du premier bâti (11), afin d'enlever les saletés de la chambre (32).

3. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 2, caractérisé par le fait que le second bâti supérieur (10) est raccordé au premier bâti inférieur (11) par une barre de commande (27) que l'on peut actionner de l'extérieur du deuxième bâti (10) pour détacher le second bâti (10) et les séparateurs à cyclone (22, 23) du premier bâti (11), et pour ensuite séparer le second bâti (10) des séparateurs à cyclone (22, 23).

4. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 3, caractérisé par le fait que la barre de commande (27) comporte un arbre creux et communique avec le conduit d'admission (48) lorsqu'elle est attachée au premier bâti inférieur (11), et que la barre de commande (27) a un bouton (62) que l'on peut actionner pour mettre le conduit (48) à l'air exté-



rieur au travers de l'arbre creux.

5. Appareil de nettoyage par aspiration comme revendiqué dans l'une quelconque des revendications 2 à 4, caractérisé par le fait que le tuyau creux rigide (19), comportant la seconde tête de nettoyage, est monté de façon détachable dans la douille (18) et est monté de façon coulissante dans un tube flexible (21) raccordé au bâti inférieur (11).

6. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 5, caractérisé par le fait que le tuyau rigide (19) peut coulisser par rapport au tube flexible (21) pour se mettre en prise avec un dispositif à clapet (85) situé dans la douille (18) et commandant le conduit d'admission (48), le dispositif à clapet (85) fermant normalement le raccordement d'admission avec la première tête de nettoyage (17), de façon à raccorder le conduit d'admission (48) avec le tuyau creux (19).

7. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 1, caractérisé par le fait que le clapet (87) comprend un dispositif d'encliquetage (90) pour mettre en prise de façon fixe le tuyau creux (19), lorsqu'il est introduit dans la douille (82) de façon à permettre au tuyau creux (19) de servir de manche pour l'appareil.

8. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 7, caractérisé par le fait que le dispositif d'encliquetage (90) est

monté pivotant dans le clapet (87), qu'il est adapté pour tenir le tuyau creux (19) avec l'extrémité du conduit maintenu à distance de l'extrémité de la douille (82), et que le dispositif d'encliquetage (90) peut être relâché par un mouvement, vers le bas du tuyau (19) dans la douille (82), pour faire pivoter le dispositif d'encliquetage (90) par rapport au clapet (87).

9. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 1, caractérisé par le fait que le tuyau (19) est monté de façon télescopique à l'intérieur de la partie de tube flexible (21) et y est emboîté lorsque son extrémité inférieure est placée dans la douille (82), l'extrémité ouverte supérieure du tuyau creux (19) faisant saillie hors de la partie de tuyau et constituant un manche (20) pour l'appareil.

10. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 1, caractérisé par le fait que le tête de nettoyage de la partie qui entre en contact avec le sol (17) comprend une unité de brosses tournantes (76) qui comprend un dispositif à cliquet (79) empêchant l'unité de brosses de tourner lors d'un des sens du mouvement de l'appareil.

11. Appareil de nettoyage par aspiration comme revendiqué dans la revendication 10, caractérisé par le fait que les touffes de poils (75) de l'unité de brosses (76) passent entre des plaques espacées, pendant leur rotation, de façon à enlever les saletés accumulées.

