Feb. 28, 1950 D. H. REEVES 2,499,330

VACUUM CLEANER

Filed Aug. 12, 1944 3 Sheets-Sheet 1

Fig. 1

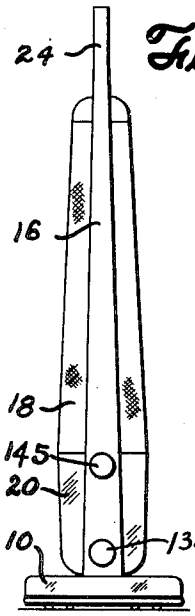
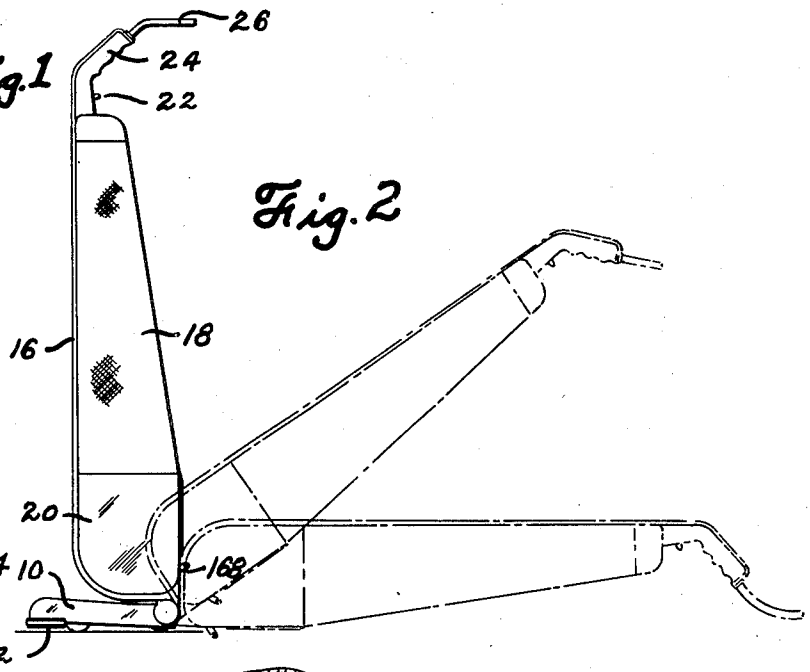


Fig. 2



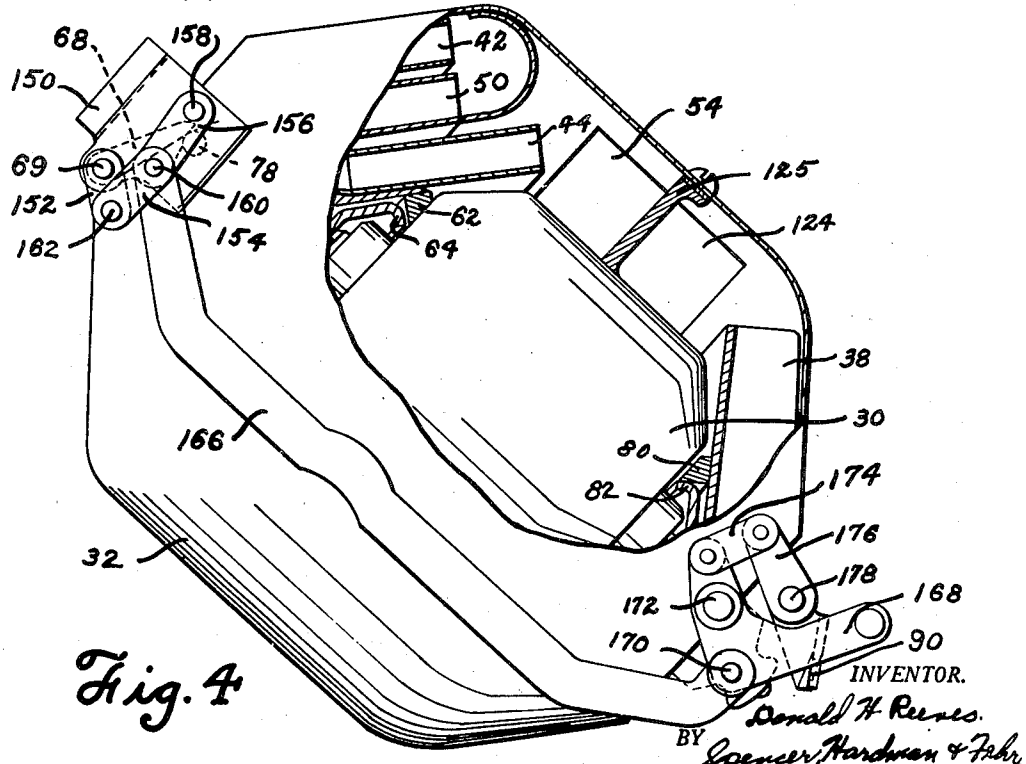


Fig. 4

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VACUUM CLEANER

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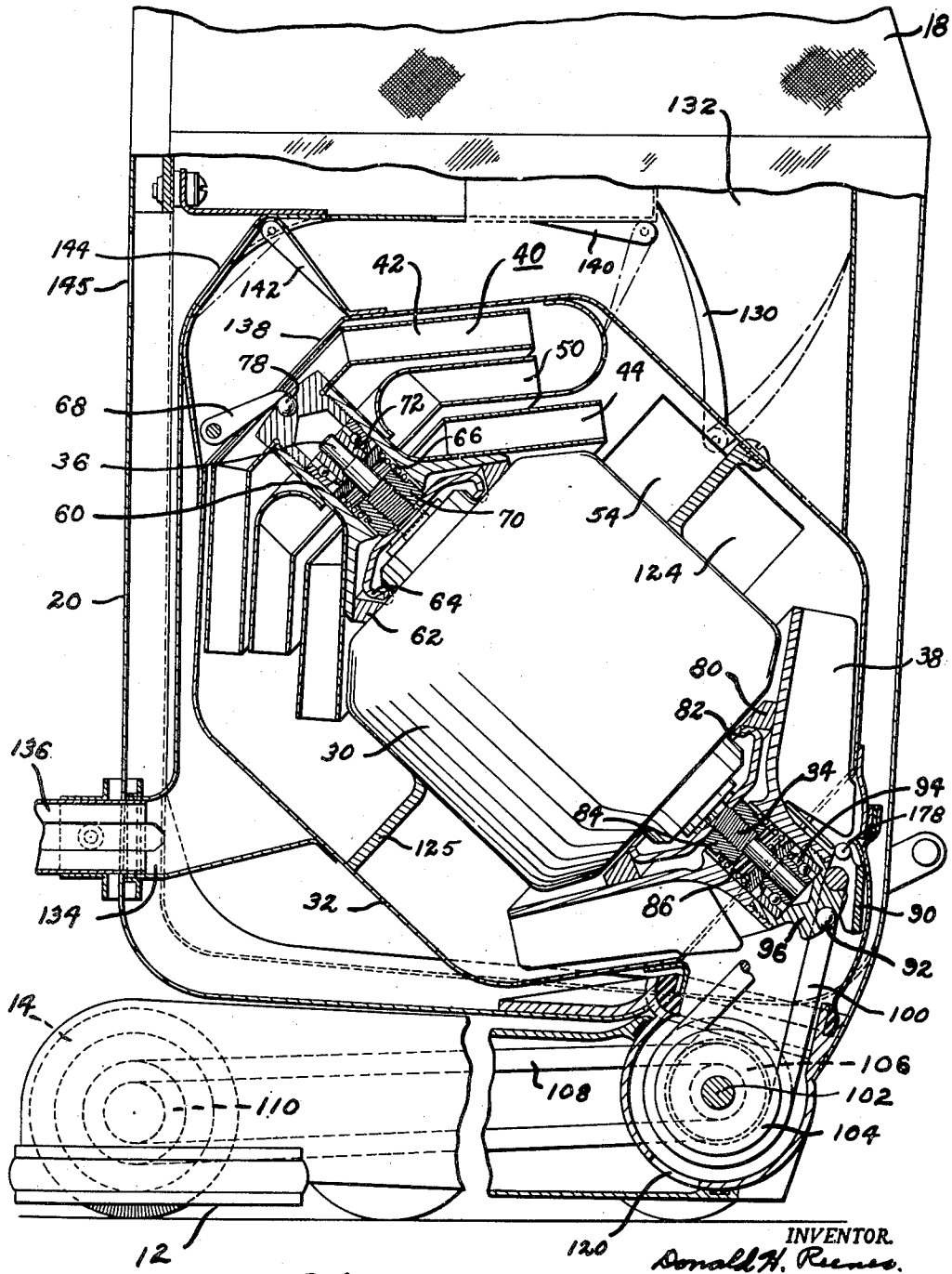


Fig. 3

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VACUUM CLEANER

Filed Aug. 12, 1944 3 Sheets-Sheet 3

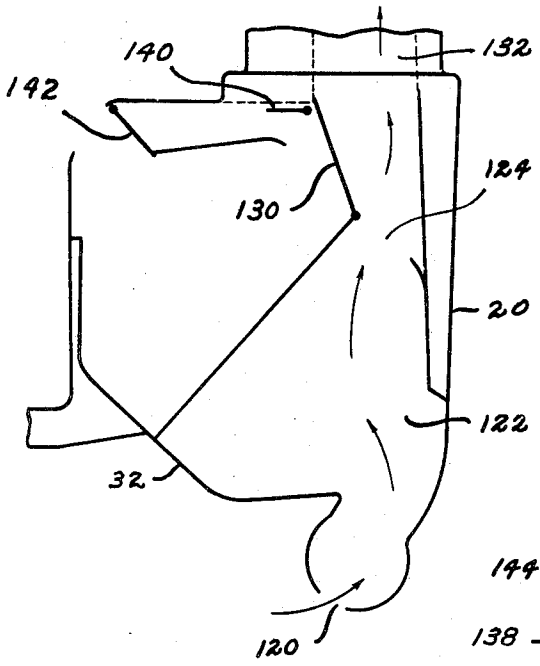


Fig. 5

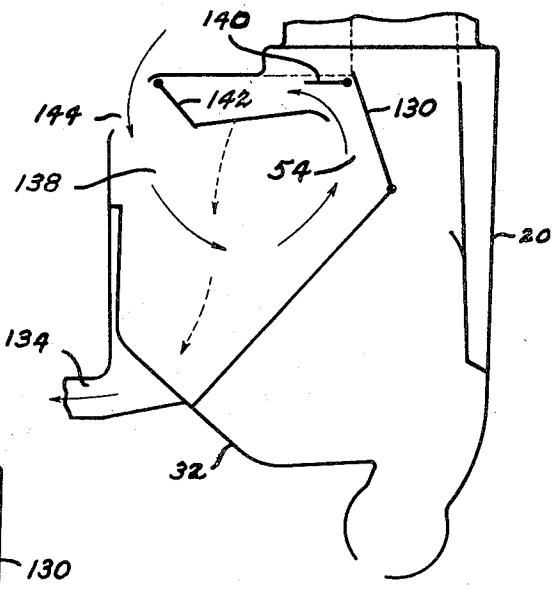


Fig. 6

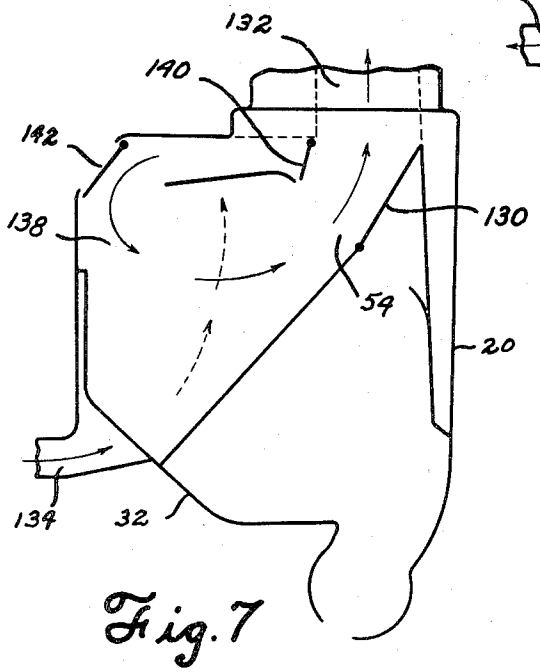


Fig. 7

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2,499,330

UNITED STATES PATENT OFFICE

2,499,330

VACUUM CLEANER

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Application August 12, 1944, Serial No. 549,152

5 Claims. (Cl. 15—330)

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This invention relates to a domestic appliance and more particularly to an improved vacuum cleaner construction.

It is an object of this invention to provide a vacuum cleaner having improved cleaning ability.

Another object of this invention is to provide a vacuum cleaner in which the amount of air handled and the amount of suction produced may be varied for different types of cleaning operations.

Still another object of this invention is to provide improved means for changing over from on-the-floor cleaning to off-the-floor cleaning.

A further object of this invention is to provide an improved suction-creating means including a plurality of fans and means for selectively declutching the fans from the driving motor.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a front elevational view of a vacuum cleaner embodying my invention;

Fig. 2 is a side elevational view illustrating the manner in which the handle unit may be pivoted relative to the floor unit;

Fig. 3 is a fragmentary sectional view showing the arrangement of the fans together with the means for clutching and declutching the fans from the main motor shaft;

Fig. 4 is a fragmentary view, with parts broken away, showing the clutch operating mechanism;

Fig. 5 is a diagrammatic view showing the arrangement of the dampers and the air-flow when the unit is used for on-the-floor cleaning;

Fig. 6 is a diagrammatic view showing the arrangement of the dampers and the air-flow when the unit is used for blowing air through the hose attachment; and

Fig. 7 is a diagrammatic view showing the arrangement of the dampers and the air-flow for off-the-floor cleaning purposes.

Referring now to Fig. 1 of the drawings, reference numeral 10 designates the ambulatory body unit which includes the usual floor nozzle 12 and agitator 14. Reference numeral 16 designates generally the handle unit which includes a dust separating bag 18, a fan and motor housing 20, main switch 22 and handle grip 24. Reference numeral 26 designates the extension cord through which current is supplied to the motor. A cord reel (not shown) is mounted directly within the outer confines of the dust separating bag 18 in

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the manner disclosed in my copending application S. N. 506,152 filed October 4, 1943, which matured into Patent No. 2,374,457 on April 24, 1945.

The motor 30 is of the type in which the main shaft projects from both ends. As best shown in Fig. 3, the motor includes a first shaft projection 34 and a second shaft projection 36.

A fan assembly 38 is adapted to be drivingly connected to the shaft portion 34 when it is desired to use the cleaner for on-the-floor cleaning. The design of the fan 38 is such that it is capable of handling a large volume of air at a relatively low pressure in comparison with the air handled by the fan generally designated by the reference numeral 40 and which is adapted to be driven by the shaft portion 36.

The fan 40 includes sections 42 and 44 which are arranged in series. The air to be handled by the fan 40 first enters the fan section 42 and then flows through the stationary air directing member 50 which directs the air to the inlet of the fan section 44. The air leaving the fan section 44 is discharged from the casing 32 through the air outlet 54 as will be explained more fully hereinafter. The fan 40 being a two-stage fan produces a high suction, such as required for efficient off-the-floor cleaning.

The fan sections 42 and 44 are secured to the rotatable hollow shaft portion 60 which in turn is slidably mounted on the shaft portion 36 and which carries a clutch ring 62 designed to engage the clutch element 64 when the hollow shaft portion 60 is moved outwardly on the shaft portion 36. A spring 66 normally biases the hollow shaft 60 outwardly on the shaft extension 36, whereas the clutch lever 68, which is operated in a manner to be described more fully hereinafter, is used for overcoming the force of the spring 66 so as to disengage the clutch ring 62 from the clutch element 64. The clutch ring 62 is shown out of engagement in Fig. 3 of the drawing. The clutch element 64 is carried directly by the shaft portion 36 so as to rotate therewith at all times. A nut 70 clamps the clutch element 64 in place on the shaft portion 36. A ball bearing assembly 72 rotatably supports the hollow shaft 60 on the outer end of the shaft 36, as shown. By virtue of the above described arrangement, the hollow shaft 60 does not rotate along with the motor shaft unless the clutch ring 62 is pushed into engagement with the clutch element 64 by means of the spring 66. A ball 78 is provided adjacent the outer end of the hollow shaft 60, as shown, so as to reduce the friction between the hollow shaft 60 and the clutch operating lever 68.

A somewhat similar clutch arrangement is provided between the shaft portion 34 and the fan assembly 38. Again referring to Fig. 3, reference numeral 80 designates a clutch ring carried directly by the fan assembly 38. Reference numeral 82 designates a complementary clutch element which is directly secured to the shaft portion 34 so as to rotate along with the shaft whenever the motor operates. The clutch element 82 is held in place by means of the nut 84 which is arranged as shown. The spring 86 biases the fan 38 together with the clutch ring 80 into clutching engagement at all times. The force of the spring 86 may be overcome by the pivoted clutch lever 90 which is arranged to push against the ball 92 carried by the fan assembly 38, as shown. A ball bearing assembly 94 rotatably supports the fan assembly 38 on the outer end of the shaft portion 34 with the result that when the clutch ring 80 is moved out of engagement with the clutch element 82 the fan assembly 38 will not rotate even though the motor 34 is in operation. The clutch rings 62 and 80 when in disengaged positions bear against the motor casing 30 so as to insure non-rotation of the fans 40 and 38 respectively.

A pulley 96 which forms a part of the fan assembly 38 serves to drive the belt 100. A jack shaft 102 is provided as shown, which carries a pair of pulleys 104 and 106. The belt 100 cooperates with the pulley 104 so as to drive the jack shaft 102. The pulley 106 cooperates with the main agitator belt 108 which in turn cooperates with the agitator pulley 110 in accordance with well known practice. By virtue of the above described clutch and pulley arrangement it is obvious that when the fan assembly 38 is declutched from the motor, the agitator 14 will be rendered inoperative.

Since the amount of power required to drive the agitator 14 represents an appreciable percentage of the total power required, it is obvious that declutching of the on-the-floor fan materially reduces the load on the motor. It is apparent therefore, that more power is available for operating fan 40 than fan 38 whereby the fan 40 can be made of larger size or can be operated at a higher speed. By virtue of the above described arrangement, the fan 40 is capable of producing a relatively high suction which is especially desirable for off-the-floor cleaning purposes.

In order to best understand the air-flow within the unit, reference should be made to Figs. 5, 6 and 7 which diagrammatically illustrate the air-flow. Referring to Fig. 5, it will be observed that when the unit is used for on-the-floor cleaning purposes, air from the floor noozle 12 enters the unit through the inlet opening or port 120, from whence it is directed into the main fan inlet 122 so as to be picked up by the fan 38 and discharged through the outlet 124. A damper 130 directs the air leaving outlet 124 upwardly through the passage 132 which leads to the dust separating bag 18. The wall 125 divides the casing 32 into two chambers as shown, and separates the outlets 54 and 124 from one another.

When it is desired to change over from on-the-floor cleaning to off-the-floor cleaning, the dampers 130, 140 and 142 are moved from the positions in which they are shown in Fig. 5, to the positions in which they are shown in Fig. 7. Also the fan 38 is declutched from the motor and the fan 40 is shifted so as to be driven by the motor. As shown in Fig. 7, air enters through the hose or converter port 134 to which a hose or other off-the-floor cleaning attachment 136 may be attached, and is caused to pass around the outside of the main motor and fan casing 32 so as to be directed to the fan inlet 138 arranged as shown. Air entering the inlet 138 is picked up by the fan 40 and is discharged through the outlet 54 from whence the air is directed into the passage or port 132 by the dampers 130 and 140.

When it is desired to operate the unit as a blower rather than a suction cleaner, the fan 40 is operated by the motor 30 and the dampers 142, 140 and 130 are arranged as shown in Fig. 6 with the result that the air will be sucked in through the opening or port 144 by the fan 40 and will be discharged out through the opening 54 from whence it will pass around the outside of the main motor and fan casing 32 and will be directed through the hose connecting port 134. It will be noted that the dampers occupy the same position in Fig. 6 as in Fig. 5 and the only difference is in the use of fan 40 instead of fan 38. The outer motor housing 20 (see Fig. 3) is provided with an opening 145 through which air may be supplied to the port 144 when the apparatus is used for blowing.

Inasmuch as the arrangement described hereinabove never requires the operation of both of the fans simultaneously it is preferable that some means be provided for operating both of the clutches simultaneously whereby the one clutch is declutched whenever the other clutch is in operation. In Fig. 4 of the drawing I have shown, for purposes of illustration, a simple clutch operating linkage mechanism which may be used for operating the clutches. As shown therein the clutch operating lever 68 is pivoted on the pin 69 carried by any suitable bracket mechanism such as the bracket 150 which is preferably secured directly to the housing 32. The shaft 69 is designed to be rotated by the link 152 which in turn is operated by the link 154. The link 154 is guided in its movement by the link 156 carried by the stationary pivot 158. A floating pivot 160 connects the links 154 and 156 whereas a floating pivot 162 connects the links 152 and 154 as shown. A tie-rod 166 is provided for shifting the floating pivot 160 so as to impart movement to the clutch lever 68. The tie-rod 166 has its one end pivotally secured to the clutch operating handle element 168 by means of the pivot pin 170. The clutch operating handle element 168 is carried by a stationary pivot 172 which in turn is secured to the housing 32. A link 174 imparts movement from the member 168 to the link 176 which is carried by the rotatable shaft 178. The shaft 178 is free to rotate only about a fixed center and has secured thereto the clutch operating member 90 which is designed to engage the ball 92 when it is desired to declutch the fan 38 from the motor shaft portion 34. By virtue of the above described linkage mechanism it is obvious that both of the clutch operating levers 68 and 90 may be operated in unison by movement of the handle element 168 and that only one of the fans will be arranged in driving engagement with the driving motor at any one time. It is also obvious that the arrangement of the links is such that either clutch is held in disengagement by an overcenter toggle mechanism as shown in Fig. 4. Thus the links 154 and 156 constitute a toggle for holding the clutch arm 68 in declutching position. Likewise if the clutch arm 90 is moved into declutching position it will be so held by the links 168 and 174.

While the form of embodiment of the invention

as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In a vacuum cleaner, an ambulatory body unit having four ports, a floor nozzle connected to one of said ports, a second of said ports being connected to a dust filter and a third of said ports being connectible to an off-the-floor cleaning attachment, a first single-stage fan having an inlet connected to said one port and an outlet connectible to said second port for on-the-floor cleaning, a second multi-stage fan having an inlet selectively connectible to either said third port or the fourth of said ports and an outlet selectively connectible to either said second port or said third port respectively for off-the-floor cleaning, a motor for driving said fans, clutch means for selectively clutching either of said fans to said motor to be driven thereby, means for controlling said clutch means for clutching either of said fans while declutching the other fan, and means for controlling the connections between the fans and the three last-named of said ports, the last-mentioned means including a damper for selectively opening and closing the connections between said second port and said outlets of said second and first fans respectively.

2. In a vacuum cleaner, an ambulatory body unit having four ports, a floor nozzle connected to one of said ports, a second of said ports being connected to a dust filter and a third of said ports being connectible to an off-the-floor cleaning attachment, a first single-stage fan having an inlet connected to said one port and an outlet connectible to said second port for on-the-floor cleaning, a second multi-stage fan having an inlet selectively connectible to either said third port or the fourth of said ports and an outlet selectively connectible to either said second port or said third port respectively for off-the-floor cleaning, a motor for driving said fans, clutch means for selectively clutching either of said fans to said motor to be driven thereby, means for preventing simultaneous operation of said fans, and means for controlling the connections between said fans and the three last-named ports, the last-mentioned means including a damper for selectively opening and closing the connections to said inlet of said second fan from said third and fourth ports.

3. In a vacuum cleaner, an ambulatory body unit having four ports, a floor nozzle connected to one of said ports, a second of said ports being connected to a dust filter and a third of said ports being connectible to an off-the-floor cleaning attachment, a first single-stage fan having an inlet connected to said one port and an outlet connectible to said second port for on-the-floor cleaning, a second multi-stage fan having an inlet selectively connectible to either said third port or the fourth of said ports and an outlet selectively connectible to either said second port or said third port respectively for off-the-floor cleaning, a motor for driving said fans, clutch means for selectively clutching either of said fans to said motor to be driven thereby, and means for controlling the connections between said fans and the three last-named of said ports, the last-mentioned means including a damper for selectively opening and closing the connections between the outlets of both said fans and said second port and a damper for selectively opening and closing the connections between the inlet of said second fan and said third and fourth ports.

4. In a vacuum cleaner, an ambulatory body unit having four ports, a floor nozzle connected to one of said ports, a second of said ports being connected to a dust filter and a third of said ports being connectible to an off-the-floor cleaning attachment, a first fan having an inlet connected to said one port and a outlet connectible to said second port for on-the-floor cleaning, a second fan having an outlet selectively connectible to either said second port or said third port and an inlet selectively connectible to either said third port or the fourth of said ports for off-the-floor cleaning, said first fan being capable of handling a larger volume of air at a lower suction than said second fan, a motor, clutch means for selectively clutching either of said fans to said motor to be driven thereby, and means for controlling the connections between said fans and the three last-named of said ports, the last-mentioned means including a damper for selectively opening and closing the connections between said outlet of either fan and said second port and dampers for selectively opening and closing the connections between said third and fourth ports and said inlet and outlet of said second fan.

5. In a vacuum cleaner, an ambulatory body unit having four ports, a floor nozzle connected to one of said ports, a second of said ports being connectible to a dust filter and a third of said ports being connectible to an off-the-floor cleaning attachment, a first fan having an inlet connected to said one port and an outlet connectible to said second port for on-the-floor cleaning, a second fan having an outlet selectively connectible to either said second port or said third port and an inlet selectively connectible to either said third port or the fourth of said ports for off-the-floor cleaning, one of said fans being capable of handling a larger amount of air at a lower suction than the other, a motor, clutch means for selectively clutching either of said fans to said motor to be driven thereby, and means for controlling the connections between said fans and the three last-named of said ports, the last-mentioned means being operable selectively to open or close the connection to said second port from said outlet of said first fan and to close or open respectively the connection to said second port from said outlet of said second fan.

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