United States Patent

Batson et al.

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[54] VACUUM CLEANER AND EXHAUST HOUSING

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[52] **U.S. Cl.** ..... **55/417,** 15/327 E, 55/472

[51] **Int. Cl.** **B01d 46/02**

[58] **Field of Search** ..... 55/467, 470–473, 55/410, 417; 15/327; 417/423 A; 415/219 B, 207, 206; 98/41

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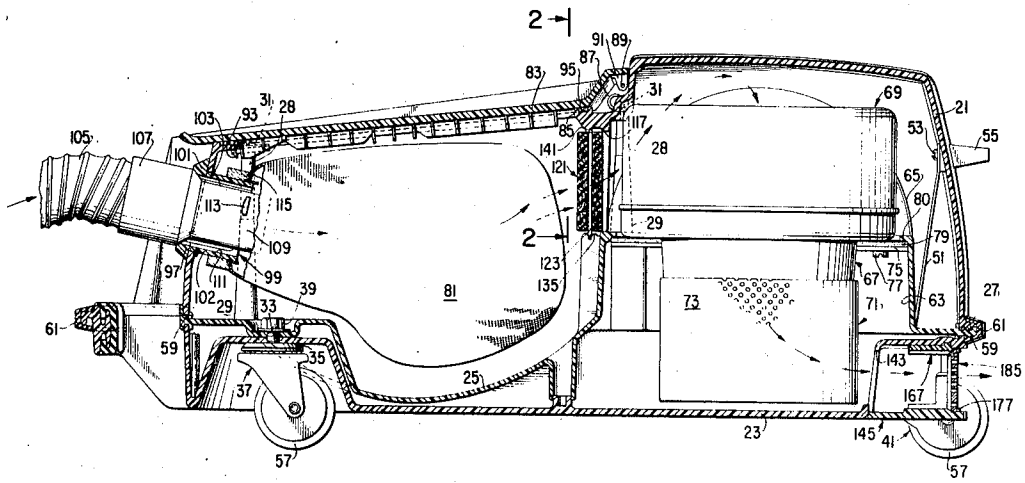
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[57] **ABSTRACT**

A vacuum cleaner of the canister variety for domestic use having upper and lower housing sandwiching an intermediate housing therebetween. An air inlet is formed at the front of the upper housing and an exhaust housing is secured to the rear of the lower housing. A dust bag is positioned between the upper and intermediate housing and is separated from a motor blower assembly by an apertured partition wall. A washable permanent secondary filter, fitted about a wire form frame, is positioned on the dust bag side of the aperture in the partition wall by means of a pair of slotted ribs which receive a portion of the wire frame and a cam shaped rib which also holds a portion of the wire frame. The exhaust housing includes a sliding door having spaced air slots and a rear wall having similar spaced air slots alternately offset from those of the door. A hose assembly blower connection aperture is formed in the exhaust housing adjacent to the slotted rear wall. During vacuum operation the sliding door is positioned in front of the hose assembly blower aperture and air is exhausted from the motor-blower assembly through both sets of slots, but during blower operation the door is positioned in front of the rear wall with the solid portion of the door closing off the slots in the wall of the exhaust housing to concentrate all the exhaust air through the hose assembly blower connection aperture.

3 Claims, 6 Drawing Figures



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SHEET 1 OF 2

Fig. 1

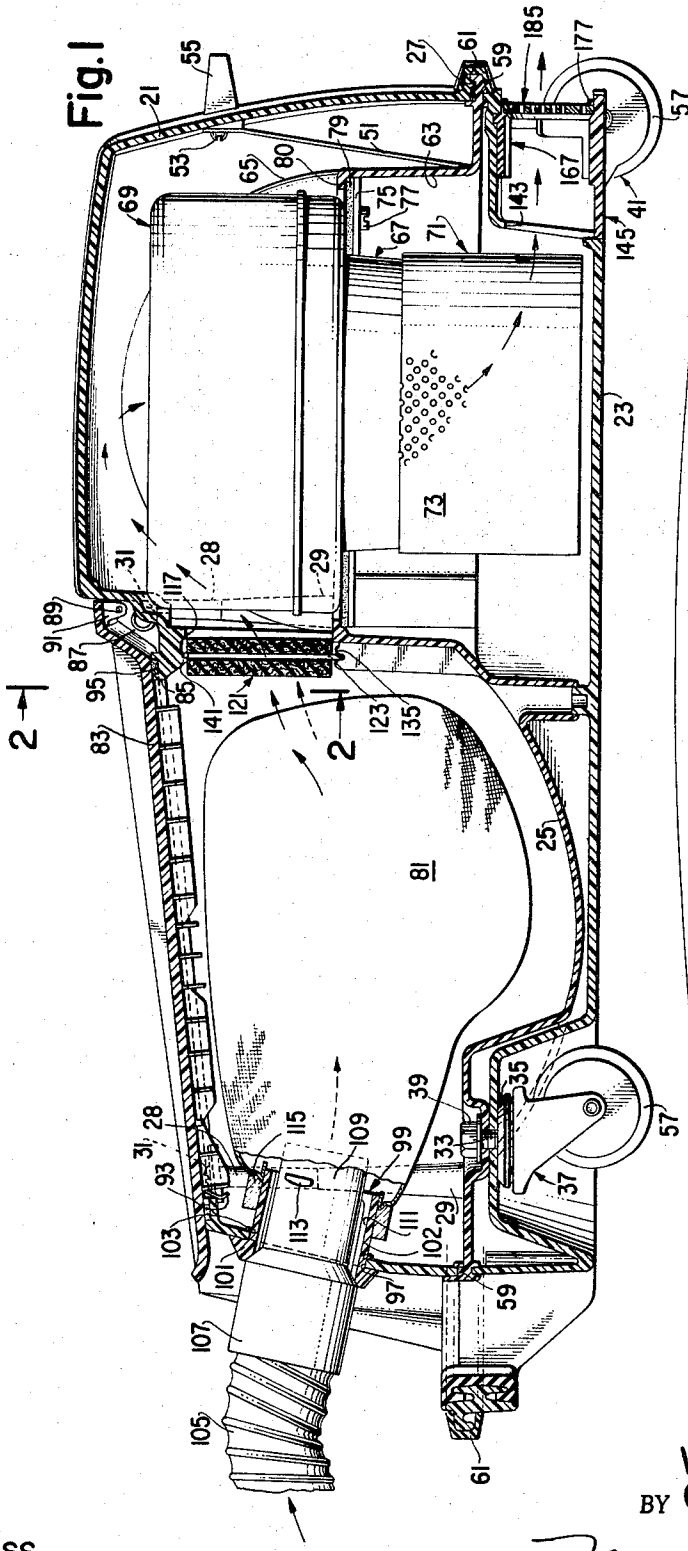
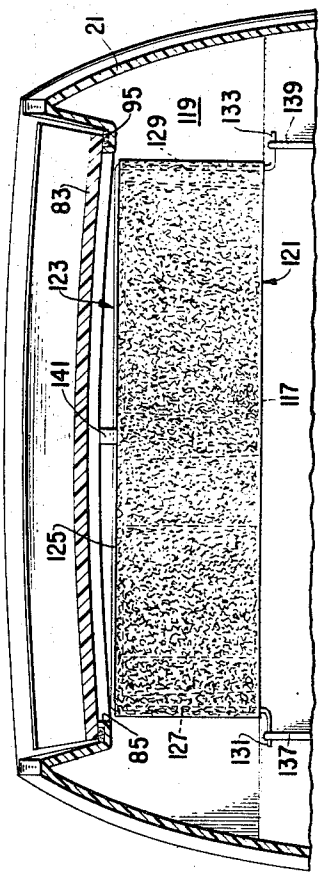


Fig. 2



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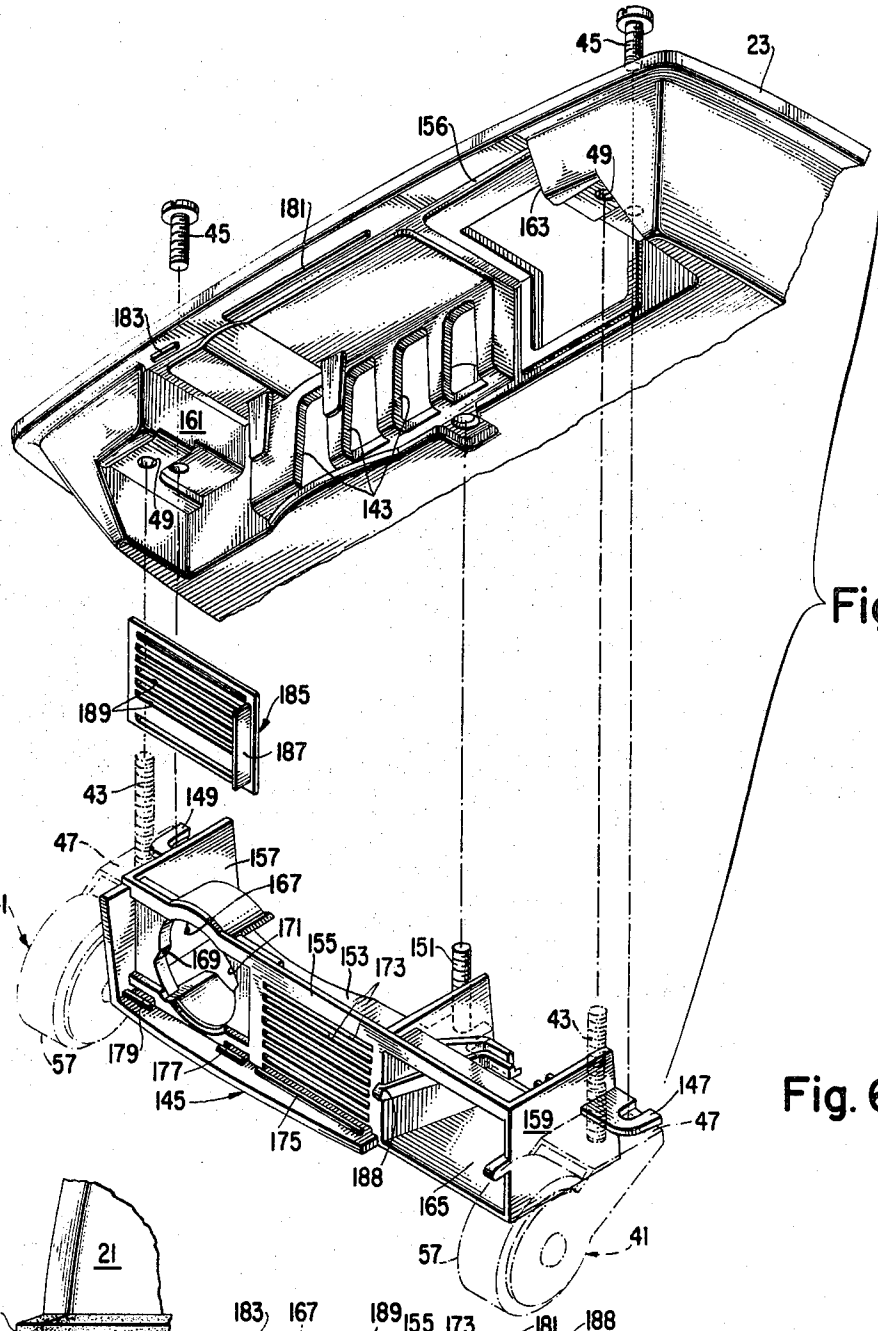


Fig. 3

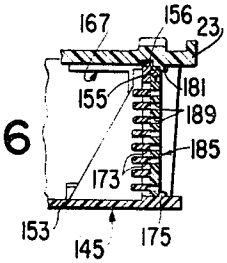


Fig. 6

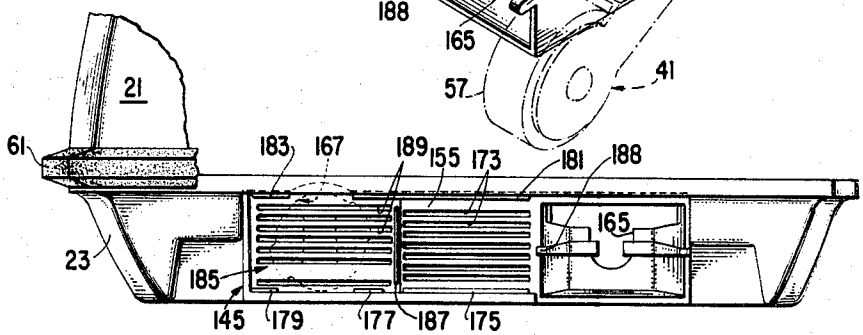


Fig. 4

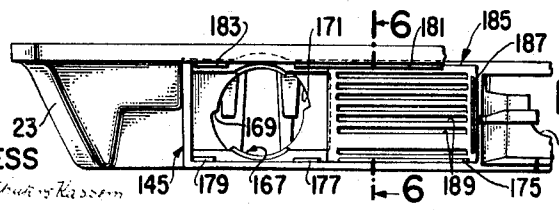


Fig. 5

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VACUUM CLEANER AND EXHAUST HOUSING

BACKGROUND OF THE INVENTION

This invention relates to vacuum cleaners and more particularly to an improved canister type of vacuum cleaner which can be operated either in a suction mode or a blower mode.

It is desirable to have the capability of operating a vacuum cleaner as a blower for various cleaning chores or for use with special attachments such as a spray attachment. A blast of air exhausted from the cleaner is thus a desirable feature under these particular circumstances. However, when operating the cleaner under normal conditions, it is objectionable for the exhaust air to be concentrated in a blast for the obvious reason that since the air blast is directional it tends to disturb objects in its path and blow any dust in its path about without control. It is, therefore, a requirement that vacuum cleaners be designed such that the air exhausted therefrom when operating in the vacuum mode is a low velocity stream which is dispersed over a large area.

Various prior art approaches to arrive at a balance between the two diverse functional requirements of a dispersed exhaust for suction operation and a concentrated exhaust blast for blower operation have been attempted. Some prior art vacuum cleaners in an attempt to utilize the exhaust port for both suction and blower modes have placed a flow dispersing filter type material over the port so that in the suction mode the exhausted air is not emitted as a blast. This, however, reduces the effectiveness of the blower mode since there is a designed in restriction to an air blast. Other cleaners, in an attempt to utilize separate exhaust ports for suction and for blower operation have incorporated complicated features such as special valves which open the normal exhaust and close the blower exhaust during suction mode, and open the blower exhaust and close the normal exhaust during the blower mode.

SUMMARY OF THE INVENTION

This invention overcomes the deficiencies of the prior art vacuum cleaners by providing an exhaust diffuser housing having two apertured sections through which the air may exhaust during the suction mode, a first of said sections being closed during the blower mode so that all the air may be concentrated through the second section. The second section of the exhaust housing has a blower outlet aperture into which the hose may be inserted and connected thereto when operating in the blower mode. The first section of the exhaust housing has a plurality of lateral slots separated by solid portions. An exhaust diffuser door having a plurality of lateral slots similar to those of the first section of the diffuser housing, but having the slots and solid portions alternately offset therefrom, is slidable between the first and second sections. During the suction mode the slidable door is positioned in front of the second section and air is exhausted through both sets of slots, but during the blower mode the door is positioned in front of the first section such that the solid portions thereof block flow through the slots of the first section and the solid portions of the first section block flow through the slots of the door to effectively close the first section and concentrate all the flow through the second section.

Accordingly, it is a primary object of the present invention to provide in a vacuum cleaner a novel and improved construction for diffusing the exhaust air so that a dispersed stream of air is exhausted during operation of the cleaner in the suction mode and a concentrated blast of air is exhausted for use as a blower.

Another object of this invention is to provide in a vacuum cleaner a novel and improved arrangement for converting from the suction to the blower mode.

A further object of this invention is the provision in a vacuum cleaner of means for closing a portion of the exhaust diffuser to concentrate the flow of air through another portion thereof for blower operation.

A still further object of this invention is the provision in a vacuum cleaner of an exhaust diffuser housing having two apertured sections through which air may exhaust during the suction mode and having a door which, positioned in front of a first of said sections during said suction mode, allows air to flow through both sections, but which, positioned in front of the second section during the blower mode, closes off the flow of air through the second section and forces all the exhaust air through the first section.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular features and advantages of the invention, as well as other objects, will become apparent from the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a vertical sectional view substantially along the longitudinal center line of a vacuum cleaner embodying the present invention;

FIG. 2 is a fragmentary cross sectional view taken substantially along the line 2—2 of FIG. 1;

FIG. 3 is an exploded perspective view of the rear portion of the vacuum cleaner of FIG. 1 showing the exhaust diffuser housing and exhaust diffuser door disassembled from the lower housing;

FIG. 4 is a fragmentary rear elevational view of the cleaner shown in FIG. 1 with the exhaust diffuser door positioned for operation of the cleaner in the suction mode;

FIG. 5 is a fragmentary rear elevational view of the lower portion of the cleaner of FIG. 1 with the exhaust diffuser door positioned for operation of the cleaner in the blower mode; and

FIG. 6 is a cross sectional view taken substantially along 6—6 of FIG. 5.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring now to the accompanying drawings wherein like reference numerals denote similar parts throughout the several views, there is disclosed a canister vacuum cleaner comprising a frame having an upper housing 21, a lower housing 23, and a bulkhead or intermediate housing 25 trapped by the upper and lower housings in sandwich-like relationship therebetween. The three housings are fitted together at their periphery by conventional means comprising a series of tongue and groove connections generally designated 27. To secure the upper housing 21 to the bulkhead 25 there are provided on the upper housing four downwardly extending integrally molded cylindrical bosses 28 (only two of which are illustrated) which register with four similar upwardly extending threaded bosses 29 on the bulkhead (only two of which are illustrated). A screw 31 passes through each boss 27 and is threadedly received within each boss 29. A threaded stud 33 fixed to caster 35 of a front wheel assembly 37 passes through the lower housing 23 at the front thereof and is threadedly received by a nut 39 bearing on the upper face of the bulkhead to secure the lower housing to the bulkhead at the front thereof. At the rear of the cleaner a pair of fixed axis wheel assemblies 41 are each secured to the lower housing 23 by a pair of screws 43 and 45. Each screw 43 registers with and passes in succession through a wheel bracket 47 of the assembly 41, a hole 49 formed in the rear of the lower housing and a boss (not shown) formed in the bulkhead, and is threadedly received in a lug (not shown) formed in a substantially V-shaped support bracket 51 secured to the upper housing 21 by a pair of screws 53 (only one of which is illustrated) that pass through holes in the upper housing and thread into a plastic molded tab 55. It is thus evident that the lower housing is secured to the bulkhead by the elements that secure the wheel assemblies to the cleaner. The wheel assemblies 37 and 41 include wheels 57 each of which comprise a molded plastic wheel covered with an extended plastic soft surface thread and allow manipulation of the cleaner in the conventional manner. Moreover, the rear wheel assemblies 41 and the tab

55 facilitate storage of the cleaner in an endwise position and allow the cleaner to be stood upon its rear end when cleaning areas such as steps. A seal 59 provides sealing between the upper housing and the bulkhead at their outer periphery, while a conventional bumper 61 surrounds the complete cleaner to provide additional sealing, as well as the usual protection against damaging furniture.

The bulkhead 25 is formed at the rear thereof with a pair of molded pockets 63 and 65 within which are respectively mounted a motor blower assembly 67 and an electric cord reel assembly (not shown), both of which may be of any suitable standard construction. The air moving or motor blower assembly 67 preferably comprises a two stage fan unit 69 and a coaxial driving motor unit 71, the motor being cooled by the high airflow created by the fans. Suffice it to say that in the present preferred embodiment the airflow enters an inlet opening (not shown) in the front (top) of the fan unit casing and is exhausted at the motor end through a cylindrically shaped motor blower guard 73 that is formed with exhaust apertures (only some of which are illustrated) in its cylindrical wall and is secured to the motor frame by screws (not shown). A flat circular mounting plate 75 having a large central opening is secured by screws 77 to a flange on the motor blower with a resilient seal 79 trapped therebetween so that a portion of the seal is pressed against the motor blower flange. The pocket 63 is shaped to accept the assembled motor blower 67, mounting plate 75 and seal 79 which are then attached to a flange 80 on the pocket with a series of screws (not shown) that force the remaining unexposed areas of the seal into proper engagement with the flange 80. The mounting of the motor blower in this manner effects a minimization of vibration when the unit is in operation. A conventional push-push switch (not shown) is mounted at the front of the cleaner to activate and deactivate the motor blower.

A vacuum compartment, within which is located a porous filter bag 81, is formed by the walls of the bulkhead 25, the upper housing 21 and a plastic molded filter bag access door 83 which fitted over a recessed flanged opening 85 in the upper housing. Looped about each screw 31 and secured thereby to the upper housing is one end of a wire formed spring 87 having a single coil. The other end of each spring 87 is bent to form an axle, each of which fit within a hole 89 formed in a pair of tabs 91 (only one of which is illustrated) extending downwardly from the rear of door 83 to hingedly mount the same relative to the upper housing. At the front of the door 83 is secured a spring bracket cam latch 93 which may be camed under a lip on the front flange of the opening 85 to lock the door in the closed position. A seal 95 secured, such as by glue, about the periphery of the opening 85 on the upper housing, ensures a substantially sealed relation between the door and the housing when the door is shut and the latch is engaged.

Formed in the front wall of the upper housing is a central opening 97 within which is inserted an intake connector 99 having a flange portion 101 and a cylindrical extension 102. The connector 99 is secured in the upper housing by means of its front flanged portion 101 and an annular retaining ring 103 which together lock the connector axially to the upper housing. The connector, furthermore, includes outwardly extending lugs (not shown) which register in notches (not shown) in the upper housing opening to prevent rotational movement about the connector axis. A hose 105 fitted with a coupling 107 having an adaptor 109 at its other end is connected into a frontal opening 111 of the connector 99. The adaptor 109 includes a pair of lugs 113 (only one of which is shown) equally spaced about the periphery thereof which register with a similarly shaped pair of notches formed in the frontal opening 111 and the cylindrical extension 102, and which lock the hose in the inlet when the adaptor is given a slight clockwise twist. The disposable filter bag 81 includes a cardboard mounting collar which slips onto the cylindrical extension 102 of the connector 99 and is held thereon by friction so that the dust and dirt in the inlet airstream passing through the hose 105 remains in the bag as the air is drawn through the vacuum or filter bag compartment by the motor blower assembly.

Mounted in the filter bag or vacuum compartment of the cleaner in front of a pair of openings 117 formed in a partition wall 119 which separates the vacuum compartment from the motor blower compartment is a washable, permanent, secondary filter 121. This filter comprises a continuous strip of open pore plastic foam folded into the shape of a loop or pocket and provides additional cleaning of the air after it has been drawn through the filter bag 81 and also serves as a protective backup filter should the filter bag rupture. The filter is formed by heat welding or stapling the ends of a strip of resilient plastic foam material to form a continuous loop, pocket or receptacle. The filter is then slipped over and about a substantially U-shaped spring metal wire form frame 123 having its central leg 125 substantially of the same length as one half the length of the entire strip of filter material so as to hold the filter form substantially taut. The two upstanding legs 127 and 129 of the frame 123 abut with the inner surface of the filter and act to support the filter and aid the central leg in holding the filter form substantially taut. At the free end of each leg 127 and 129, the frame is bent to form a respective axle portion 131 and 132, each of which sets in a slot 135 (only one is illustrated) formed in a respective upwardly extending rib 137 and 139 molded in the bulkhead 25. Extending downwardly from the upper housing 21 above the filter in substantially the same plane as the ribs 137 and 139 of the bulkhead, is an integrally molded camming tooth 141. The filter is inserted into the cleaner by placing the axles 131 and 133 in their respective slots in the ribs 137 and 139 and then pivoted upwardly until the leg 125 snaps under the tooth 141 and is locked thereby between the tooth 141 and the wall 119 with the filter in a sealed relation with the wall 119 so that the airflow in the vacuum compartment must flow therethrough. To remove the filter 121 for cleaning or washing, the leg 125 is released from tooth 141, the axles 131 and 133 are removed from their respective slots, and the filter strip is removed from the wire frame.

It should now be clear that during the suction mode of operation dirt laden air enters the cleaner through the hose 105 and passes through the bag 81 and thence through the filter 121 into the inlet of the fan and is exhausted at the motor end of the motor blower unit through the blower guard 73. The exhaust air then passes through outlet apertures 143 formed in the rear of the lower housing 23 and is exhausted therefrom through an exhaust diffuser housing 145.

The housing 145 includes a pair of open slotted lugs 147 and 149 which are trapped in position beneath the lower housing by the screws 45 which aid in securing the wheel brackets to the lower housing. A screw 151, which passes through the housing 145 and is threadedly received in the bottom of housing 23, secures the exhaust diffuser housing in its trapped position so that the exhaust housing and the lower housing together act as a conduit to conduct air from the outlets 143 to the exterior of the cleaner. The housing 145 comprises a floor 153, a rear wall 155 extending upwardly from the floor and received within a slot 156 in the lower housing to aid in positioning the housing 145, and a pair of side walls 157 and 159 also extending upwardly from the floor 153 and which snuggly fit, when the housing is secured in position, against respective shoulders 161 and 163 molded on the lower housing 23. At one end of the exhaust housing within the wall 155 is molded a recessed pocket 165 which receives an adaptor (not shown) for storing the electric cord plug (not shown). The remainder of the housing 145 comprises two apertured sections or ports formed in the rear wall 155. A first of these sections has an opening 167 including a pair of opposed notches 169 and 171; the opening being of the same configuration as the frontal opening 111 formed in the inlet connector 99. The configuration of the opening 167 is such as to receive the hose adaptor 109 during blower operation as will presently be described. The second section includes a plurality of horizontally disposed slots 173 formed between similarly disposed portions in the rear wall 155.

Formed on the floor **153** of the exhaust housing **145** are three short upstanding ribs **175**, **177** and **179** which are vertically disposed in the same plane as two short downwardly extending ribs **181** and **183** formed on the lower housing **23**. Trapped between the ribs **175**, **177**, **179**, **181** and **183**, and the rear wall **155** when the housing **145** is secured in place, is an exhaust diffuser door **185**. The door **185** is slidable along the rear wall **155** in upper and lower tracks respectively formed by the ribs **181**, **183** and the rear wall **155**, and the ribs **175**, **177**, **179** and the wall **155**. A molded tab **187** on the door **185** acts as a finger gripping surface for moving the door between the first apertured section to the second apertured section formed in the rear wall **155**. The wall **157** and a rib **188** formed as part of the cord storing pocket **165** act as stops for the door in its lateral travel. The door **185** includes a plurality of horizontally disposed slots **189** formed between solid portion of the door and which are similar to slots **173** formed in wall **155**, but the slots and solid portions of the door **185** are alternatively staggered or offset from the slots and solid portions of the wall such that, as shown in FIGS. **5** and **6**, when the door is positioned in front of this section of the exhaust housing, the solid portions between the slots of the door close off the slots in the exhaust housing and the solid portions between the slots of the exhaust housing close off the slots in the door thus causing all the air from the fans to exhaust out the aperture **167**. When the door is positioned as just described, all the air is concentrated through hole **167** and the cleaner is in the blower mode. The hose adaptor **109** may then be inserted into the opening **167** and locked therein by a slight clockwise twist. When suction mode operation is desired the door **185** is slid from in front of the second section to in front of the hole **167** in the first section after the hose has been removed and reset in the inlet **99**. The exhaust air may now pass through both apertured sections of the housing **145**, i.e., through the hole **167** and out the slots **189**, and through the slots **173**. By flowing through both sets of slots **173** and **189** during the suction mode, the exhaust air is properly dispersed.

It should be noted that although this invention has been illustrated with the slots in the door **185** and the housing **145** being horizontally disposed, any arrangement of apertures which would result in solid portions of each element blocking off flow through the apertures during blower mode fall within the inventive concept of the invention. All such modifications which do not depart from the spirit of the invention are intended to be within the scope of the appended claims.

We claim:

1. In a vacuum cleaner of the canister type comprising a vacuum cleaner housing having a filter compartment, a porous filter bag mounted in said filter compartment, an air moving unit compartment communicating with said filter compartment, means defining an air inlet in said housing communicating with said filter bag, means defining an air outlet in said housing communicating with said air moving unit compartment, and an air moving unit mounted in said air moving unit compartment for drawing dirt laden air through said inlet and discharging filtered air through said outlet, the improvement comprising: an exhaust housing mounted to the vacuum cleaner housing in communication with said outlet for receiving substantially all the air discharged therethrough, said exhaust housing including a wall having two exhaust ports, a first of said ports comprising a single large aperture, the second port comprising a plurality of slots separated by solid portions of said wall and in juxtaposition with said single aperture, a plate having a plurality of slots of substantially the configuration of the slots of said second port and separated by solid portions of said plate, means defining a slideway downstream of said ports for slidably mounting said plate on said exhaust housing adjacent said wall, said plate being positioned in said slideway and selectively slidable between a first position superposed over said first port and a second position superposed over said second port, said slots and solid portions of said plate being offset relative to the slots and solid portions of said second port such that when said plate is positioned in the second position the solid portions of the plate mask the slots of said second port and the solid portions of said wall mask the slots of said plate.

2. In a vacuum cleaner of the canister type comprising a vacuum cleaner housing having a filter compartment, a porous filter bag mounted in said filter compartment, an air moving unit compartment communicating with said filter compartment, means defining an air inlet in said housing communicating with said filter bag, means defining an air outlet in said housing communicating with said air moving unit compartment, and an air moving unit mounted in said air moving unit compartment for drawing dirt laden air through said inlet and discharging filtered air through said outlet, the improvement comprising: an exhaust housing mounted to the vacuum cleaner housing in communication with said outlet for receiving substantially all the air discharged therethrough, said exhaust housing including a rear wall having two exhaust ports, a floor abutting said wall, and a pair of side walls each abutting said floor and said rear wall, said floor, side walls and rear wall being disposed in abutting relationship to said vacuum cleaner housing and secured thereto to form a conduit for said air from said outlet, a first of said ports comprising a single large aperture, the second port comprising a plurality of slots separated by solid portions of said wall and in juxtaposition with said single aperture, a plate having a plurality of slots of substantially the configuration of the slots of said second port and separated by solid portions of said plate, means defining a slideway downstream of said ports for slidably mounting said plate on said exhaust housing adjacent said wall, said plate being positioned in said slideway and selectively slidable between a first position superposed over said first port and a second position superposed over said second port, said slots and solid portions of said plate being offset relative to the slots and solids portions of said second port such that when said plate is positioned in the second position the solid portions of the plate mask the slots of said second port and the solid portions of said wall mask the slots of said plate.

3. In a vacuum cleaner as recited in claim **2** wherein said slideway defining means comprises at least a first rib formed on said floor and at least a second rib formed on said vacuum cleaner housing above said wall, each of said ribs disposed in a plane substantially parallel to said wall.

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