Nov. 16, 1965 F. P. HAYBA 3,217,351

VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 1

Fig. 1.

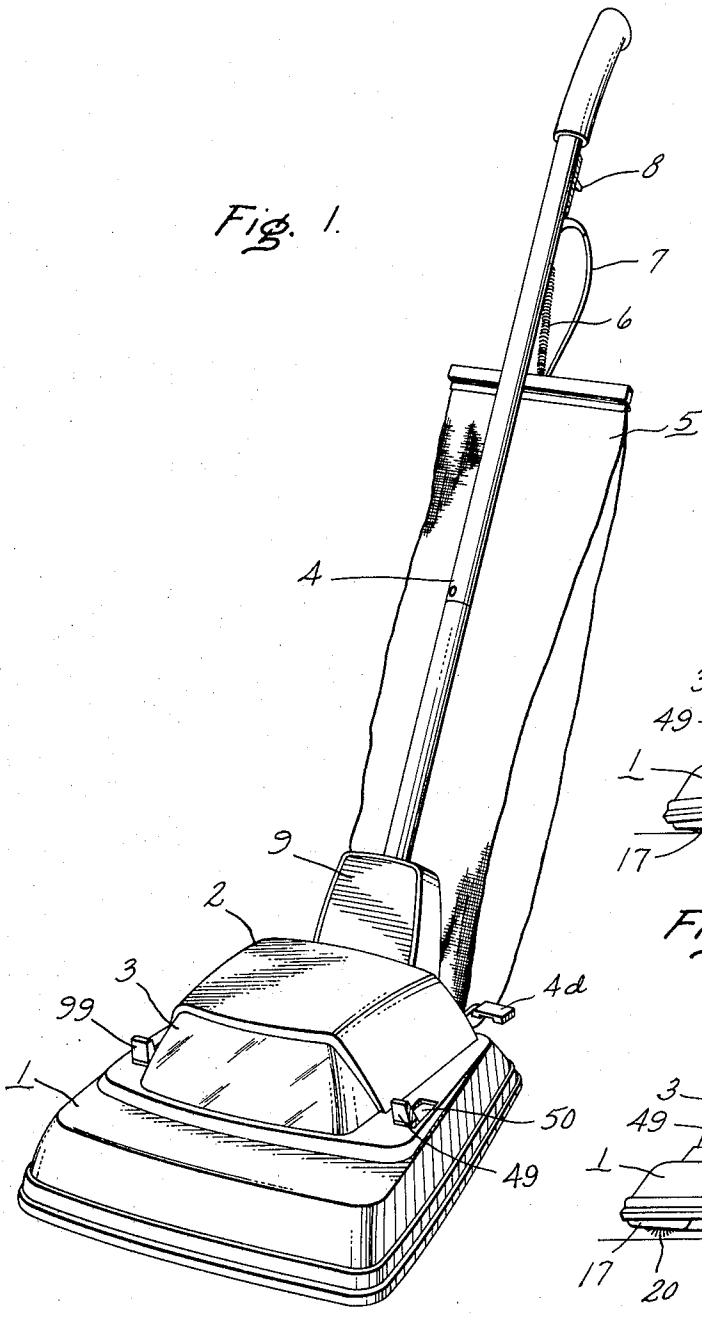


Fig. 2.

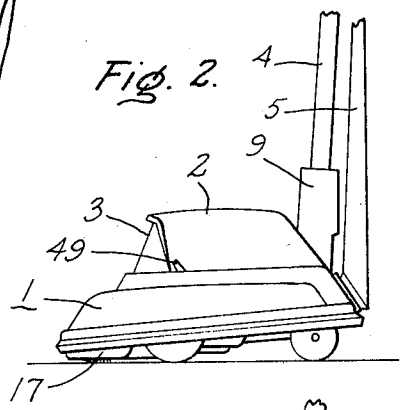
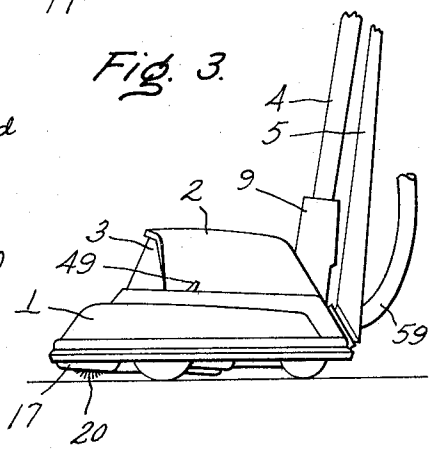


Fig. 3.



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Nov. 16, 1965 F. P. HAYBA 3,217,351

VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 2

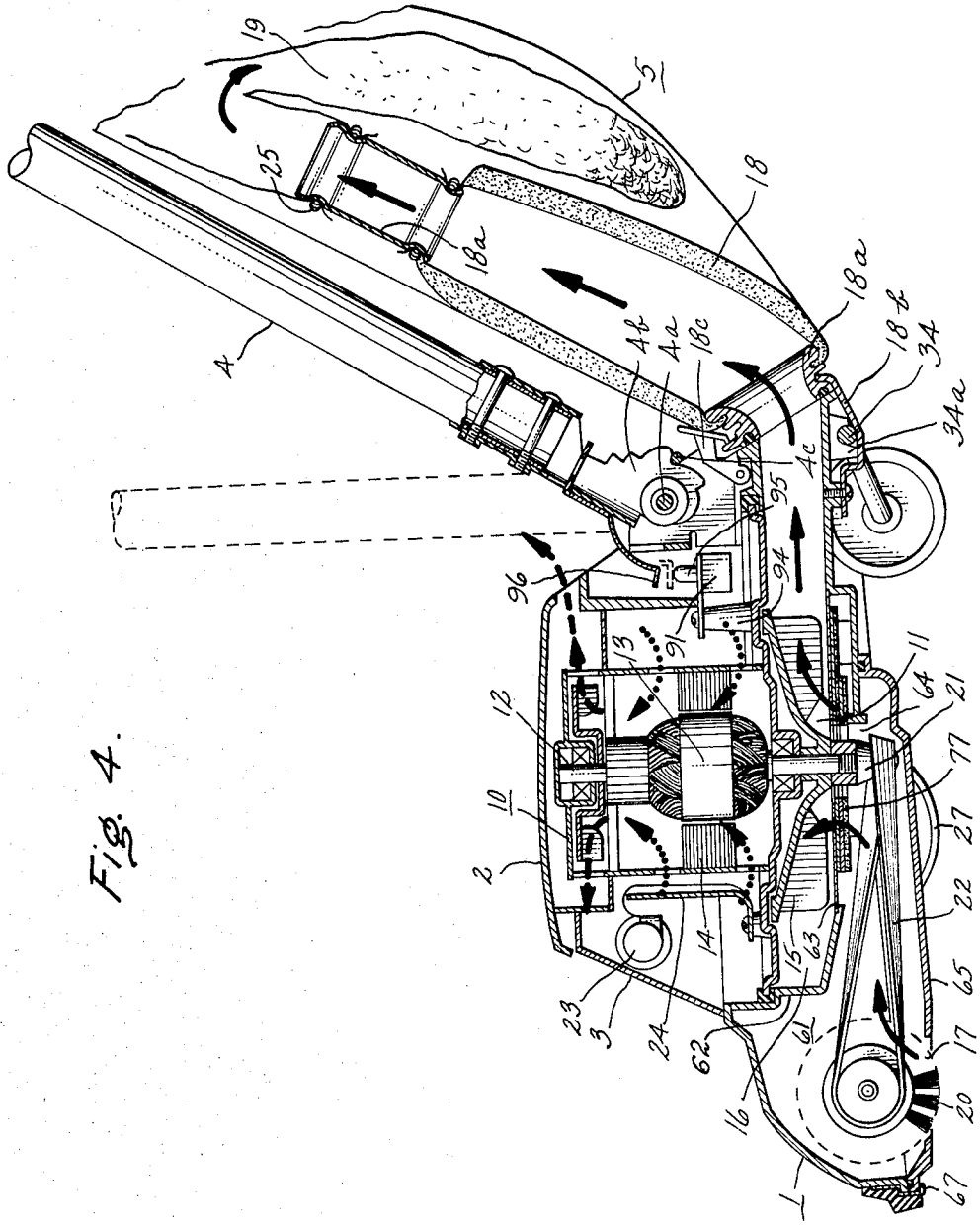

Fig. 4.

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VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 3

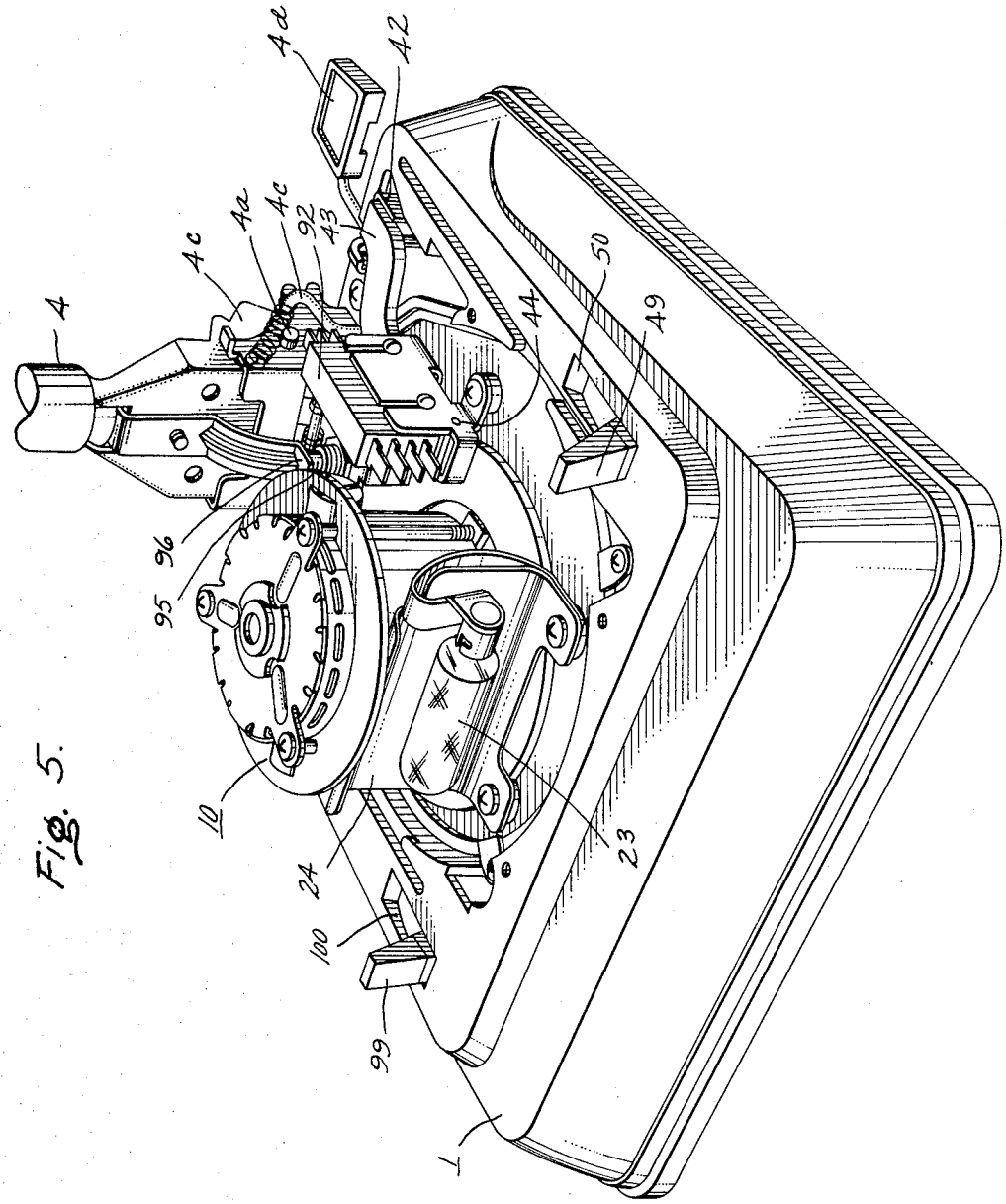

Fig. 5.

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VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 4

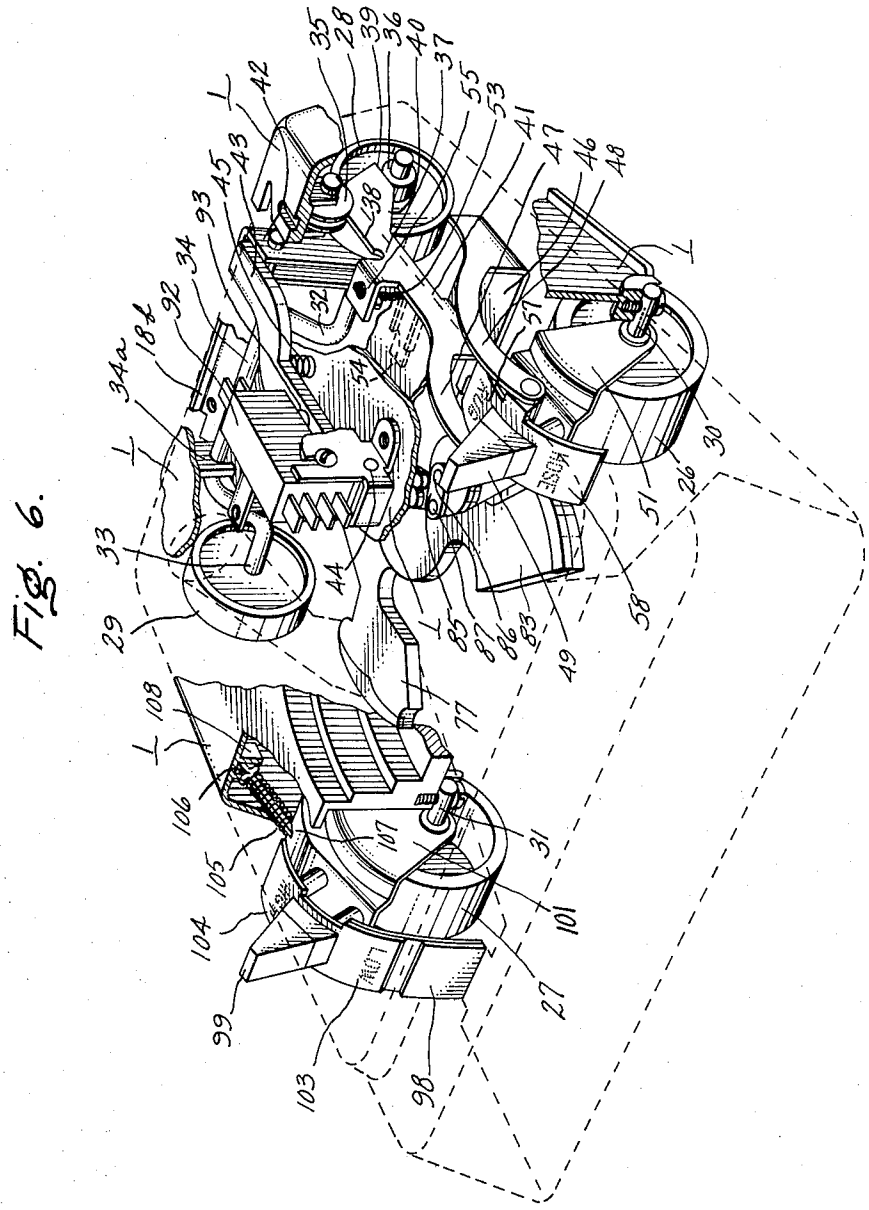

Fig. 6.

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VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 5

Fig. 7.

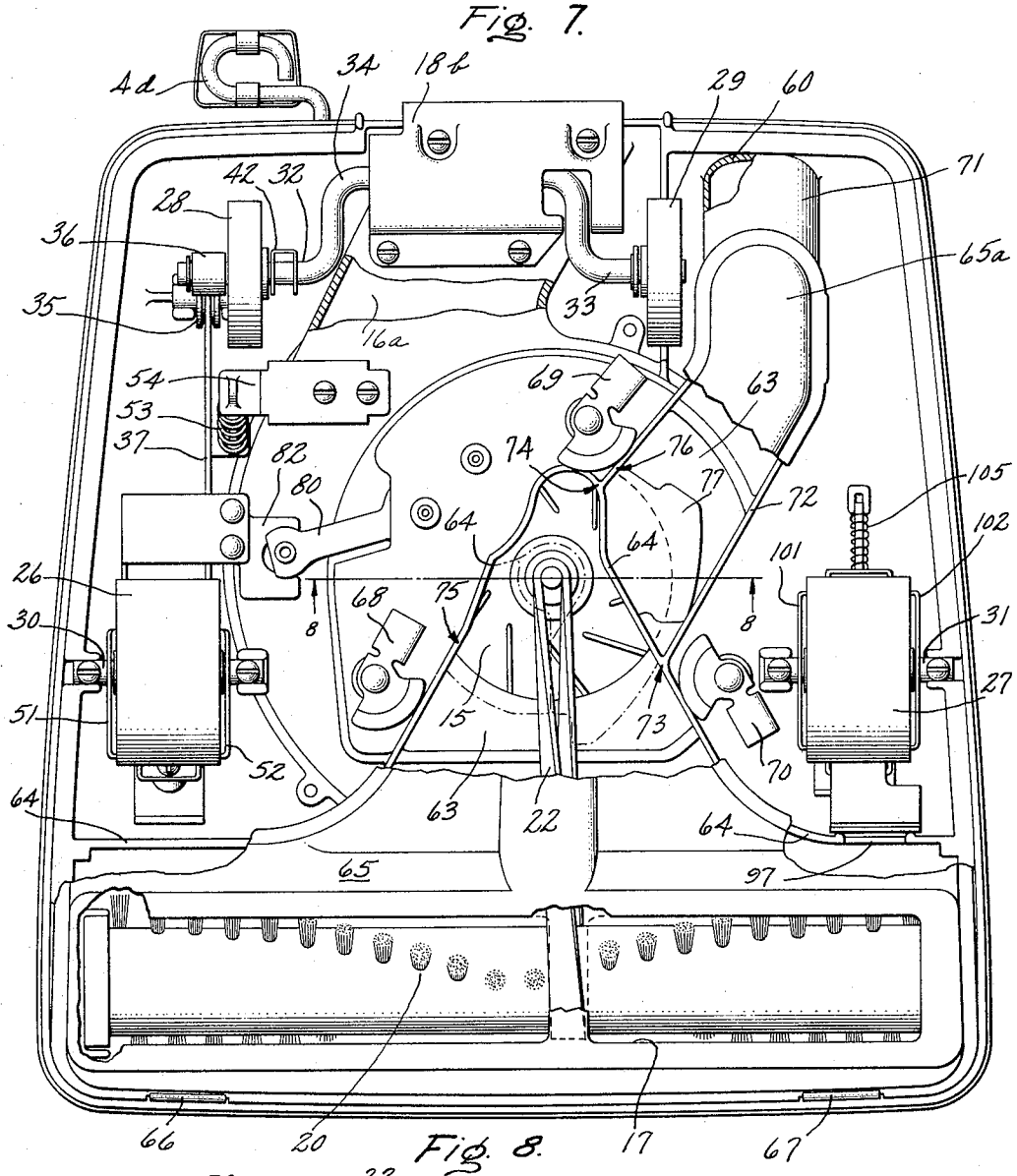
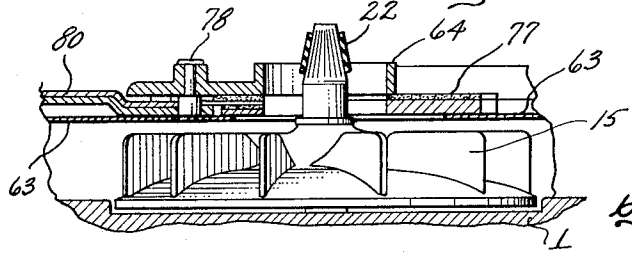


Fig. 8.



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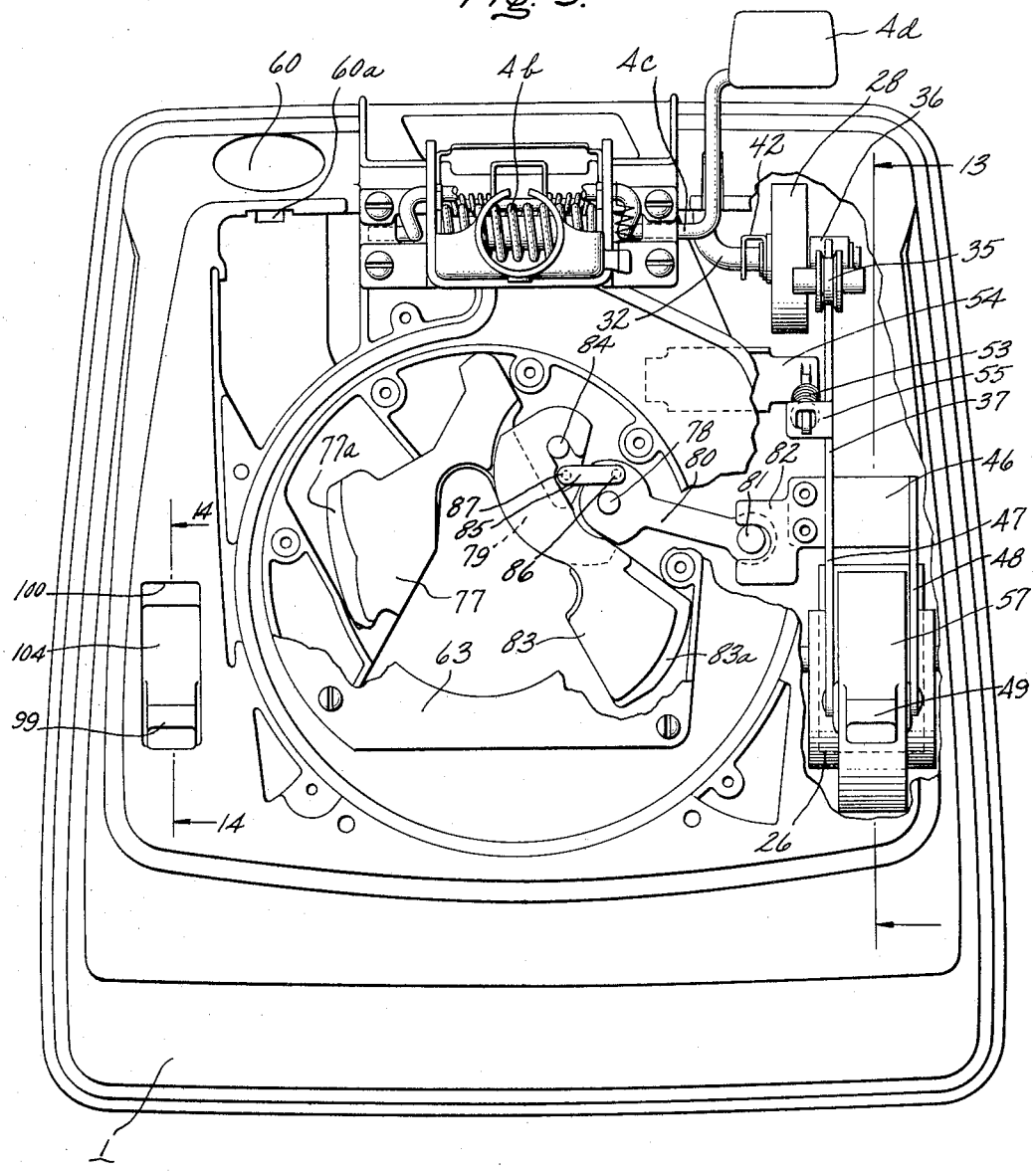
Nov. 16, 1965 F. P. HAYBA 3,217,351

VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 6

Fig. 9.



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Nov. 16, 1965 F. P. HAYBA 3,217,351

VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 7

Fig. 10.

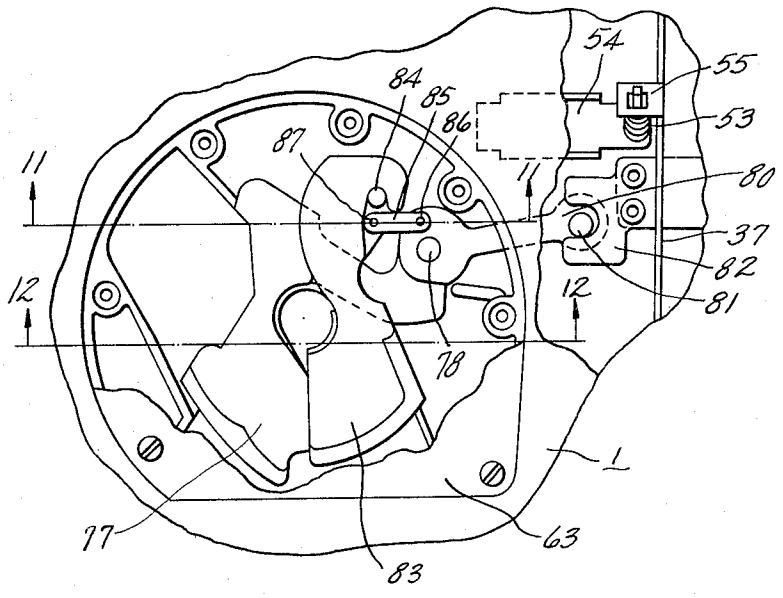


Fig. 11.

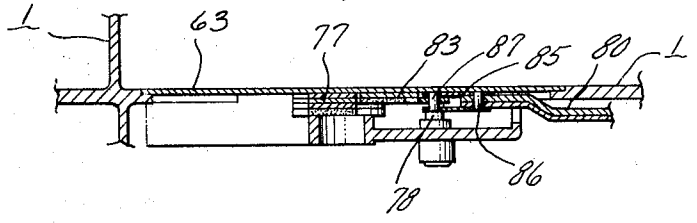
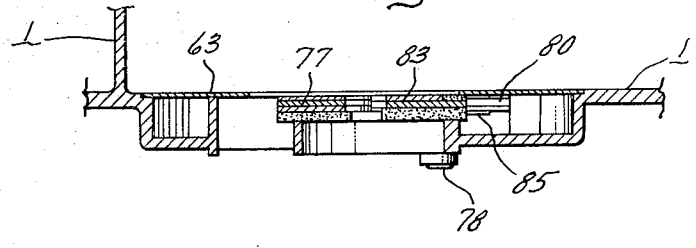


Fig. 12.



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Nov. 16, 1965 F. P. HAYBA 3,217,351

VACUUM CLEANER

Filed Oct. 9, 1962 8 Sheets-Sheet 8

Fig. 13.

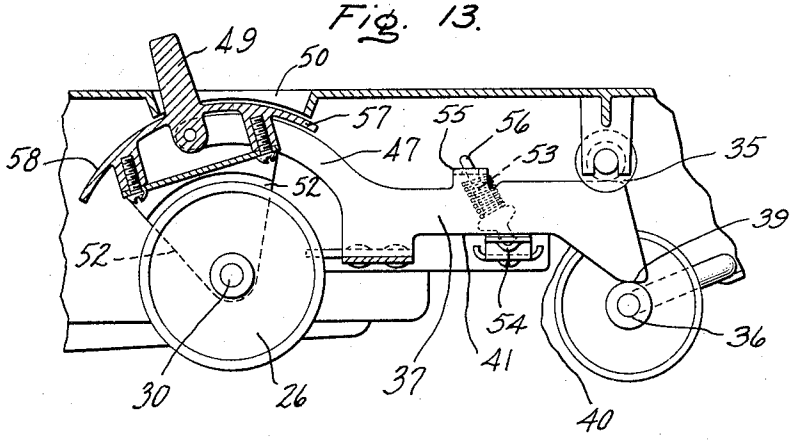


Fig. 14.

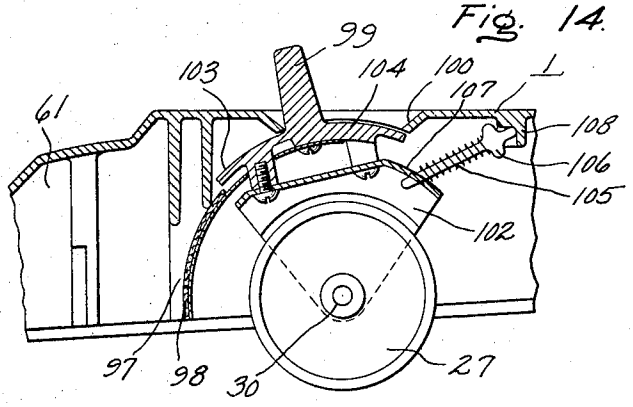
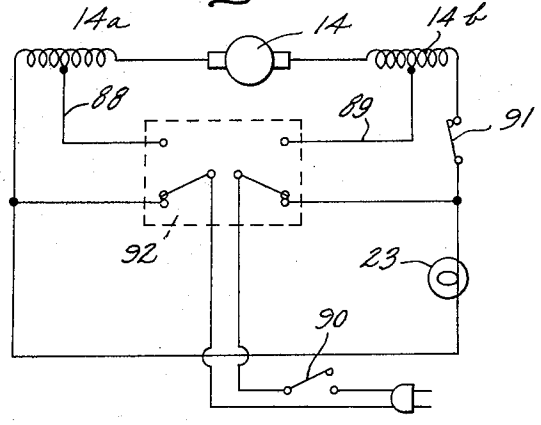


Fig. 15.



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United States Patent Office 3,217,351 Patented Nov. 16, 1965

3,217,351

VACUUM CLEANER

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Filed Oct. 9, 1962, Ser. No. 229,339
11 Claims. (Cl. 15—324)

This invention relates to vacuum cleaners, and more particularly to vacuum cleaners of the upright type operable to clean floor surfaces and also off-the-floor objects such as draperies and furniture.

The term "upright vacuum cleaner" is commonly used in referring to a cleaner having a suction producing motor-fan unit and a suction nozzle mounted in a single casing or housing provided with supporting wheels, and a handle sufficiently long to enable the cleaner to be moved over floor surfaces while the operator remains in a standing position. Such cleaners are generally provided with a power-driven brush or agitator associated with the suction nozzle so as to agitate the surface of the carpet underlying the nozzle during carpet cleaning operations.

While the primary function of upright vacuum cleaners is to clean floor surfaces such as bare floors and carpets some presently available upright cleaners may also be used for off-the-floor cleaning, i.e., the cleaning of household furniture, draperies and the like. Such dual purpose cleaners are provided with one or more cleaning tools or nozzles adapted to be connected to a flexible hose which may be attached to the cleaner casing. Various arrangements have been utilized for altering the air-flow paths in the casing so as to produce suction in the cleaning tool rather than the floor nozzle when off-the-floor cleaning is to be performed. Also, various arrangements for preventing a power-driven brush associated with the floor nozzle from agitating the underlying portion of the floor surface have been incorporated in cleaners having such a brush.

Upright cleaners of the type which may be converted for use in off-the-floor cleaning compete in the market place with other types of vacuum cleaners, such as canister cleaners and tank cleaners, which do not have a floor nozzle built into the cleaner casing. Instead, cleaners of the canister and tank types are provided with various cleaning nozzles or tools (including a floor nozzle) all of which are connected to the source of suction in the cleaner casing by means of a flexible hose. Generally speaking, the latter cleaners have proved to be more popular than convertible upright cleaners among those interested in maximum ease and effectiveness in off-the-floor cleaning. Convertible upright cleaners heretofore available to housewives have generally required more effort to prepare them for off-the-floor cleaning, as compared with canister and tank cleaners. Further, some of the convertible uprights which have been offered for sale have been less maneuverable and harder to use for off-the-floor cleaning than canister and tank cleaners.

Accordingly, an important object of the present invention is to provide an improved upright vacuum cleaner convertible for off-the-floor cleaning which is capable of high performance in both floor cleaning and off-the-floor cleaning operations.

Another object of the invention is to provide a vacuum cleaner of the aforementioned dual type which may be easily converted for either floor cleaning or off-the-floor cleaning.

Another object of the invention is to provide a dual purpose upright cleaner which may be conditioned for either floor cleaning or off-the-floor cleaning by manual actuation of a single lever.

Another object of the invention is to provide an improved mechanism for changing the air-flow path in a dual purpose upright cleaner so that suction may be produced either in a floor nozzle or in a separate suction inlet.

Still another object of the invention is to provide improved means for altering the suction characteristics of an upright cleaner floor nozzle.

In accordance with one aspect of this invention there is provided a vacuum cleaner comprising a casing having a suction nozzle therein arranged for floor cleaning, a rotary brush associated with the floor nozzle and a suction inlet in the casing separate from the floor nozzle, the latter inlet being adapted for connection with a flexible hose suitable for use with off-the-floor cleaning tools. An electrically powered motor fan unit is mounted on the casing and is arranged to produce suction in either the floor nozzle or the separate suction inlet in accordance with the positions of a pair of shutters movably mounted so as to obstruct air-flow from either the floor nozzle or the suction inlet. A lever which may operate either manually or by foot is provided for positioning the shutters.

The manually operable lever is also connected to means for retracting the rear wheels of the cleaner so as to tilt the cleaner casing about the axis of the front wheels, which are located immediately behind the floor nozzle, thus lifting the floor nozzle and the brush associated therewith away from the underlying floor surface. Preferably the manually operable lever also functions to actuate a switch arranged to increase the speed of the motor-fan unit during off-the-floor cleaning and to decrease its speed when the floor nozzle is in use, since greater suction is required for effective cleaning with tools attached to a relatively long flexible hose.

In accordance with another aspect of this invention, the axles of the front wheels of the cleaner are utilized to support a pair of levers for alterning the suction characteristics of the floor nozzle. The levers extend through slots in the top wall of the cleaner casing and may be pivoted between two opposite positions at the ends of their slots, each lever being provided with a pair of oppositely extending curved plates underlying their respective slots so that one or the other of each pair of plates is visible through the slot. One lever may be utilized as the manually operable lever mentioned in the preceding paragraph while the other lever may be connected to a closure member associated with a vent opening in the floor nozzle in such a way that the vent may be opened or closed depending upon the position of the lever. Such a vent opening is useful when the floor nozzle is used to clean deep pile rugs since it is desirable to reduce the degree of suction during a cleaning operation of this nature.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. However, the organization and method of operation of the invention, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view of a vacuum cleaner incorporating the present invention;

FIG. 2 is a fragmentary side elevation view of the cleaner shown in FIG. 1, showing the floor nozzle in floor cleaning position;

FIG. 3 is similar to FIG. 2 but shows the rear wheels of the cleaner retracted so as to lift the floor nozzle away from the floor surface;

FIG. 4 is a side view partially in section of the cleaner shown in FIG. 1;

FIG. 5 is a perspective view of the same cleaner, some of the parts broken away or removed to show details of construction;

FIG. 6 is similar to FIG. 5 except that a number of

other parts have been broken away or removed to show details of construction;

FIG. 7 is a bottom plan view of the cleaner, some of the parts being broken away;

FIG. 8 is a fragmentary cross-sectional view taken along the line 8—8 in FIG. 7;

FIG. 9 is a top plan view of the cleaner, some of the parts being broken away;

FIG. 10 is a fragmentary view of a portion of the cleaner as it appears in FIG. 9, but with the parts in a different position;

FIG. 11 is a fragmentary cross-sectional view along line 11—11 in FIG. 10;

FIG. 12 is a fragmentary sectional view along line 12—12 in FIG. 10;

FIG. 13 is a fragmentary sectional view taken generally along the line 13—13 in FIG. 9;

FIG. 14 is a fragmentary sectional view taken along the line 14—14 in FIG. 9; and

FIG. 15 is a schematic wiring diagram showing the electrical components of the vacuum cleaner.

Referring to the drawings, the vacuum cleaner illustrated therein comprises a casing generally designated by the numeral 1, a hood 2 secured on the top wall of the casing, a light transmitting window 3 supported on the casing at the front of hood 2 and a handle 4 mounted at the rear of the casing for pivotal movement about pin 4*a* which is secured to the casing. Means including a latch plate 4*b* and a spring biased latch rod 4*c* operated by a foot pedal 4*d* are provided so that handle 4 may be releasably latched in a vertical position.

A dust bag assembly 5 is secured to the rear of the casing, and also to the upper portion of handle 4 by suitable means such as a spring 6. An electric power cord 7 is attached to the upper portion of handle 4, the cord 7 being sufficiently long to permit the cleaner to be operated from an ordinary wall outlet. A line switch operating handle 8 extends from the rear of the upper portion of handle 4 so that the cleaner may be energized and denergized at the will of the operator. The patrs forming the connection between handle 4 and casing 1 are enclosed by a decorative housing 9 mounted on the lower portion of the handle.

A motor-fan unit generally designated by the numeral 10 is mounted on casing 1 within hood 2 so as to produce sub-atmospheric pressure in portion 11 of the casing. Motor-fan unit 10 includes a vertically disposed shaft 12 on which are mounted the rotor 13 of a series wound electric motor 14 and a centrifugal fan 15 located in a scroll chamber 16 in casing 1. In operation, motor-fan unit 10 functions to produce suction in a suction nozzle 17 which is horizontally disposed along the lower front edge of casing 1, and to discharge air from scroll chamber 16 into a sound muffling transition duct 18 and thence into a duct collecting bag 19.

An air passageway 16*a* in casing 1 connects scroll chamber 16 with the lower end of transition duct 18. As shown in FIG. 4, the transition duct is provided with a flanged clamping collar 18*a* on its lower end arranged to be secured to casing 1 in alignment with pasageway 16*a*. The lower edge of collar 18*a* rests between the rear edge of casing 1 and the upper rear edge of plate 18*b* which is fastened to casing 1 by screws or the like as shown in FIG. 7. A spring biased member latch 18*c* is pivotally mounted on casing 1 so as to engage the upper edge of collar 18*a* and releasably hold transition duct 18 in sealed alignment with discharge passage 16*a*.

A rotary brush 20 is mounted in suction nozzle 17 so as to be in contact with the floor surface when the cleaner casing 1 is in the position shown in FIG. 2, and is connected in driven relationship to motor shaft 12 by means of a pulley 21 and an endless belt 22. When the vacuum cleaner disclosed herein is used for floor cleaning, it is desirable that the area of the floor surface in front of the cleaner be illuminated, and accordingly, there is provided

an electric lamp 23 mounted within hood 2 in front of a reflector 24 so as to transmit light through front window 3. It will be understood that as use of the vacuum cleaner continues, dirt and litter accumulate in bag 19 and that when it becomes filled, it must be either removed and emptied or if it is of the disposable type, removed and replaced by a clean bag. The outermost covering of the bag assembly 5 is made of cloth or plastic material provided with a suitable opening (which may be closed by a zipper, if desired) allowing removal and replacement of bag 19. Bag 19 may be removably secured to the uppermost end portion 18*a* of transition duct 18 by any suitable means such as a continuous coiled spring 25.

Casing 1 of the cleaner is supported for movement on a floor surface by a left front wheel 26, a right front wheel 27, a left rear wheel 28, and a right rear wheel 29. Axles 30 and 31 on which front wheels 26 and 27 are respectively mounted are fixedly secured to casing 1, while rear wheels 28 and 29 are respectively mounted on offset axle portions 32 and 33 of an axle 34 mounted for pivotal movement on the casing in a pair of bosses 34*a* integral therewith. The central portion of axle 34 resting in bosses 34*a* is held in place by plate 18*b*, as shown in FIGS. 4 and 7. Thus, wheels 28 and 29 are mounted for limited vertical movement with respect to casing 1 so that they may be retracted to an uppermost position or extended downwardly to a downward position, permitting suction nozzle 17 to be supported in a raised position spaced from the underlying floor surface or lowered to a position in which brush 20 contacts the floor surface. It will be understood that floor nozzle 17 is supported in its raised position when the cleaner is used for off-the-floor cleaning purposes and that in this manner agitation of a single portion of a floor surface by rotary brush 20 during such cleaning is prevented.

Rear wheels 28 and 29 may be supported in either their extended or retracted positions by means including a pair of guide members 35 and 36 arranged to cooperate with a horizontally movable spacer plate 37. The upper edge 38 of spacer plate 37 is substantially straight and generally horizontal, and is arranged to ride in engagement with guide member 35 which is preferably a rotary spool provided with spaced flanges arranged to guide plate 37. Guide member 35 is mounted for rotation on a portion of casing 1 while guide member 36 is carried by axle portion 32 and is preferably a roller mounted for rotation on the outermost end of axle portion 32. The lower edge of spacer plate 37 is provided with a cam surface 39, shown in FIG. 6 as being in contact with guide member 36, an inclined cam surface 40 and another straight cam surface 41 vertically spaced with respect to cam surface 39.

Axle portions 32 and 33 are spring biased upwardly, by means now to be described, so that guide member 36 always presses against one of the other of cam surfaces 39 and 41 and straight edge portion 38 of spacer plate 37 is held in engagement with guide member 35. This is accomplished by providing a channel-shaped link 42 pivotally mounted at its lower end to axle portion 32 and at its upper end to a lever 43 supported on casing 1 by pivot pin 44. Lever 43 is spring biased upwardly, as viewed in FIG. 6, by means of a compression spring 45 so that upward force is always exerted on offset axle portions 32 and 33.

The forward end of spacer plate 37 is formed to provide a connecting portion 46 which includes a pair of laterally spaced connecting arms 47 and 48. Arms 47 and 48 are pivotally mounted on a lever 49 which in turn is pivotally mounted on casing 1 for movement between the forwardly extending position shown in FIGS. 2, 6 and 13 and the rearwardly extending position shown in FIGS. 3 and 10. It will be understood that in the forwardly extending position of lever 49 guide member 36 rests in engagement with cam surface 39 of plate 37 and that in the rearwardly extending position of the lever guide member 36 rests in engagement with cam surface 41 of plate 37. Thus, suction nozzle 17 may be positioned either in close proximity to

the underlying floor surface as shown in FIG. 2 or spaced therefrom as shown in FIG. 3.

Lever 49 extends upwardly through a slot 50 in the top wall of casing 1 and preferably this slot is located directly above front wheel 26 so that shaft 30 on which the wheel rotates may serve the additional function of supporting lever 49. Thus, as shown in FIGS. 6, 7 and 13, lever 49 includes a pair of spaced downwardly extending parallel arm portions 51 and 52 which embrace the upper portion of wheel 26 and are pivotally mounted on shaft 30. Lever 49 is maintained in either its forwardly extending position or its rearwardly extending position by an over-center spring 53 supported at its lower end by a bracket 54 fixedly secured to casing 1 and at its upper end to a flanged portion 55 of spacer plate 37. As thus shown in FIG. 13 a guide rod 56 is located within and along the axis of spring 53, being pivotally secured at its upper end to flange 55 and at its lower end to bracket 54.

In order to maintain slot 50 substantially closed at all times and to provide means for indicating the function the vacuum cleaner is conditioned to perform, a pair of curved guide plates 57 and 58 are secured to lever 49 so as to extend on opposite sides thereof along its path of movement. Guide plates 57 and 58 are located immediately below and in close proximity to slot 50 so that one or the other of them is visible to the operator in accordance with the position of the lever. Plate 57 which is visible through slot 50 when lever 49 is in the position shown in FIG. 2 may have imprint thereon in some suitable manner, the word "rug" while plate 58 may have the word "hose" imprinted thereon since plate 58 is visible when the lever is in the position shown in FIG. 3, i.e., the position in which off-the-floor cleaning may be performed by means of a flexible hose.

Off-the-floor cleaning attachment hose 59 (see FIG. 3) is adapted to be removably secured in suction inlet 60 located in the rear wall on the right side of casing 1 when viewed from behind the cleaner, as shown in FIG. 9. An aperture 60*a* may be provided in the casing wall adjacent inlet 60 to receive a latching projection (not shown) on the end portion of hose 59 in accordance with conventional practice.

Referring now to FIGS. 4 and 7, when the vacuum cleaner disclosed herein is used for floor surface cleaning, air entering floor nozzle 17 passes through a suction chamber 61 formed in part by the forward top portion of casing 1, the forward portions of the side walls of the casing, wall 62 which forms part of scroll chamber 16 and plate 63 which is provided with a generally semi-circular opening in the central portion thereof through which motor shaft 12 extends. Suction chamber 61 is also formed in part by a vertical wall 64 extending inwardly and perpendicular to the left side wall of casing 1, as viewed in FIG. 7, and continuing in a curved sweep up around the axis of motor shaft 12 and then continuing back forwardly toward the forward portion of the casing until it bends so as to interset and merge with the right side wall of casing 1. The bottom wall of suction chamber 61 is formed by soleplate 65 which is removably secured to the bottom of the casing by means of a pair of clips 66 and 67 secured to the front wall of the casing and also by means of three rotary cam shaped locking devices mounted on the casing and designated by the numerals 68, 69 and 70. The configuration of the rear portion of soleplate 65 corresponds to the configuration of vertical wall 64, and in addition includes a rearwardly extending off-set arm portion 65*a*, while the configuration of the forward portion of the soleplate conforms to the configuration of the lower edges of the forward portions of the side walls of the casing and the front wall thereof. Preferably a sealing gasket is interposed between the lower edges of the aforementioned vertical walls, including wall 64 and the corresponding portions of soleplate 65. Thus, it will be seen that floor nozzle 17 is actually formed as an opening in soleplate 65, being rectangular in configuration and extending across substantially the entire width of the soleplate.

When it is desired to use the vacuum cleaner for off-the-floor cleaning, it is necessary to prevent air-flow between suction chamber 61 and low pressure portion 11 of the casing while at the same time establishing an air-flow path between air inlet 60 and sub-atmospheric pressure portion 11. In accordance with the present invention, this is accomplished by providing shutter means arranged perpendicular to the axis of rotation of motor shaft 12 and movable about axes parallel to the motor shaft between a first position in which air-flow between air inlet 60 and sub-atmospheric pressure portion 11 is prevented while leaving the latter in communication with suction chamber 61 and a second position in which air-flow through suction chamber 61 is prevented and an air inlet 60 is placed in commuication with sub-atmospheric portion 11.

The path of air flow between air inlet 60 and sub-atmospheric portion 11 includes a tubular passageway 71 which opens into a communicating passageway defined by a depending wall 72 integral with casing 1 and having the configuration of an offset loop beginning at junction point 73 where it intersects vertical wall 64 and continuing rearwardly until it becomes an integral part of tubular wall 71 where it turns back toward the forward portion of the casing and continues until it intersects vertical wall 64 at junction point 74. Rearwardly extending off-set portion 65*a* of soleplate 65 is arranged to rest in sealing engagement with wall 72 and forms the bottom wall of the passageway being described. Finally, a portion of the top wall of this passageway is formed by the portion of plate 63 which overlies an intermediate section of the aforementioned rearwardly extending portion 65*a* of the soleplate. As shown in FIG. 7, the opening in plate 63 is semi-circular beginning at the point on wall 64 indicated by the numeral 75 and continuing for approximately 200° to the point on wall 72 indicated by the numeral 76. During floor cleaining operations, the air inlet passageway communicating with air inlet 60 is closed by a shutter 77 which, in the position shown in FIG. 7, obstructs the opening between the aforesaid passageway and sub-atmospheric portion 11. This opening is defined by the portion of wall 64 between intersections 73 and 74 on wall 72 and the curved portion of the opening in plate 63 indicated by a curved broken line.

Referring now to FIGS. 8 and 9, shutter 77 is mounted for pivotal movement about a pivot pin 78 fixedly secured to casing 1 so that the shutter may move from the position shown in FIG. 9 (the filoor cleaning position) and the position shown in FIG. 10 (the off-the-floor cleaning position). Connecting portion 79 is an integral part of shutter 77 or is otherwise fixedly secured thereto and likewise lever arm 80 is integral with or otherwise fixedly secured to connecting portion 79. The free end of lever arm 80 is provided with a projecting stud 81 arranged to ride in a slot formed in bracket 82, and bracket 82 is fixedly secured by rivets or other suitable means to spacer plate 37. Thus movement of spacer plate 37 between its forward position and its rearward position by means of manually operable lever 49 causes shutter 77 to move from the position shown in FIG. 9 to the position shown in FIG. 10.

It will be observed that when shutter 77 is in the position shown in FIG. 10 it obstructs only approximately one-half of the opening between sub-atmospheric pressure zone 11 and suction chamber 61. Therefore, a second shutter 83 mounted for pivotal movement about pivot 84 (which is fixedly secured to casing 1) is provided to substantially complete the obstruction of the aforesaid opening when off-the-floor cleaning is to be done. It will be understood that motor shaft 12 and pulley 21 are located in the central portion of this opening, and that the configurations of shutters 77 and 83 are such that the air gap between pulley 21 and the adjacent edges of the shutters

is quite small. Shutter 83 is actuated between the positions shown in FIGS. 9 and 10 by means of a link 85 pivotally connected at one end to lever arm 80 on a pivot 86 offset from pivot pin 78 and at its other end to shutter 83 on a pivot pin 87 offset from pivot pin 84.

It is important that at least portions of the surfaces of shutters 77 and 83 which are in rubbing contact with adjacent parallel surfaces and with each other be covered with a layer of felt. The primary function of the felt surfaces on shutters 77, and 83 is to prevent grains of sand, which are sometimes picked up by the floor nozzle during cleaning operations, from jamming or damaging the shutter mechanism. It has been found that sand carried by the air stream through the cleaner may enter the clearance between the rubbing surfaces of the shutters and the adjacent parallel surfaces of the cleaner. The felt surfaces to be described provide a resilient mass into which sand grains become embedded, thus preventing them from creating frictional forces resisting sliding movement of the shutters. It has also been found that normal operation of the cleaner dislodges some of the sand which enters the felt so that large quantities do not accumulate over a period of time. It is also important that the felt surfaces not be exposed to the flow of dirt-laden air from either floor nozzle 17 or suction inlet 60. The reason for this is that the abrasive action of dirt and sand impinging directly on felt quickly wears it away. The adjacent overlapping surfaces of the shutters and the bottom surfaces thereof are not so exposed under any circumstances because the former are offset to one side of the opening in plate 63 and the latter are necessarily shifted entirely out of the air-flow path during floor cleaning operations. However, portions of the top surfaces of shutter 77 and 83 are exposed to the air which enters suction inlet 60 during off-the-floor cleaning operations. Therefore, a narrow strip of felt 77*a* is secured to an edge portion of shutter 77 which underlies plate 63 in both positions of the shutter. Similarly, a narrow strip of felt 83*a* is secured to an edge portion of shutter 83 which underlies plate 63 in both of its positions. Felt surfaces 77*a* and 83*a* extend slightly above the remaining top portions of the shutter to which they are secured, by cement, for example, so that only the felt covered portions of the shutters are in rubbing contact with plate 63.

From the description thus far it will be seen that the vacuum cleaner of the present invention may be conditioned in two separate respects for either floor cleaning or off-the-floor cleaning by movement of a single manual operable lever; namely, lever 49. A third respect in which it is desirable to alter the functional characteristics of the vacuum cleaner concerns the speed of motor-fan unit 10. In off-the-floor cleaning a relatively long flexible hose is utilized to connect the cleaning tool to air inlet 60. The degree of suction produced at the end of a hose of this nature is not as great as the degree of suction produced at the point where it is attached to the vacuum cleaner casing, primarily for the reason that since the inner surfaces of the hose cannot be made perfectly smooth they therefore offer some resistance to the flow of air through the hose. Hence, in off-the-floor cleaning it is desirable to increase the speed of motor-fan unit 10 so as to compensate for this loss of suction, and in accordance with the present invention this additional function is simultaneously accomplished upon movement of lever 49 from floor cleaning position to off-the-floor cleaning position. As illustrated in FIG. 15, which shows a schematic wiring diagram of motor 14 and its electrical connections, both field windings 14*a* and 14*b* of the motor are provided with tapped connections 88 and 89 by means of which the speed of the motor may be increased. The electrical circuit shown in FIG. 15 includes a main line switch 90 actuated by switch handle 8 on the upper portion of handle 4 of the vacuum cleaner, and electric lamp 23, a normally closed handle actuated switch 91 arranged to de-energize the motor during floor cleaning operations when the handle is moved to its vertical position (to prevent rug wear if the cleaner should be left temporarily unattended) and a double pole, double throw, speed controlling switch 92. When the contacts of switch 92 are in the positions shown in FIG. 15, and assuming line switch 90 has been closed, motor 14 is energized at its lower speed so long as handle 4 is not in its vertical position. The switch contacts of switch 92 are in the position shown in FIG. 15 when lever 49 is in its floor cleaning position. Upon movement of lever 49 to its rearmost off-the-floor cleaning position, the contacts of switch 92 are shifted so as to connect taps 88 and 89 to the two sides of the line whereupon motor 14 is energized at a higher speed in accordance with well known principles of series motor operation.

Referring now to FIG. 6, it will be seen that speed changing switch 92 is mounted on casing 1 in overlying relation with respect to pivoted lever 43 and is provided with a switch actuating button 93 resting in contact with the lever. The physical position of the parts as shown in FIG. 6 correspond to the position of switch 92 and the electrical circuit established thereby shown in FIG. 15. Thus when wheels 28 and 29 are in their downwardly extending position, the motor 14 operates at its lower speed for floor cleaning operations. Rearward movement of lever 49 so as to permit roller 36 to engage cam surface 41 causes axle 32, connecting link 42 and the free end of lever 43 to move upwardly as a result of the spring force of compression spring 45. Such movement of lever 43 causes the contacts of switch 92 to make contact with tap leads 88 and 89 (FIG. 15) and thus the speed of motor 14 is increased during off-the-floor cleaning operations.

The physical location handle actuated switch 91 is shown in FIG. 4. Thus switch 91 is mounted on a boss 94 fixedly secured to casing 1 and is positioned so that its switch actuating button 95 will be depressed by projecting portion 96 secured to handle 4 whenever the handle is moved to the upright position, shown in broken lines. Thus switch 91 is normally closed and is open only when the handle 4 is moved to its vertical position. Also, it will be observed in FIG. 15 that switch 91 is not connected in the motor circuit when the cleaner is conditioned for off-the-floor cleaning operations.

Another feature of the circuit shown in FIG. 15 involves the location of lamp 23 therein. It will be observed that lamp 23 is so connected in the circuit that it is always energized when line switch 90 is energized and switch 92 is in the low speed position as shown in FIG. 15. Thus the lamp serves not only to illuminate the floor area in front of the cleaner during floor cleaning operations, but also serves as an indication that the vacuum cleaner is plugged into an electrical outlet and that the line switch 90 is closed when the cleaner is conditioned for floor cleaning operations even though the motor is not running because handle 4 is in its upright position.

During floor cleaning operations it is desirable that means be provided for altering the suction characteristics of the floor nozzle to accommodate the nozzle to carpets of varying pile thicknesses. More specifically, it is desirable that the suction produced in floor nozzle 17 be reduced somewhat when cleaning deep pile rugs. Accordingly, there is provided in wall 64, in the portion thereof between front wheel 27 and suction nozzle 17, a vent opening 97 of generally rectangular configuration. A closure member 98 disposed behind and in close proximity to the portion of wall 64 surrounding the vent opening is also provided, and the closure member 98 is secured in fixed relation to a lever 99 projecting upwardly through a rectangular slot 100 in the top wall of casing 1.

Lever 99 is similar to lever 49 both in appearance and manner of mounting. Thus lever 99 is fixedly secured to a pair of downwardly extending supporting portions 101 and 102 which are spaced so as to embrace front wheel

27 and to be pivotally supported on axle 31. Similarly, lever 99 is provided with a pair of curved plates 103 and 104 extending on opposite sides thereof along its path of movement, the curved plates being located below and in close proximity to slot 100. Suitable words or symbols may be imprinted on plates 103 and 104 such as "low" and "high" to indicate relatively low and relatively high degrees of suction. It will be understood that when lever 99 is in the forward position, as shown in FIG. 6, for example, closure member 98 is in its lowermost position in overlying relation to vent opening 97. Upon movement of lever 99 to its rearmost position in slot 100 vent opening 97 is uncovered thus permitting the entrance of air into suction chamber 61 from a zone open to the atmosphere, thus reducing the degree of suction produced in floor nozzle 17. Lever 99 is held in either its forward or rear position by over-center spring 105 coiled about rod 106 which is supported at one end on portion 107 of lever 99 and at its other end on supporting boss 108 integral with casing 1.

From the foregoing description, it will be evident that the vacuum cleaner of the present invention may be utilized to clean floor surfaces or for off-the-floor cleaning by simply manipulating lever 49 between one of its two positions. Such manipulation of the lever simultaneously positions floor nozzle 17 properly for the desired operation, actuates shutters 77 and 83 so as to provide suction in either the floor nozzle or the air inlet 60 in accordance with the mode of cleaning desired and at the same time connects the motor-fan unit 10 so as to operate at the proper speed for the desired cleaning function. Further, the cleaner is arranged so that the motor-fan unit is deenergized during floor cleaning if the handle is moved to a vertical position, thus permitting the housewife to leave the cleaner unattended for a few minutes (to answer the telephone, for example) without leaving the vacuum cleaner running. Finally, the lamp arranged at the forward portion of the cleaner is connected so as to be energized when the cleaner is conditioned for floor cleaning and connected to the electric power supply lines so as to provide illumination during floor cleaning and also an indication that the cleaner is plugged in and turned on during floor cleaning operations.

While I have shown and described a particular embodiment of my invention, I do not desire the invention to be limited to the particular construction disclosed, and I intend by the appended claims to cover all modifications within the true spirit and scope of my invention.

What I claim is:

1. A vacuum cleaner comprising a casing having a suction nozzle horizontally disposed along its lower front edge; a power driven rotary brush in said suction nozzle; means forming a suction inlet in said casing apart from said suction nozzle adapted to be connected to a flexible hose suitable for use with off-the-floor cleaning attachments; an electrically powered motor-fan unit arranged to create sub-atmospheric pressure in a portion of said casing and to drive said brush; electrical means for selectively operating said motor-fan unit at either a first speed or a second higher speed; shutter means in said casing selectively operable to place only said suction nozzle or only said suction inlet in communication with said sub-atmospheric pressure portion of said casing; means for supporting said casing for movement on a floor surface including front wheel means mounted on said casing adjacent the rear of said suction nozzle for rotation about a fixed axis and rear wheel means carried by axle means mounted on said casing adjacent the rear edge thereof, said axle means being vertically movable between a downwardly extended position and a retracted position, the extent of said vertical movement being such that said suction nozzle and said rotary brush are in contact with the floor surface when said axle means are extended and are lifted away from the floor surface when said axle means are retracted; positioning means for holding said axle in either said extended position or said retracted position; and manually operable lever means on said casing for simultaneously actuating said electrical means, said shutter, means and said positioning means to adapt to one of two operating modes, the first operating mode having said suction nozzle in contact with the floor surface and said motor-fan unit operating at said first speed to produce suction in said suction nozzle, and the second operating mode having said suction nozzle supported above the floor surface and said motor-fan unit operating at said second speed to produce suction in said suction inlet.

2. A vacuum cleaner as defined in claim 1 in which said motor-fan unit includes a series motor having a tapped field winding and said electrical means includes a two position switch connected in circuit with said motor so that the entire portion of said winding may be energized to provide said first speed or only the tapped portion of said winding may be energized to provide said second speed.

3. A vacuum cleaner as defined in claim 1 in which said sub-atmospheric portion of said casing is in part formed by a wall having an opening a first portion of said opening communicating with said suction inlet and a second portion of said opening communicating with said suction nozzle, at least one shutter mounted for rotation parallel to and in contact with said wall, said shutter being movable between a first position overlying said first portion of said opening in which said second portion of said opening is unobstructed thereby and a second position overlying said second portion of said opening in which said first portion of said opening is unobstructed thereby, and said manually operable means being connected to move said shutter between said first and second positions.

4. A vacuum cleaner as defined in claim 1 including a handle pivotally mounted on said casing adjacent the rear thereof for movement about a horizontal axis parallel to the major axis of said suction nozzle, said handle being movable about said axis between a generally horizontal position and a generally vertical position, and normally closed switch means operable to de-energize said motor-fan unit when operating at said first speed upon movement of said handle to said vertical position.

5. A vacuum cleaner as defined in claim 4 including an electric lamp carried by said casing adjacent the front thereof so as to illuminate the floor area in front of the casing, said lamp being connected in circuit with said electrical means so as to be energized whenever said motor-fan unit is operated at said first speed regardless of the position of said handle.

6. A vacuum cleaner comprising a casing having a suction nozzle arranged to clean a floor surface, means for supporting said casing for movement across a floor surface, said supporting means including an axle having an offset portion, said axle being mounted on said casing for movement between first and second vertically spaced positions with respect thereto and a wheel carried by said offset portion of said axle, said wheel being positioned with respect to said nozzle so that said nozzle is supported in a first position with respect to the floor surface when said axle is in its first position and in a second position when said axle is in its second position, first guide means mounted on said casing, second guide means mounted on said offset portion of said axle in vertically spaced relationship to said first guide means, spacer means mounted on said casing between said first guide means and said second guide means for movement between a first position and a second position, said spacer means comprising an elongated plate having a pair of vertically spaced cam surfaces connected by an inclined cam surface on one edge thereof opposite a straight edge on said plate parallel to said pair of cam surfaces, and said plate being mounted for reciprocating horizontal movement with said straight edge parallel to its path of

movement, said cam surfaces riding in engagement with one of said guide means and said straight edge riding in engagement with the other of said guide means so that said axle is in its first position when said spacer means is in its first position and said axle is in its second position when said spacer means is in its second position, and a manually operable lever connected to said spacer means for shifting said spacer means between its first and second positions.

7. A vacuum cleaner comprising a casing having a suction nozzle arranged to clean a floor surface, means for supporting said casing for movement across a floor surface, said supporting means including axle means mounted on said casing for movement between first and second vertically spaced positions with respect thereto and a wheel carried by said axle means, said wheel being positioned with respect to said nozzle that said nozzle is supported in a first position with respect to the floor surface when said axle means is in its first position and in a second position when said axle means is in its second position, first guide means mounted on said casing, said first guide means being comprised of a spool having spaced flanges, second guide means mounted on said axle means in vertically spaced relationship to said first guide means, said second guide means being a roller rotatable about the axis of said wheel, spacer means mounted on said casing between said first guide means and said second guide means for movement between a first position and a second position, said spacer means being comprised of an elongated plate having a pair of vertically spaced cam surfaces connected by an inclined cam surface on one edge thereof opposite a straight edge on said plate parallel to said pair of cam surfaces, said plate being mounted for reciprocating horizontal movement with said straight edge parallel to its path of movement, said cam surfaces riding in engagement with one of said guide means and said straight edge riding in engagement with the other of said guide means so that said axle means is in its first position when said spacer means is in its first position and said axle means is in its second position when said spacer means is in its second position, and a manually operable lever connected to said spacer means for shifting said spacer means between its first and second positions.

8. A vacuum cleaner comprising a casing having a suction nozzle at the front thereof arranged to clean a floor surface, front wheels mounted on said casing adjacent the rear of said suction nozzle, a one-piece axle having an off-set center portion pivotally mounted adjacent the rear of said casing, rear wheels mounted on the ends of said axle, said rear wheels being movable with respect to said casing between a downwardly extending position and a retracted position upon pivotal movement of said axle so as to alter the distance between said nozzle and the floor surface, first guide means mounted on said casing, second guide means mounted on said axle at one end thereof in vertically spaced relationship to said first guide means, spacer means mounted on said casing between said first guide means and said second guide means for movement between a first position and a second position, said spacer means being so shaped that said rear wheels are in their extended position when said spacer means is in its first position and in their retracted position when said spacer means is in its second position, and a manually operable lever connected to said spacer means for shifting said spacer means between its first and second positions.

9. A vacuum cleaner comprising a casing having a suction nozzle horizontally disposed along its lower front edge, means forming a suction inlet in said casing apart from said suction nozzle adapted to be connected to a flexible hose suitable for use with off-the-floor cleaning attachments, an electrically powered motor-fan unit arranged to create sub-atmospheric pressure in a portion of said casing, means for selectively operating said motor-fan unit at either a first speed or a second higher speed, means for selectively placing only said suction nozzle or said suction inlet in communication with said sub-atmospheric pressure portion of said casing, means for supporting said casing from movement on a floor surface, power driven means for agitating the portion of the floor surface underlying said suction nozzle when said motor-fan unit is operated to produce suction therein, a handle pivotally mounted on said casing adjacent the rear thereof for moving about a horizontal axis parallel to the major axis of said suction nozzle, said handle being movable about said axis between a generally horizontal position and a generally vertical position, normally closed switch means electrically connected with said motor-fan unit, said switch means being operable to de-energize said motor-fan unit and said power driven means upon movement of said handle to said vertical position, and an electric lamp carried by said casing adjacent the front thereof so as to illuminate the floor area in front of the casing and to indicate the functional setting for the cleaner, said lamp being connected so as to be energized independently of said switch means and said handle whenever the vacuum cleaner is connected to a source of power and said motor-fan unit is set for said first speed operation and only said suction nozzle is in communication with said subatmospheric pressure portion of said casing.

10. A vacuum cleaner comprising a casing having a suction nozzle horizontally disposed along its lower lower front edge, a rotary brush in said suction nozzle, means forming a suction inlet in said casing apart from said suction nozzle adapted to be connected to a flexible hose suitable for use with off-the -floor cleaning attachments, an elecrically powered motor-fan unit arranged to create subatmospheric pressure in a portion of said casing, shutter means in said casing selectively operable to place only said suction nozzle or only said suction inlet in communication with said sub-atmospheric pressure portion of said casing, means for supporting said casing for movement across a floor surface, said supportnig means including an axle having an offset portion, said axle being mounted on said casing for movement between first and second vertically spaced positions with respect thereto and a wheel carried by said offset portion of said axle, said wheel being so positioned with respect to said nozzle and brush that the brush is supported in a first position with respect to the floor surface when said axle is in its first position and in a second position closer to the floor surface when said axle is in its second position, first guide means mounted on said casing, second guide means mounted on said offset portion of said axle in vertically spaced relationship to said first guide means, spacer means mounted on said casing between said first guide means and said second guide means for movement between a first position and a second position, said spacer means being an elongated plate having a pair of vertically spaced cam surfaces connected by an inclined cam surface on one edge thereof opposite a straight edge on said plate parallel to said pair of cam surfaces, and said plate being mounted for reciprocating horizontal movement with said straight edge parallel to its path of movement, said cam surfaces riding in engagement with one of said guide means and said straight edge riding in engagement with the other of said guide means so that said axle is in its first position when said spacer means is in its first position, and said axle is in its second position when said spacer means is in its second position, and manually operable means for simultaneously actuating said shutter means and shifting said spacer means so that said brush is in its position most proximate to the floor surface when the shutter means is positioned so that only the suction nozzle is in communication with said sub-atmospheric pressure portion of said casing, and so that the brush is in its position spaced furthest from the floor surface when said shutter means is positioned so that only said suction inlet is in communication with said sub-atmospheric pressure portion of said casing.

11. A vacuum cleaner comprising a casing having a suction nozzle horizontally disposed along its lower front

edge, a rotary brush in said suction nozzle, means forming a suction inlet in said casing apart from said suction nozzle adapted to be connected to a flexible hose suitable for use with off-the-floor cleaning attachments, an electrically powered motor-fan unit arranged to create sub-atmospheric pressure in a portion of said casing, shutter means in said casing selectively operable to place only said suction nozzle or only said suction inlet in communication with said sub-atmospheric pressure portion of said casing, means for supporting said casing for movement across a floor surface, said supporting means including an axle means mounted on said casing for movement between first and second vertically spaced positions with respect thereto and a wheel carried by said axle means, said wheel being so positioned with respect to said nozzle and brush that the brush is supported in a first position with respect to the floor surface when said axle means is in its first position, and in a second position closer to the floor surface when said axle means is in its second position, first guide means mounted on said casing, said first guide means being comprised of a spool having spaced flanges, second guide means mounted on said axle means in vertically spaced relationship to said first guide, said second guide means being a roller rotatable about the axis of said wheel, spacer means mounted on said casing between said first guide means and said second guide means for movement between a first position and a second position, said spacer means being comprised of an elongated plate having a pair of vertically spaced cam surfaces connected by an inclined cam surface on one edge thereof opposite a straight edge on said plate parallel to said pair of cam surfaces, said plate being mounted for reciprocating horizontal movement with said straight edge parallel to its path of movement, said cam surfaces riding in engagement with one of said guide means and said straight edge riding in engagement with the other of said guide means so that when said spacer means is in its first position said axle means is in its first position, and when said spacer means is in its second position said axle means is in its second position, and manually operable means for simultaneously actuating said shutter means and shifting said spacer means so that said brush is in its position most proximate to the floor surface when the shutter means is positioned so that only the suction nozzle is in communication with said sub-atmospheric portion of said casing, and so that the brush is in its position spaced furthest from the floor surface when said shutter means is positioned so that only said suction inlet is in communication with said sub-atmospheric pressure portion of said casing.

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