Feb. 28, 1939. D. G. SMELLIE 2,148,656

SUCTION CLEANER

Filed Dec. 11, 1936 4 Sheets-Sheet 1

Fig. 1

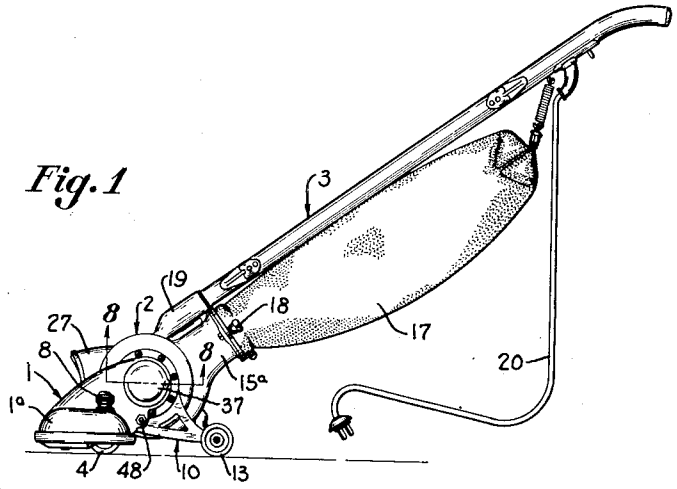
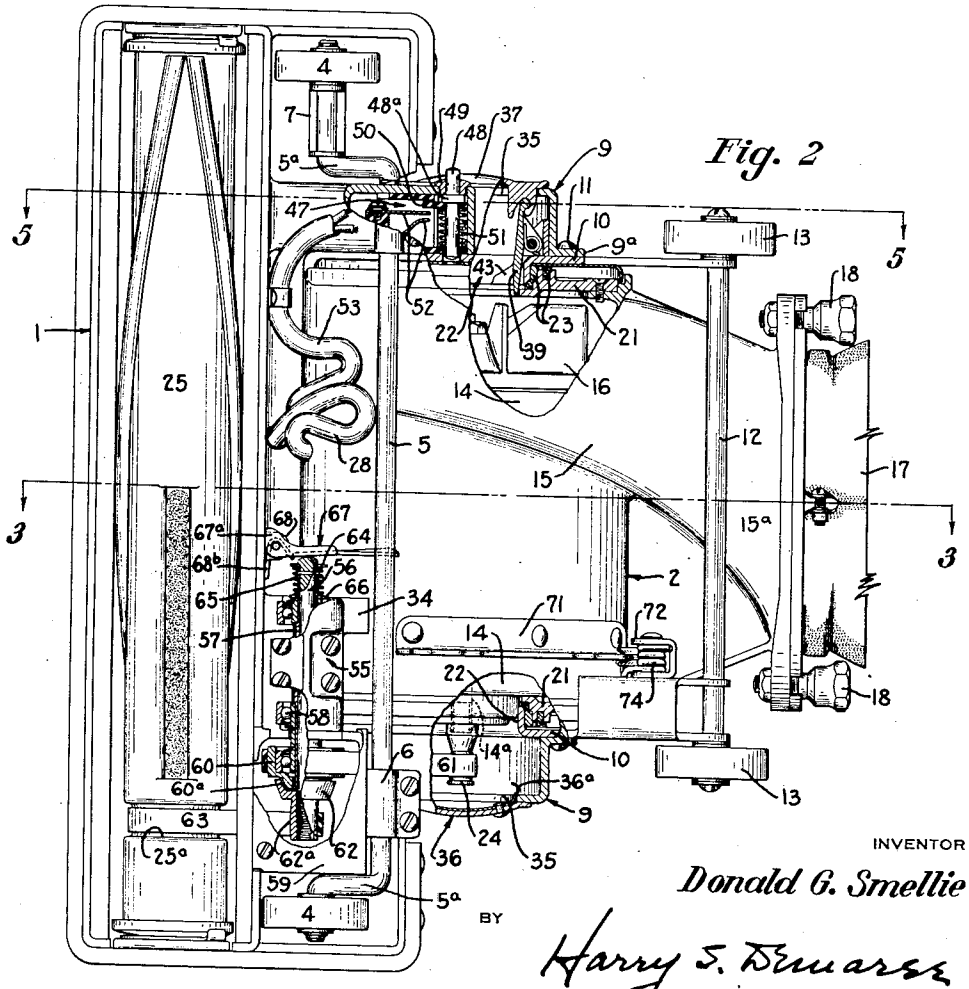


Fig. 2



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SUCTION CLEANER

Filed Dec. 11, 1936 4 Sheets-Sheet 2

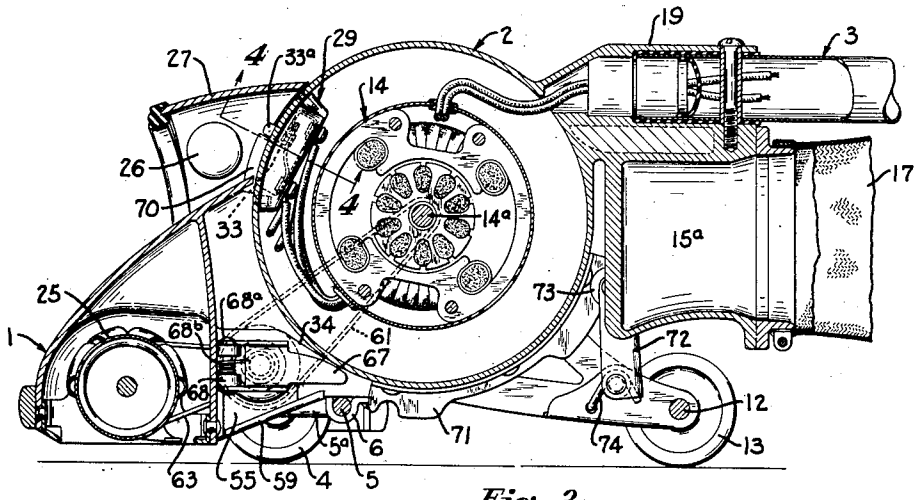

Fig. 3

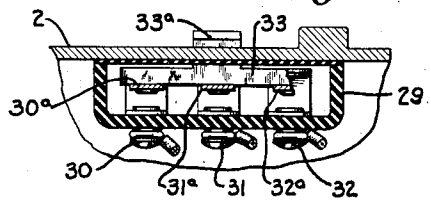

Fig. 4

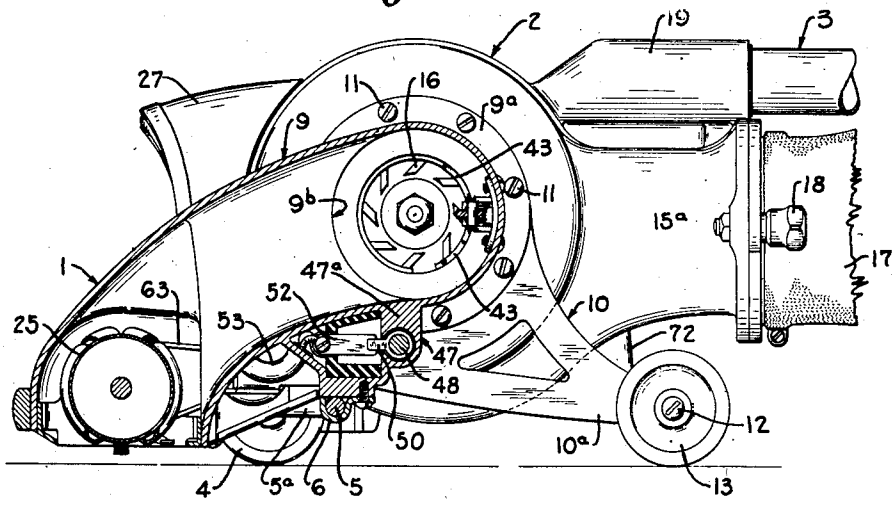

Fig. 5

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SUCTION CLEANER

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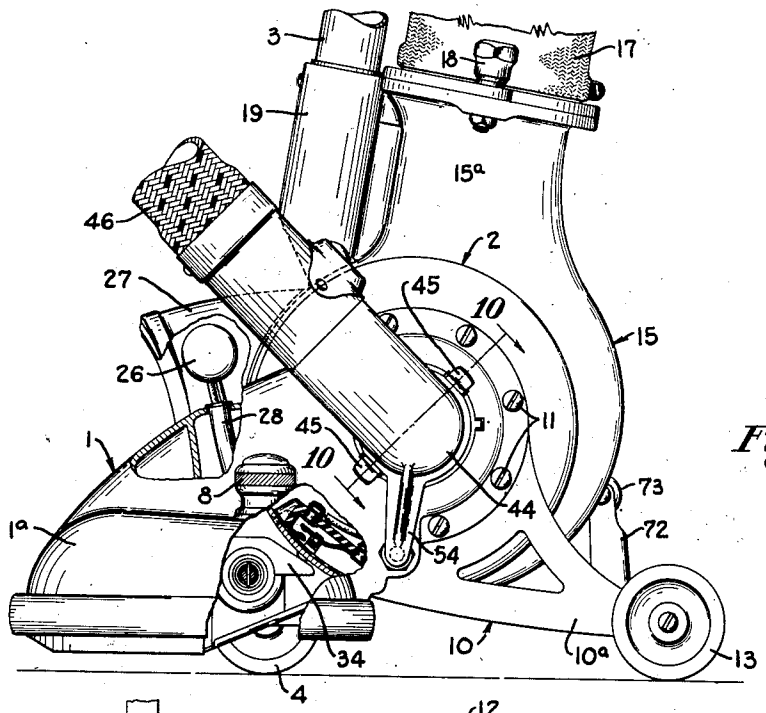

Fig. 6

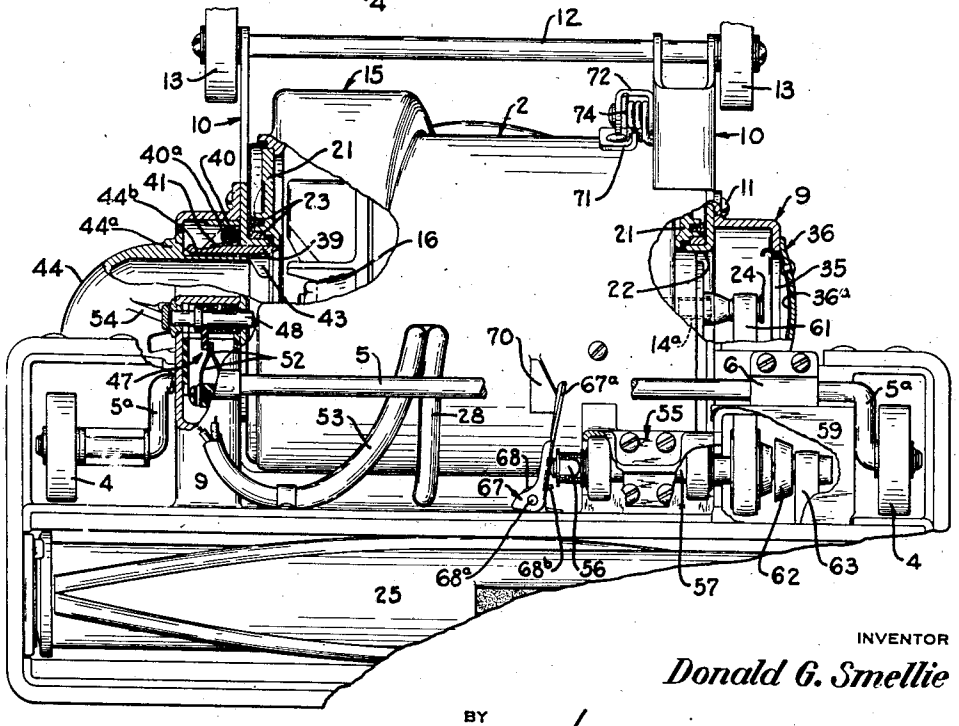

Fig. 7

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SUCTION CLEANER

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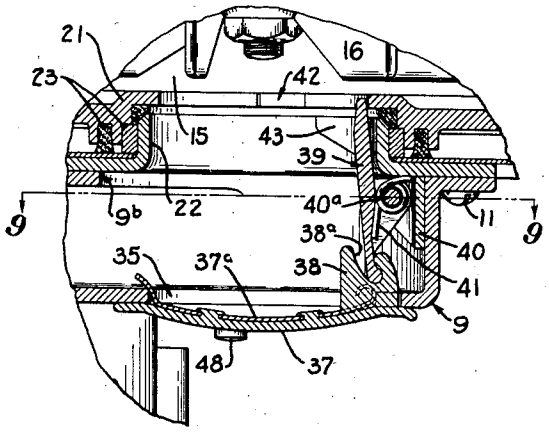

Fig. 8

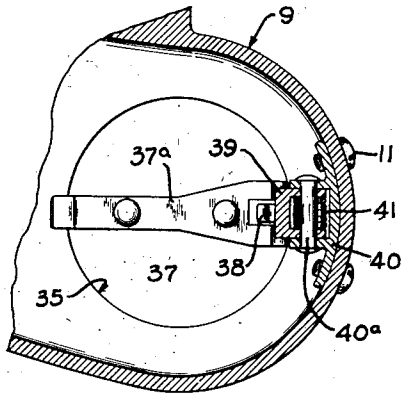

Fig. 9

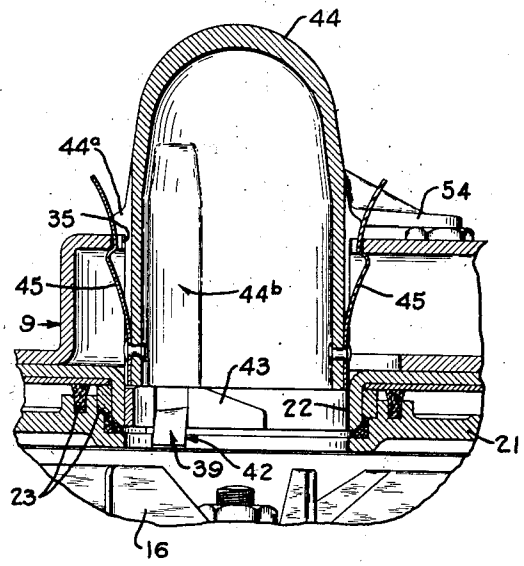

Fig. 10

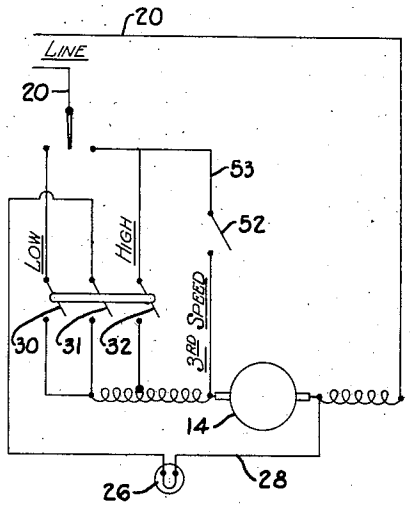

Fig. 11

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Patented Feb. 28, 1939

2,148,656

UNITED STATES PATENT OFFICE

2,148,656

SUCTION CLEANER

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Application December 11, 1936, Serial No. 115,284

16 Claims. (Cl. 15—9)

The invention relates to improvements in suction cleaners and more particularly to a cleaner that is capable of being used for off-the-floor cleaning operation in addition to its normal on-the-floor operation, the term "off-the-floor" having reference to cleaning operations carried on through a hose and auxiliary dusting tools.

The particular type of suction cleaner embodying the novel features hereinafter to be set forth, differs somewhat from the conventional cleaner design in that the motor and suction fan are housed within a cylindric casing extending horizontally of the cleaner and carried by a wheeled casing forming the main nozzle. Trunnions support the cylindric casing so that it is free to turn on its axis and through the swinging of the handle fixed thereto. A dirt receiving bag is detachably connected at one end to an exhaust outlet extending radially from the portion of cylindric housing forming the fan chamber and is attached or suspended from the handle at its upper or outer end and, since the handle and the outlet connections are both integral with the rotative motor and fan housing, the dirt bag swings with the handle and as a part of the same unit. A suction cleaner of this particular type is capable of being converted for off-the-floor cleaning operation as is true also of other styles of cleaners following the more conventional design. So, also, there are certain functional changes or rearrangements that are necessary in converting a suction cleaner from one mode of operation to the other and these will be briefly enumerated. In the first place, it is customary to equip suction cleaners of the portable handle maneuvered type with a headlight carried centrally and just above the nozzle and otherwise arranged to illuminate the area immediately in front of the cleaner, thus affording the operator a better vision of the surface over which the cleaner is being maneuvered. However, a headlight is of no use during "off-the-floor" cleaning operations, and although a switch may be provided for turning off the headlight by hand, it is preferred to control it entirely through the movement of the handle, that is, by moving the handle into and from its so-called storage position, the headlight is automatically switched off and on.

Secondly, it is desirable to increase the suction created by the cleaner during "off-the-floor" cleaning operation in order to compensate for the loss of suction due to the greatly increased length of the air passage through the hose. Increased suction is obtained by increasing the speed of the suction fan directly connected with said motor and increased motor speed is obtained by cutting out more of the resistance in series with the motor field winding. It might be stated that it is customary to provide suction cleaners with two rates of motor speed for normal floor cleaning operation, namely, "high" and "low" speeds, and controlled through a switch located near the upper end of the handle. Thus, for the off-the-floor cleaning operation, an even higher or so-called third speed is provided. But obviously, there is no particular necessity for rearranging the electrical circuits of the cleaner until the conversion from on-the-floor to off-the-floor operation actually takes place and therefore it is proposed to control a third speed switch by contact with the converter member as it is applied to the cleaner.

Moreover, while the motor is operating with the switch on third speed it is advisable that the finger operated switch on the handle remain in operation so that the cleaner can be stopped and started in the usual manner. Therefore, it is further proposed to open both the normal "high" and "low" speed motor circuits preparatory to switching over to "third" speed operation by means of handle controlled switches whereby the current supply to the motor is shut off as the handle is shifted into its upright or storage position. And further in this connection, it is proposed to combine the handle control of the motor with the control of the headlight, with the result that both circuits will be opened and closed simultaneously with the movement of the handle into and out of the so-called storage position.

But it is to be further noted that inasmuch as the third speed motor circuit is controlled by the application of the converter member, whereas the normal motor speed circuits are controlled by the movement of the handle, it follows that the handle should first be moved into storage position to open the motor circuit completely, whereupon the converter member may then be attached and the change to third speed made. Obviously then, means should be provided for preventing the third speed circuit being closed until the normal speed circuits are open, and vice versa. Therefore, still another object of the invention is to provide an interlocking arrangement which will prevent the application of the converter member to the cleaner until the handle has been shifted into its storage position.

And finally, the cleaner of the present disclosure is equipped with a rotative agitator extending lengthwise within the nozzle and having protruding beaters and brushes which are designed to contact the carpet surface during normal on-the-

floor cleaning operation. But since the cleaner remains more or less stationary during off-the-floor cleaning operation, it is quite necessary to either lift the entire nozzle portion above the floor surface so that the agitator will not contact the carpet or else to put the agitator out of operation by disconnecting it from the motor by which it is normally driven. In the present disclosure it is proposed to throw the agitator automatically out of operation by means of a clutch interposed between the agitator and the motor, said clutch being controlled by the movement of the handle with the result that, by the act of swinging the handle into its storage position, the agitator is thrown out of operation during the period that the handle remains in that position.

Thus it will be seen that there are incorporated in the present disclosure, two groups of operating changes that accompany the conversion of the cleaner from on-the-floor to off-the-floor operation, one group being controlled by the movement of the handle and the other group (in this case the third speed change) being controlled by the application of the converter member and finally, the interposing of interlocking means between groups so that one change cannot be made until another has been completed, or more specifically, the means for preventing the application of the converter member until the handle has been thrown upwardly into storage position, and opening the motor circuit preparatory to the shift to third speed.

With this introduction a more detailed description of the various features of the invention will now be described in greater detail and in connection with the drawings, in which—

Figure 1 is a general view in side elevation of a suction cleaner of the general type hereinbefore described embodying the novel features of the invention,

Figure 2 is an enlarged bottom plan view of the cleaner with portions of the outer casing wall broken away and parts shown in section,

Figure 3 is a view in vertical longitudinal section through the central portion of the cleaner as taken on line 3—3 of Figure 2,

Figure 4 is a detailed view in cross section taken on line 4—4 of Figure 3,

Figure 5 is an enlarged view in side elevation of the cleaner body with a portion at one end shown in section as taken on line 5—5 of Figure 2,

Figure 6 is a view in side elevation corresponding somewhat to the showing of Figure 5 but with the motor casing and handle assembly swung upwardly into the storage position of the handle and the converted member attached for converter operation,

Figure 7 is a bottom plan view of the cleaner corresponding generally to the showing of Figure 2 but with the motor casing and handle assembly swung into storage position and the converter member attached, as shown in Figure 6,

Figure 8 is an enlarged detail view in cross section through the converter port into the fan chamber showing the manner in which the port cover is normally locked in place to prevent the attachment of the converter member,

Figure 9 is a detail view in cross section through the converter port as taken on line 9—9 of Figure 8,

Figure 10 is a detail view in cross section taken through the converter port with the converter fitting in place as taken on line 10—10 of Figure 6, and

Figure 11 is an explanatory diagram of the electrical circuits of the cleaner and the various control switches.

Referring first to the general assembly of the suction cleaner embodying the novel features of the present disclosure and as shown in Figure 1, the body of the cleaner comprises two relatively movable sections, namely, a wheeled casing 1 devoted for the most part to the formation of a nozzle 1*a* extending transversely across the front of the cleaner and a cylindric casing or housing 2 rotatively supported on said casing 1 with its axis arranged horizontally and extending transversely thereof, and including the handle 3 as a unitary part thereof.

Referring in greater particular to the casing 1, the nozzle portion 1*a* thereof, is relatively shallow and wide although the suction mouth occupies but the forward half of its width as clearly shown in Figure 2. At the extreme outer ends of the nozzle and immediately behind the nozzle suction mouth are downwardly facing open cavities in which are located a pair of supporting wheels 4—4 which are journalled at the end of a transverse shaft 5, extending transversely beneath the underside of the casing 1 and supported in suitable bearing brackets 6, 6. The extremities of the shaft 5 are bent at right angles to form a crank arm 5*a* extending in a general forward direction and carrying the wheels 4, 4 at their ends, so that by imparting a slight rocking motion to the shaft, the forward or nozzle portions of the casing 1 may be raised and lowered bodily with respect to the surface on which the cleaner is resting. Manually adjustable means are provided for raising and lowering the nozzle through the wheels 4, 4 the same consisting generally of a threaded stem 7 pivotally connected with a crank arm at one end of the shaft 5 (as shown at the top in Figure 2), said stem extending vertically through the top wall of the nozzle portion 1*a* of the casing 1 and being surmounted by an adjusting knob 8 (Figure 1). This device for adjusting the height of the nozzle is old in the art and therefore need not be described in greater detail.

Now, just inwardly from the ends of the nozzle portion of the casing 1 are two rearwardly extending hollow sections 9—9 communicating at their forward and lower ends with the nozzle chamber and following the upward and rearwardly curved contour terminate in semi-circular ends, including an integral marginal flange 9*a* surrounding and outlining large annular openings 9*b* in the inner laterally facing walls thereof, all as clearly shown in Figure 5. These rearwardly extending casing sections 9, 9 form a rearwardly facing U-shaped recess in which is located the rotative housing 2 which is journalled in a manner presently to be described.

Fastened to the inner faces of flanges 9*a* of the segment 9, 9 are plates 10, 10 permanently fixed thereto by means of screws 11 to thus become integral parts of the casing 1. These plates 10, 10 are extended rearwardly and downwardly in the form of arms 10*a*, 10*a*, which support at their lower extremities, a transverse axle 12 on which is journalled a pair of wheels 13, 13. Thus the casing 1 provides a wheeled carriage on which the rotative housing 2 is supported substantially midway between the front and rear pair of supporting wheels.

Referring now to the rotative housing 2, one-half (on the bottom in Figure 2) encloses the driving motor 14 while the remainder forms fan chamber 15. Within the fan chamber is located

the suction fan 16 having direct driving connection with the motor 14, being mounted on an extension of the armature shaft 14a thereof. The portion of the casing 2 which constitutes the fan chamber is identified not only by the fan enclosed therein but by a somewhat helical enlargement gradually increasing in width and radial dimension throughout substantially one-half the circumference of the housing and then extending tangentially therefrom to form the flanged exhaust outlet 15a from the fan chamber and to which the fabric dust bag 17 is removably attached through the medium of clamping bolts 18. Immediately above the outlet connection 15a from the fan chamber and formed integral with the housing 2 is a socket member 19 adapted to receive the cleaner handle 3. Except for the mounting of the handle on the rotative housing 2, there is nothing unusual in its construction or equipment, being preferably a hollow tube through which the current supply conductors pass, after entering the handle near its outer end as a long extension cord 20 in accordance with the approved practice (Figures 1 and 3).

It is to be noted in passing that inasmuch as the handle 3 is integral with the rotative motor housing 2 and the dirt bag 17 is carried by both, the bag becomes a part of the rotative motor and fan chamber unit, and hence is not subjected to the usual bending and flexing that obtains where the handle swings relative to the fan chamber. Hence much of the destructive wear and tear on the bag is eliminated.

Referring to the mounting of the rotative cylindric housing 2 on the wheeled casing 1 and between the rearwardly extending sections 9, 9 thereof, it will be noted, as shown in Figure 2, that the end walls of the housing 2 are formed by circular end plates 21, 21 having centrally disposed annular openings, and that the plates 10, 10 which form the supporting arms for the rear wheels 13, 13 of the casing 1, are also provided with annular openings registering with the end openings in the housing 2, and surrounded by inwardly extending marginal flanges 22 which fit and project into said openings. These annular flanges 22, 22 form bearings and with the addition of suitable sealing rings as at 23, complete the trunnions for the cylindric housing 2.

Now, the openings at each end of the rotative housing 2 are enclosed by the ends of the hollow sections 9, 9 of the casing 1 which form passageways leading forwardly to the nozzle chamber. Referring to Figure 2, the passageway through the section 9 at the left hand end of the housing 2 communicates directly with the fan chamber, and it is through this passageway that the dust-laden air passes from the nozzle chamber into the fan chamber and finally discharges from the exhaust outlet 15a and into the dirt bag 17.

At the opposite end of the cylindric housing 2 (the lower end in Figure 2), the armature shaft 14a projects through the opening and into the upper end of the passageway formed by the companion section 9, carrying at its end a drive pulley 24, which ultimately drives a rotative agitator 25 extending lengthwise of the nozzle chamber and just above the suction mouth.

The rotary agitator 25 consists of a metallic shell having brush and beater elements projecting from its surface, the tip ends of these elements projecting a short distance below the plane of the suction mouth for contact with the carpet surface. The agitator is driven from the pulley end of the motor shaft through an arrangement of belts and an intermediate clutch mechanism operative to throw the agitator out of operation when the cleaner is being used for off-the-floor cleaner operations as previously described. However, a detailed description of agitator drive and clutch mechanism will be preceded by a discussion of certain other features of the cleaner construction.

It has been previously stated that the cleaner is equipped with a headlight for illuminating the floor surface in front of the nozzle. This means of illumination consists of a small lamp 26 enclosed within a hoodlike enclosure 27, formed integral with the top wall of the wheel casing 1 and located centrally of and immediately forward of the rotative motor and fan housing 2. This enclosure or hood is open at its front side and is so shaped as to direct the rays from the lamp in a forwardly and downwardly inclined direction. The lamp is supported in a standard socket and current for the lamp is carried thereto through a conductor cable 28 forming a part of the electrical circuit of the cleaner. As shown in the wiring diagram, Figure 11, the lamp circuit 28 is connected in parallel with the high and low motor speed circuits and likewise with the third speed circuit for converter suction operation.

As further shown in Figures 3 and 4 a small switch box 29 is fastened on the inside surface of the cylindric housing 2, occupying a portion of the space surrounding the motor 14. The normal position of this switch box is toward the front of the housing and, in the swinging movement of the latter, traverses an arc of substantially 90 degrees. This switch box is made of a suitable insulating material, such as a molded plastic substance, and anchored in the wall thereof is a group of three switches 30, 31 and 32, having external binding posts and fixed contacts within the switch box, the latter being adapted to contact corresponding spring contact fingers 30a, 31a, and 32a, respectively, consisting of flexible metal strips anchored in the wall of the switch box and also provided with externally exposed binding posts.

Also mounted within the switch box 29 is a switch bar 33 extending transversely adjacent the free ends of the parallel contact fingers and having a centrally disposed button-like projection 33a which passes radially through an aperture formed in the cylindric wall of the housing 2, and a short distance beyond, so that by pressing inwardly on the button the switch bar will open the three circuits simultaneously through the switches 30, 31 and 32. Presently, the means for automatically pressing the button of the switch bar inwardly to open these three circuits will be described, but for the present it is to be understood that normally the several circuits remain closed by the inherent resiliency of the spring contact fingers forming the movable members of the three switches. As shown in the wiring diagram, Figure 11, the intermediate switch 31 controls the lamp circuit 28 while the outermost switches 30 and 32 control the normal "high" and "low" speed motor circuits respectively. No attempt will be made to identify each and every conductor making up the electrical circuits of the cleaner since they follow standard electrical practice, although it may be pointed out, and as is readily discernible from the wiring diagram of Figure 11, that the three circuits mentioned, namely, the high and low speed motor circuits and the headlight circuit, will be simultaneously

opened and closed by the switch bar **33**. Again, it will be noted that the third speed circuit (and so designated on the wiring diagram Figure 11) is connected in parallel with the high speed circuit so that with the low and high speed motor circuits open, the third speed circuit can be controlled either by the handle mounted switch or by a separate switch operative by the suction converter member in its application to the cleaner, as will presently be pointed out.

But continuing the discussion of the three circuits arranged to be simultaneously opened and closed by the button pressed switch bar **33**, attention is now directed to Figures 2, 3 and 6 in particular, where there will be observed a wedged shape cam **34** projecting horizontally and rearwardly from the rear of the nozzle chamber near the base of the casing **1**, and terminating almost in contact with the outer surface of the cylindric housing **2**. This cam, with its surface substantially tangential to the periphery of the housing **2**, is located in the path of button projection **33***a* of the switch bar **33**. In Figure 3 it will be noted that the handle **3** extends horizontally and parallel to the floor level and that the angular position of the cylindric housing **2** is such that the switch box **29** with the switch button **33***a* projecting therefrom is positioned just behind the headlight hood **27**. Now, by rotating or raising the handle to its vertical or so-called "storage" position as shown in Figure 6, the entire motor and fan assembly is swung in a counterclockwise direction through an arc of approximately 90 degrees thus carrying the switch button **33***a* downwardly and in contact with the inclined face of the cam **34**, this contact pressing the switch bar **33** inwardly and thus opening the head light circuit as well as the high and low speed motor circuits. In short, the movement of a handle into its upright or storage position puts both the motor and headlight out of operation.

Now, as explained in the introduction, the movement of the handle into storage position is the first step in the operation of converting the cleaner for off-the-floor cleaning operation. The second step, then, is the mounting of the converter member to which one end of the suction hose is connected.

As clearly shown in Figures 2, 8 and 9, there are provided in the vertical and outwardly facing side walls of the two integral sections **9,9** of the casing **1**, annular openings or ports **35, 35** concentric with and having substantially the same diameter as the openings in the end of the cylindric housing. These ports **35, 35** are normally closed by removable cover plates **36** and **37** circular in shape and slightly convex outwardly, being held in place by means of diametrically arranged leaf springs **36***a* and **37***a* respectively, riveted to the backs of these plates and provided with rounded end clips which snap over the edges of the ports when the cover plates are pressed into place.

Figures 8 and 9 show the manner in which the cover plate **37** for the port **35** at the fan end of the cleaner is held in place, this port being the one into which the converter member is inserted in the act of converting the cleaner to off-the-floor operation. This cover plate is not only equipped in the spring clips for holding it in place, but with a locking or latching device which prevents its removal from the port and therefore the attachment of the converter member, unless the handle has first been swung to its upright or storage position. Moreover, after the handle has been moved to its upright position and the conversion made, the latching device also acts to hold the handle in that position until the cleaner has been restored to position for off-the-floor operation.

Thus, the converter port cover plate **37** is provided with an integral tongue **38** projecting at right angles from its inner face and adjacent the edge thereof. This tongue is elongated somewhat in a radical direction and extending inwardly from its tip end is a notch **38***a* curving slightly in an outward direction toward the periphery of the plate and terminating at its bottom in a rounded seat as clearly shown in Figure 8.

Now, coacting with the tongue **38** on the cover plate **37** is a spring-pressed latch member **39** extending horizontally inward from the edge of the plate just clearing the inner surface of the flange forming the opening or "eye" to the fan chamber, and pivotally mounted intermediate its ends upon a fixed bracket **40** located just outside of the said eye. The bracket **40** includes a pin **40***a* around which is coiled a torsion spring **41** acting upon the latch member to press its innermost end against the edge of the fan eye. The outer extremity of latch member **39** is a slightly enlarged and rounded end and is adapted to fit within slot **38***a* of the port member **37** and in its latched position. Thus, when the port cover **37** is in place the outer end of the latch member engages the notched tongue **38** and the latch member is held stationary with its inner end in contact with the edge of the opening leading into the fan chamber.

But, as shown in Figures 8 and 10, a notch **42** is cut in the edge of the central opening in the adjacent end plate **21** of the rotative housing **2** immediately inwardly from the edge of the annular flange **22**. Moreover, this notch **42** is so located circumferentially of said opening, that in swinging the handle into its upright position, said notch will register with the inner end of the latch member, allowing the latter to rock slightly under the action of its spring and into latching engagement therewith at the same time releasing the cover plate so that the latter can now be removed to permit the converter member to be inserted into the port **35**.

Thus, it will be seen that the latch member performs a two-fold duty, namely, locking the port cover plate **37** against removal and thus preventing the insertion of the converter member into the converter port until the handle has first been swung upwardly into its storage position and, secondly, having completed the conversion it prevents the handle from being shifted or displaced from its upright or storage position until after the converter member has been removed and the port cover plate **37** replaced.

And finally, to prevent any possible damage to the latch member as the result of an attempt on the part of the operator to swing the handle while it is locked in storage position, metal reinforcing segments **43, 43** are preferably welded to the inner face of the flange **22** forming the fan "eye", these segments **43, 43** being spaced apart circumferentially to provide a notch for the latch member and thus relieve the strain or shock resulting from a sudden blow or force applied to the handle while still latched in storage position.

Thus it will now be seen that having once removed the cover plate **37**, having previously shifted the handle into its storage position, the conversion operation can now be completed together with the switch over to the high-speed motor operation as will now be described.

Referring now more particularly to Figures 6, 7 and 10 the converter member 44 is nothing more than a light metal elbow fitting having at one end a portion of a slightly reduced external diameter dimensioned to fit snugly into the converter port 35, and cutting off the normal air inlet passageway to the fan chamber by seating the "eye" thereto. As shown in Figure 10, a pair of spring locking clips 45, 45 are attached adjacent the end of the fitting and extending rearwardly are adapted to engage the edges of the converter port 35 to hold the fitting in place. An annular shoulder 44a insures the proper seating of the fitting in the converter port and a longitudinal slot 44b in the outer end surface provides clearance for the latch member 39. The opposite end of the converter fitting is arranged to receive one end of the dusting tool hose 46 with a suitable finger releasable latching device.

Now recalling that the application of the converter member 44 is to be accompanied by a switch over to the third speed, the means for accomplishing this now will be described with particular reference to Figures 2, 5, and 7.

Immediately below the converter port 35 on the fan chamber side of the cleaner is a switch box 47 formed by wall segments integral with the casing 1 and in which are mounted the parts of a switch for opening and closing the so-called third speed circuit of the motor. This switch comprises a spring plunger 48 extending horizontally and transversely of the switch box just beneath the converter port and supported for limited endwise movement within a bearing 47a formed by the rear wall of the switch box 47. (Figure 5.) One end of the plunger normally projects through a bushing 49 at the outer end of the bearing, a collar 48a on the plunger limiting the projecting end to about one-fourth of an inch in length. Carried by the plunger 48 is a contact member 50 of a suitable insulating material and having the form of a finger projecting laterally and forwardly into the main part of the switch box or casing in which the circuit closing members are located. A coil spring 51 surrounds the plunger 48 and bearing against the annular flange, the collar 48a adjacent holds the plunger in its normal position.

Located in the path of the contact member 50 carried by the plunger 48 is a pair of spring contact members 52, 52 mounted in spaced relation on suitable insulated supports. These contact members 52, 52 form the switch in the third speed circuit 53 of the motor connected in parallel with the normal high speed circuit as shown in Figure 11.

The third speed circuit controlling switch is manifestly open during normal cleaning operation and closed only during converter operation, the closing of the circuit being accomplished by the application of the converter fitting 44 and directly by the pressing inwardly of the plunger 48 of the switch by a contact finger 54, integral with the fitting 44 and projecting radially from the end portion which is inserted into the converter port. The action of the third speed switch accompanying the attachment of the converter fitting 44 will be clear from a comparison of Figures 2 and 7.

Thus to summarize the steps in changing over the motor for off-the-floor operation; first, swinging the handle into its storage position simultaneously opens the normal low and high speed motor circuit switches 31 and 32, as well as the headlight circuit switch 31, and, second, by the attachment of the converter fitting 44 the third speed motor circuit switch 52 is closed.

All of the several handle or converter controlled changes incident to conversion to off-the-floor operation, have been described in detail with the exception of the clutch mechanism which renders the agitator inoperative. Referring now particularly to Figures 2, 3 and 7, this clutch mechanism and its operation will be readily understood. Essentially, the clutch consists of a simple form of cone clutch introduced between a pair of drive belts, one extending from the motor-driven pulley to an idler pulley carried by an intermediate or jack shaft and the other from a pulley on the jack shaft to the agitator.

The clutch mechanism is preferably located on the underside of the main casing 1, just behind the nozzle opening and in line with the pulley end of the motor. A two-part bearing 55, having its upper half formed integral with the casing 1 is located just inwardly from the casing section 9 forming the passageway for the drive belt. A horizontal transversely extending jack shaft 56 is journaled in this bearing, being enclosed throughout the greater part of its length by a sleeve 57 which in turn is supported by ball bearings 58, 58 forming a part of the main clutch bearing 55. One end of the clutch assembly extends endwise beyond the bearing 55 and to the right as shown in Figure 7, and into a chamber or cavity closed at its bottom by a removable plate 59 but opening rearwardly to the passageway for the primary drive belt and opening forwardly into the nozzle chamber, this chamber being actually an enlargement of the passage formed by the rearwardly extending section 9 of the casing 1 on the motor side of the cleaner.

Mounted on the extended end of the shaft 56 is an idler pulley 60 in alignment with the pulley 24 at the end of the motor shaft 14a and carrying a drive belt 61. As clearly shown in Figure 2, the idler pulley 60 is journalled on the bearing sleeve 57 and carries on its outer face an integral friction clutch member 60a of a frustro-conical shape arranged concentrically with the axis of the shaft 56. Co-acting with the clutch member 60a is a complementary clutch member 62 fixed to the end of the shaft 56 and including a pulley 62a carrying a belt 63 extending forwardly and engaging a belt groove 25a near the adjacent end of the agitator 25.

The opposite or inner end of the shaft 56 together with its surrounding sleeve 57 projects a short distance beyond the same end of the bearing 55, although the shaft 56 also extends a somewhat greater distance and beyond the end of the sleeve 57 where it terminates in a shoulder 64 against which one end of a coiled tension spring 65 abuts its inner end similarly abutting a collar 66 surrounding the sleeve 57 and bearing flatwise against the end of the bearing 55. Thus, the spring acts to force said shaft 56 endwise and inwardly to the left as in Figure 7, it being now evident that the shaft 56 is capable of a limited endwise sliding movement within the sleeve 57, in fact, just enough to frictionally engage and disengage the two clutch members 60a and 62 carried at the outer ends respectively of the shaft 56 and the tubular sleeve 57.

Located just beyond the inner end of the shaft 56 is a clutch throw-out lever 67 pivotally mounted on the vertical rear wall of the nozzle chamber by means of a bracket 68 including a pivot pin 68a and a tension spring 68b acting to maintain the lever 67 in a position substantially perpendicular

to the axis of the shaft 56 and against movement on its rockerlike foot portion 67a as clearly shown in Figure 2. At the outer extremity of the throw-out lever is a flat contact finger having its pointed end warped slightly out of its vertical plane. Coacting with the throw-out lever 67 is an operating member 70 carried by the rotative housing 2 and consisting of a cam-like lug projecting from the outer surface thereof, the location of this lug being such that upon the swinging of the handle into its vertical or storage position it contacts the face of the warped contact finger 67 of the clutch throw-out lever thereby swinging it laterally to shift the shaft 56 endwise and thus disengage the external clutch member 62. By this action of the clutch mechanism, the idler pulley 60 continues to rotate freely on the sleeve 57, being driven by the belt 61 directly from the motor, whereas the agitator 25 ceases to rotate with the jack shaft 56 and remains stationary until the handle is swung downwardly from its storage position, whereupon the cam 70 releases the throw-out lever and the clutch is thrown in to connect the agitator 25 with the motor.

It may be added that, the cleaner of the present disclosure is preferably equipped with means for yieldably holding the rotative housing 2 in the several positions to which it may be shifted by the handle. This means consists of a cam sector 71 fixed to the outer surface of the housing 2 and extending throughout an arc of substantially 90 degrees circumferentially of said housing and normally moving throughout a semi-circular path at the rear of the cleaner. This sector 71 consists primarily of a radially projecting flange in which marginal notches are formed at each end, as well as a somewhat extended recess intermediate its ends, as clearly shown in Figure 3. Coacting with the handle position control sector 71 is a spring pressed arm 72 mounted to swing on a pivot adjacent the rear axle 12 and, extending vertically upward therefrom supports at its upper end a cam roller 73 which bears against the edge of the cam sector under the tension of a torsion spring 74, with sufficient force to support the housing against rotation in its extreme positions, as well as limiting the arc through which the handle may freely swing in what is commonly termed the working range. While the means shown for retaining the handle free swinging movement, is a common expedient in suction cleaners, it is mentioned because some such position controlling means is especially desirable where the movement of the handle into and out of its upright or storage position controls one or more functional changes in the operation of the cleaner.

To summarize the sequence of operations to be performed in converting the cleaner from on-the-floor to off-the-floor operation, the first step is to swing the handle upwardly into its upright or storage position as shown in Figures 6 and 7. In this upward movement of the handle the following alterations in the functions of the cleaner take place: First, the current supply to the headlight is cut off through the handle controlled switch 31, thus economizing on the use of electric current by the lamp as well as increasing the life of the lamp itself; second, the motor is shut off by the opening of the switches 30 and 32, and, third, the agitator is disconnected from the motor by the operation of the clutch mechanism and, lastly, with the handle in its upright position, the cleaner is prepared for the final act of conversion and is accomplished by first removing the cover plate 37 from the converter port (having been released by the shifting of the handle position), and then inserting the converter fitting 44 into the opening to the fan chamber, and simultaneously closing the third speed motor circuit, thus starting the motor for operation at the increased suction producing speed required for dusting tool operation.

And in conclusion it is to be observed that the various functional alterations performed in converting the cleaner to off-the-floor operation, are definitely related to each other, either as progressive steps in a sequence or as interlocking functions whereby one cannot be completed until one or more others have taken place, thus making for greater flexibility and safety of operation.

I claim as my invention:

1. In a suction cleaner adapted to be converted to and from off-the-floor operation, the combination of a casing having suction-creating means, a nozzle and a converter port, a motor for driving said suction-creating means and having a plurality of speed regulating circuits, a movable handle, a switch controlled by the movement of said handle into a predetermined position to control one of said circuits, said converter port being adapted to receive a converter member operative to control the other of said circuits, and means operative to regulate the order in which said circuits are opened and closed.

2. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having suction-creating means, a nozzle and a converter port communicating with said suction-creating means, a motor for driving said suction-creating means and having a plurality of different speed circuits, a movable handle, a switch controlled by the movement of said handle to open one of said circuits, said converter port being adapted to receive a converter member, a switch operative by said converter member to close the other of said circuits, and means acting to prevent the closing of said last mentioned circuit until said first mentioned circuit has been opened.

3. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having suction-creating means, a nozzle leading to said suction-creating means and a converter port also communicating with said suction-creating means, a motor for driving said suction-creating means and provided with a plurality of circuits for operating the same at a normal and at a relatively high speed, a movable handle carried by said casing and adapted in its movement to and from a predetermined position to open and close the normal speed circuit, said converter port being adapted to have a converter member attached thereto and in its attachment to close the high speed circuit, and a barrier normally preventing the attachment of said converter member and releasable by said handle in its movement into position to open said first mentioned circuit.

4. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle and a normally closed converter port, suction-creating means communicating with said nozzle and said converter port, a motor for driving said suction-creating means, a movable handle carried by said casing, said motor having a plurality of speed regulating circuits, one of said circuits being controlled by the movement of said handle to and from a predetermined position of rest, a

converter member adapted to be attached to said cleaner at said converter port and to control another of said circuits whereby said motor is operated at a different speed during off-the-floor cleaning operation and means acting to prevent the closing of one of said motor circuits until the other has been opened.

5. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle and a normally closed converter port, suction-creating means communicating with said nozzle and said converter port, a motor for driving said suction-creating means, a movable handle carried by said casing, said motor having a plurality of speed regulating circuits, one of said circuits being controlled by the movement of said handle to and from a predetermined position of rest, a converter member adapted to be attached to said cleaner at said converter port and to control another of said circuits whereby said motor is operated at a different speed during off-the-floor cleaning operation, and means for preventing the movement of said handle from its circuit opening position while said converter member is attached to said cleaner.

6. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle and a converter port, suction-creating means communicating with said nozzle and said converter port, a motor for driving said suction-creating means, a movable handle carried by said casing, said motor having an auxiliary speed regulating circuit for increasing the speed during off-the-floor operation and a switch in said circuit, a converter member adapted to be attached to said cleaner and adapted to control the action of said high speed switch during off-the-floor cleaning operation, and locking means acting to prevent the closing of one of said motor circuits until the other has been opened.

7. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle and a converter port, suction-creating means communicating with said nozzle and said converter port, a motor for driving said suction-creating means, a handle carried by said casing and adapted to be swung to and from a predetermined position of rest, said motor being provided with a plurality of circuits for operating the same at different speeds and each circuit having a switch therein, one of said switches being operated by said handle whereby the same is opened in the movement of said handle into its said predetermined position of rest, operating means for the other of said switches adapted to function in the conversion of said cleaner to off-the-floor cleaning operation to close its associated motor speed circuit, and means operative to prevent the closing of said last mentioned circuit unless said first mentioned circuit is open.

8. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle, suction-creating means having an air passage communicating with said nozzle and a converter port communicating with said air passage, a driving motor for said suction-creating means having a plurality of circuits for operating at different speeds, a handle carried by said casing and adapted to swing to and from a predetermined position of rest, a converter member adapted to be inserted into said port, one of said motor circuits being adapted to be opened in the movement of said handle into its said predetermined position of rest, and the other of said motor speed circuits being adapted to be closed in the act of attaching said converter member at said port, and means actuated by the movement of said handle to prevent the attachment of said converter member except when said handle is in its predetermined position of rest.

9. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle, a suction-creating means having an air passage communicating with said nozzle, and a converter port communicating with said air passage, a closure member for said converter port, a driving motor for said suction-creating means having a plurality of circuits for operating at different speeds, a handle carried by said casing and adapted to swing to and from a predetermined position of rest, a converter member adapted to be inserted into said port upon the removal of said closure member, a handle controlled switch adapted to open one of said motor circuits in the movement of said handle into its said predetermined position of rest, a switch in the other of said motor speed circuits and adapted to be closed in the attachment of said converter member at said port, and latching means normally holding said closure member against removal from said converter port but operative by the movement of said handle into its predetermined position of rest to release said closure member.

10. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle, suction-creating means having an air passage communicating with said nozzle, and a converter port communicating with said air passage, a driving motor for said suction-creating means having a plurality of circuits for operating at different speeds, a handle carried by said casing and adapted to swing to and from a predetermined position of rest, a converter member adapted to be inserted into said port, one of said motor circuits being adapted to be opened in the movement of said handle into its said predetermined position of rest, and the other of said motor speed circuits being adapted to be closed in the act of attaching said converter member at said port, and means actuated by the movement of said handle to prevent the attachment of said converter member except when said handle is in its predetermined position and thence to lock said handle in its predetermined position of rest while said converter is attached.

11. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle, a suction-creating means having an air passage communicating with said nozzle and a converter port communicating with said air passage, a closure member for said converter port, a driving motor for said suction-creating means having a plurality of circuits for operating at different speeds, a handle carried by said casing and adapted to swing to and from a predetermined position of rest, a converter member adapted to be inserted into said port upon the removal of said closure member, a handle controlled switch adapted to open one of said motor circuits in the movement of said handle into its said predetermined position of rest, a switch in the other of said motor speed circuits adapted

to be closed in the attachment of said converter member at said port, and latching means normally holding said closure member against removal from said converter port but operative by the movement of said handle into its predetermined position of rest to release said closure member and thence to lock said handle in said predetermined position of rest while said closure member is removed from said converter port.

12. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a movable handle, a suction-creating means, a motor for driving said suction-creating means and having a normal speed circuit and a higher speed circuit for off-the-floor operation, a headlight including a lamp circuit, switches in said circuits, a handle controlled switch operating member for opening and closing said normal motor speed and headlight circuits, and means for converting said cleaner to off-the-floor cleaning operation and simultaneously closing said higher motor speed circuit, and means controlled by the movement of said handle and acting to prevent the completion of the converting operation unless said normal speed motor circuit is open.

13. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle and a headlight, suction-creating means and a driving motor therefor carried by said casing, said motor being wired for normal speed operation for on-the-floor operation and a higher speed for off-the-floor operation, means for controlling the speed of the motor including switches, said headlight including a lamp circuit having a switch therein, a handle carried by said casing and adapted to be swung relatively thereto to and from a predetermined position of rest, a switch-operating member controlled by the movement of said handle and adapted to actuate said normal speed motor switch and said headlight lamp circuit switch whereby both are open while said handle is in its predetermined position of rest, a converter member adapted to be attached to said cleaner and operative to close the switch controlling the higher speed of said motor, and a barrier member normally acting to prevent the attachment of said converter member and releasable by the movement of said handle to permit said converter member to be attached when the normal speed circuit is open.

14. In a suction cleaner adapted to be converted to and from off-the-floor cleaning operation, the combination of a casing having a nozzle, a housing enclosing suction-creating means and a driving motor therefor journalled on said casing, a handle rigidly mounted on said housing, said motor having a normal speed for on-the-floor cleaning operation and a higher speed for off-the-floor operation, means for controlling the speed of the motor including switches, a switch-operated member carried by said housing and adapted in the movement of said handle to actuate said normal motor speed switch to open the same while said handle is in a predetermined position of rest, a converter member adapted to be attached to said casing and simultaneously to close the switch controlling the higher speed of said motor, and a barrier member operative by said handle to permit the attachment of said converter member only when said normal motor speed switch has been opened.

15. In a suction cleaner, the combination of a casing having a nozzle, a cylindric housing supported on said casing to rotate about a horizontal axis, a motor mounted axially of said housing, a fan directly connected with said motor and enclosed within a portion of said housing forming a chamber and an exhaust outlet therefor, said casing having an air passage connecting said nozzle with said fan chamber at one end of said housing and a converter port communicating with said air passage, a handle fixed to said rotative housing, a plurality of motor speed regulating switches carried by said housing, a stationary switch operating member mounted on said casing and located in the path of said switch operating member whereby said motor regulating switches are opened by contact with said switch operating member in the swinging movement of said handle into a predetermined position of rest, another motor speed regulating switch supported by said casing and including a shiftable switch member exposed adjacent said converter port, and a converter member adapted to be inserted in said port and to contact the shiftable switch member of said last mentioned motor speed regulating switch.

16. In a suction cleaner, the combination of a casing having a nozzle, a cylindric motor and fan housing supported on said casing to rotate about a horizontal axis, a handle carried by said housing, said housing being provided with an inlet opening to said fan adjacent one end and communicating with said nozzle through a passageway having a converter port registering with said inlet opening, a closure plate normally closing said converter port, a switch for controlling the current supply to said motor and adapted to be opened and closed by the swinging movement of said handle into and from a predetermined position of rest, a motor speed increasing switch supported by said casing adjacent said converter port and adapted to be closed by the insertion of a converter member into said port upon the removal of said port closure plate and latching means acting to prevent the removal of said converter port closure member, but operative in the movement of said handle into its predetermined position of rest to release said closure plate.

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