Oct. 15, 1940. D. C. GERBER 2,218,166

SUCTION CLEANER

Filed Sept. 19, 1938 2 Sheets-Sheet 1

Fig. 1

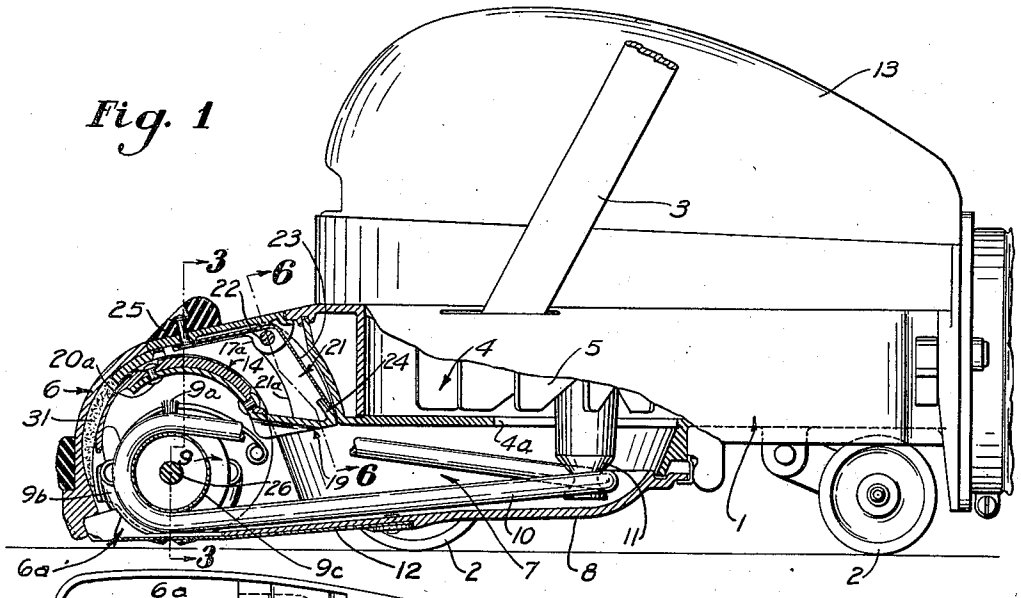
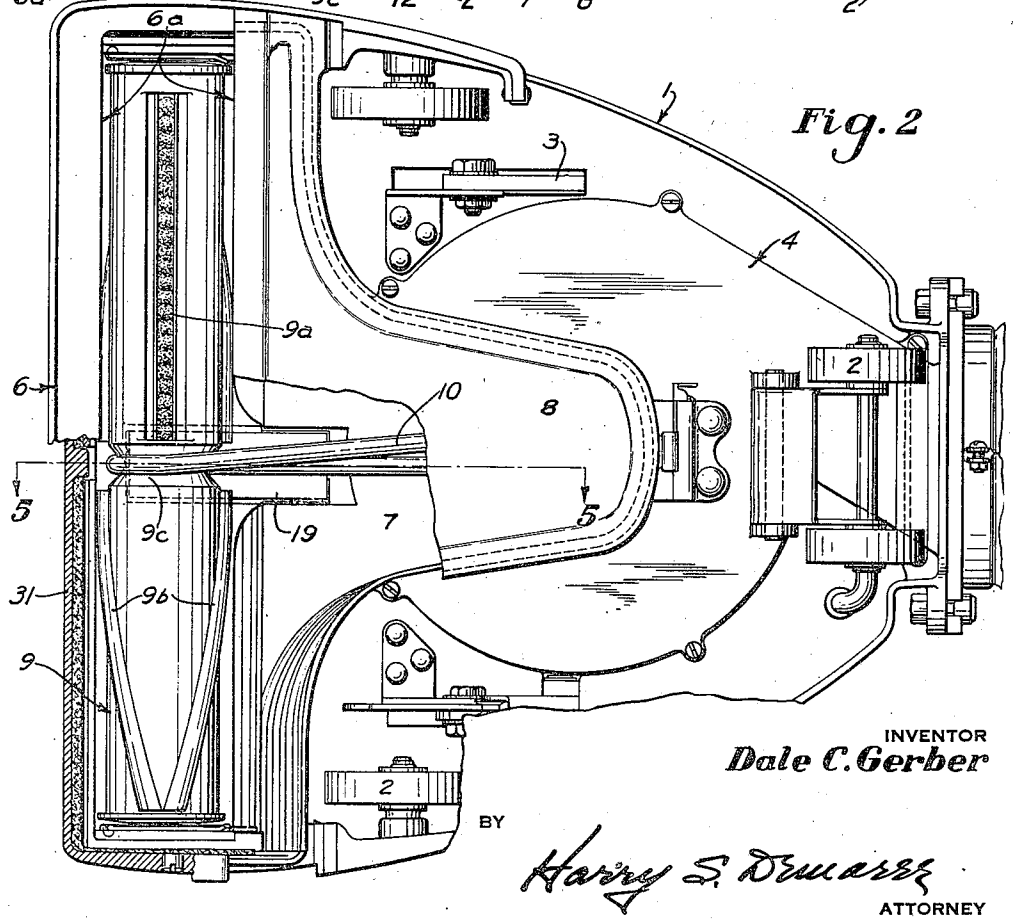



Fig. 2




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SUCTION CLEANER

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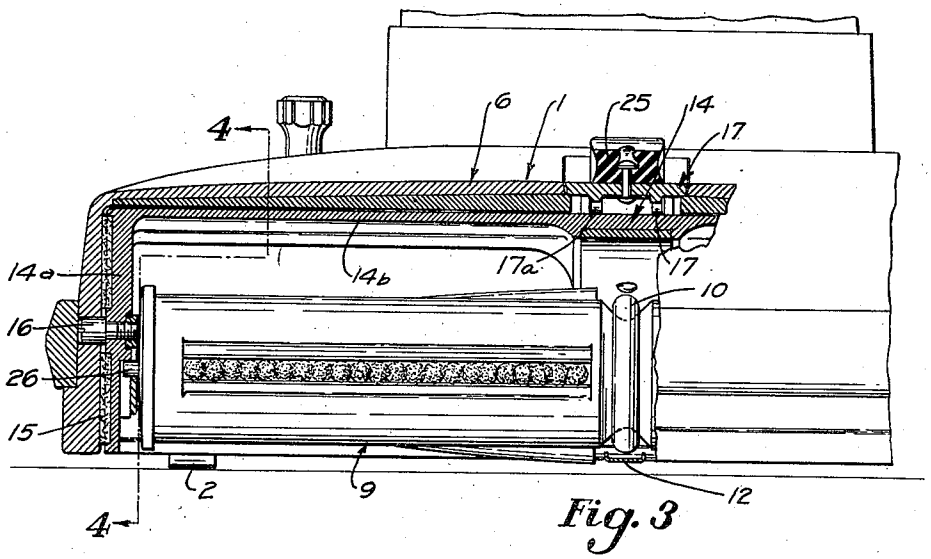



Fig. 3

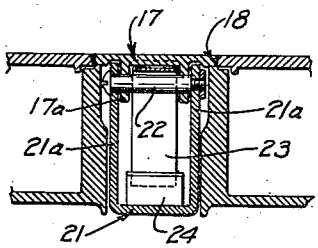



Fig. 6

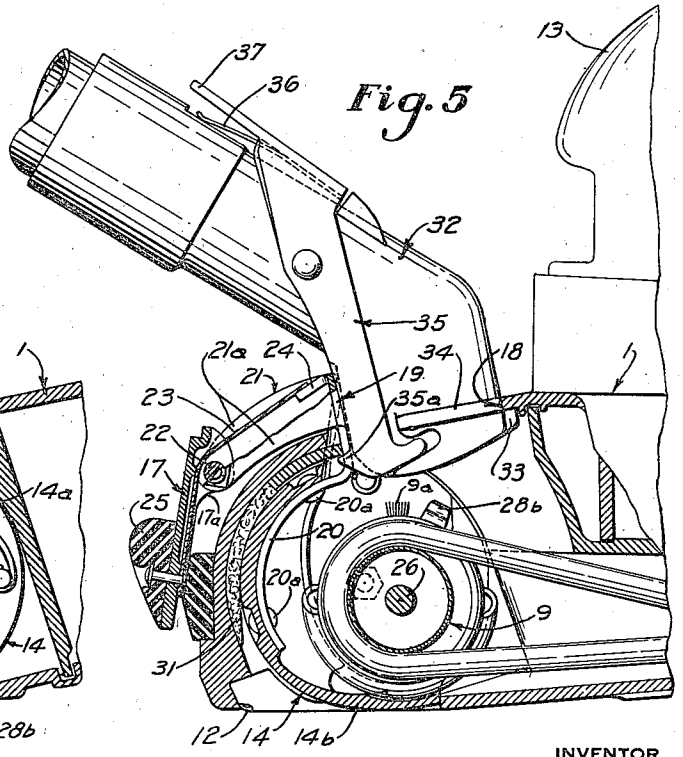



Fig. 5

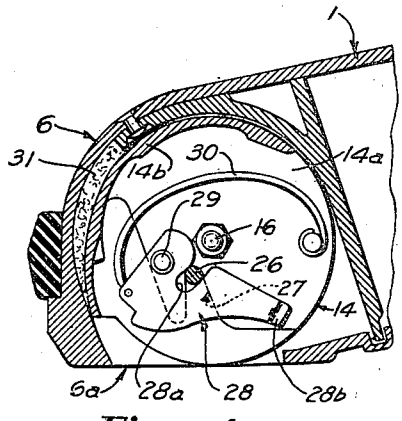



Fig. 4

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# UNITED STATES PATENT OFFICE

2,218,166

## SUCTION CLEANER

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Application September 19, 1938, Serial No. 230,603

13 Claims. (Cl. 15—9)

This invention relates to improvements in suction cleaners and more particularly to a novel mechanism for converting a suction cleaner to and from off-the-floor cleaning operation.

As well known in the art, there are several types of portable handle-maneuvered suction cleaners which can be converted into a stationary suction or air pressure creating device for cleaning furniture, draperies and other surfaces above the floor level through a hose and suitable dusting tools. For convenience, therefore, the operation of altering a cleaner from so-called on-the-floor to off-the-floor operation is termed "conversion," and the means or mechanism for accomplishing the conversion is referred to as the converter valve or member, depending on whether the particular part is incorporated in the body of the cleaner or carried by the auxiliary dusting tool hose.

Heretofore, one of the more common methods of converting a suction cleaner to off-the-floor cleaning operation is to insert a special fitting carried at the end of the dusting tool hose through a valved port leading into the main air passageway from the nozzle chamber and seating immediately in front of the inlet opening to the fan chamber, so that the suction is at once transferred from the main nozzle to the auxiliary hose.

The present invention seeks to accomplish the same end with a somewhat different arrangement, consisting primarily of a converter valve adapted to swing in an arcuate path across the mouth of the main nozzle and simultaneously uncover a port into which one end of a dusting tool hose is inserted, whereupon connection is made with the fan chamber through the upper portion of the nozzle chamber now closed to the atmosphere.

The suction cleaner designed for conversion to and from off-the-floor cleaning operation in accordance with the invention preferably includes a rotary agitator in the nozzle chamber, the same comprising a cylindric body provided with brush and beater elements which contact the carpet surface during normal floor cleaning operation. However, when the cleaner is converted for off-the-floor cleaning it is found desirable to lift the nozzle slightly above its normal height in order to avoid the possibility of any undue wear of the carpet in contact with the agitator. Therefore, it is proposed to mount the rotative agitator within the nozzle so that it is raised bodily from its normal operating position and out of the path of the converter valve as the latter traverses the suction mouth.

Thus, the primary object of the invention is to provide a converter arrangement in which the converter valve is housed within the nozzle chamber and is operative to swing or rotate in the arc of a circle to close off the suction mouth and simultaneously connect the hose with the source of suction.

And another object of the invention is to mount the converter valve and agitator in such a way as to shift the latter bodily and with an eccentric movement as the converter valve moves into its converting position, thereby shifting the agitator out of the path of the converter valve and, incidentally, in a direction to slacken its driving belt and thus temporarily disconnect the agitator from its source of power during the period that the cleaner is being operated with the dusting tool.

Having set forth the essential features and objects of the invention, a preferred embodiment thereof will now be described in detail and in connection with the accompanying drawings, in which:

Figure 1 is a general view of a suction cleaner in side elevation with its nozzle portion in section to show the converter arrangement.

Figure 2 is a bottom plan view of the cleaner with a portion of the nozzle broken away.

Figure 3 is a fragmentary view in front elevation with the nozzle shown in vertical section as taken on line 3—3 of Figure 1.

Figure 4 is a detail view in vertical section of the agitator bearing arrangement at one end of the converter valve as taken on line 4—4 of Figure 3.

Figure 5 is a slightly enlarged view in vertical section as taken on line 5—5 of Figure 2 and showing the converter valve shifted from its normal position in Figure 1 to converted position and the dusting tool hose attached; and

Figure 6 is a detail view in vertical section through the converter port and cover as taken on line 6—6 of Figure 1.

The suction cleaner embodying the present invention is generally of standard design, consisting of a main casing 1, supported upon wheels 2 and adapted to be maneuvered over the carpet surface by means of a handle having pivotal connection with the casing 1 through a U-shaped bail 3, so that it is free to swing in a vertical plane as the cleaner moves forwardly and rearwardly.

The main casing 1 includes a fan chamber 4 in which is mounted a motor-driven fan 5. The fan chamber communicates with a nozzle cham-

ber 6 extending across the forward end of the main casing 1 forming an integral part thereof. The nozzle chamber has a downwardly facing suction mouth 6a of generous width extending its full length. The nozzle chamber also communicates with the fan chamber through an air passage 7 formed in part by a removable bottom plate 8 and leading to the inlet opening or "eye" 4a to the fan chamber immediately above.

Extending lengthwise of the nozzle chamber is a rotary agitator 9 consisting of a cylindric shell having a predetermined arrangement of the brush elements 9a and helically arranged beater elements 9b projecting from the surface thereof, the agitator being so positioned as to permit said brush and beater elements to project a short distance below the plane of the suction mouth 6a. The agitator is driven by means of a belt 10 engaging a centrally located belt groove 9c in the surface of the agitator and, extending rearwardly through the air inlet passage 7, passes around a driving pulley 11 at the lower end of the axially extended hub portion of the fan projecting downwardly through the fan eye 4a into the air passage below. A belt guard 12, consisting of a thin metal strip with upturned edges, extends crosswise of the suction mouth just beneath the belt 10 and is secured at one end to the underside of the bottom plate 8.

The agitator is thus directly driven from the fan which in turn has direct driving connection with a motor (not shown) supported vertically upon the top wall of the casing 1 and enclosed within a removable dome-like hood or cover 13.

So much of the cleaner construction thus far described is more or less standard and therefore may not be considered in further detail. However, the converter arrangement embodying the novel features of the present disclosure will now be considered with some particularity.

Referring now to the nozzle chamber 6, extending transversely across the forward end of the casing 1, it will be noted that it consists of a cavity roughly circular in transverse or cross-sectional contour. Journalled to rotate upon a horizontal axis coinciding with the center line of the nozzle chamber, is a shutter-like converter valve 14 consisting of circular end walls 14a, 14a and a transverse arcuate wall segment 14b extending throughout an arc approximating a semi-circle, or 180°. This valve member extends the full length of the nozzle chamber with its end walls in close contact with the end faces of the nozzle chamber. In fact, the end faces of the valve member are recessed to support felt washers 15, 15 acting to form an air-tight seal between the ends of the valve member and the end walls of the nozzle chamber.

The converter valve 14 is journalled upon bearings 16, 16, fitted axially in its end walls 14a, 14a and supported in sockets bored through the end walls of the nozzle chamber, as clearly shown in Figure 3. Thus, the converter valve 14 is mounted to rotate upon its axis, although its rotative movement is limited to an arc of approximately 90° to close off the suction mouth.

The movement of the valve member is performed by hand and by means of a hinged closure plate 17 carried by the converter valve. This plate normally closes a port 18 formed in the top wall of the nozzle chamber and which, when the valve member is rotated to a position to close the suction mouth, communicates directly with the nozzle chamber and receives a special fitting carried at one end of the dusting tool hose,

Referring particularly to Figures 1 and 5, the mounting of the port cover 17 on the converter valve 14 will now be described: Secured to the upper and rear edge of the converter valve 14 is a bracket 19 having a flat curved base portion 20 extending circumferentially from the upper edge of the arcuate wall portion of the valve and fastened to the inner face thereof by rivets 20a. From the upper edge of the valve, the bracket projects outwardly and radially for a short distance to form the base of a U-shaped yoke 21 consisting of a pair of transversely spaced arms 21a, 21a projecting forwardly and parallel with the surface of the valve but exterior of the nozzle chamber. The yoke 21 of the bracket supports a hinge pin 22 at its end, and the pin in turn pivotally supports the closure plate 17 through the medium of ears 17a, 17a on the underside of the plate and spaced apart along its rear edge.

Now, the closure plate 17 is fashioned to seat flush within the port 18, the latter being rectangular in shape and elongated in transverse direction, that is, from front to rear. By preference, the closure plate is yieldably held to its seat by a flat leaf-spring 23 riveted at one end to the underside of the closure plate and, passing between the plate and the hinge pin 22, is bent inwardly to pass between the arms 21a of the yoke 21 with its other end bearing against a tongue 24 at the base of the yoke 21. Thus the leaf-spring acts to exert sufficient tension on the cover plate to hold it in its seat, although it can be readily unseated grasping a knob 25 fastened at the forward edge of the closure plate. By preference, this knob 25 is made of rubber or the like, and otherwise shaped to eliminate possible damage to furniture.

Now, to explain the action and operation of the converter valve member 14, and which incidentally, is the first step in the operation of converting the cleaner from on-the-floor to off-the-floor operation, the operator tilts the port closure plate 17 by lifting its forward edge upwardly in the manner just explained, and grasped firmly in the hand, is pulled forwardly and downwardly carrying the yoke 21 with it and rotating the converter valve about its axis in a counterclockwise direction as shown in Figure 5, with its forward and lower portion now traversing the suction mouth and its leading edge abutting the rear lip thereof, thus completely closing it to the passage of air.

It will be noted that the rotative movement of the valve member is limited to an arc of approximately 90°, the limiting factor being the contact between the radially extending yoke portion of the bracket 19 and the forward edge of the port from which its cover plate has been displaced; it being further noted (Figure 5) that upon completion of the counter-clockwise rotation of the valve, the base portion of the bracket projects upwardly in a practically vertical position at the forward edge of the port which otherwise is entirely open and now in position to receive the hose attaching fitting, as will presently be described.

But first, attention is directed to the mounting of the agitator 9, assuming that the cleaner is so equipped. As herein shown, the agitator is provided with carpet contacting brushes and beater bars projecting slightly beyond the nozzle mouth and, while it would be possible to mount the converter valve so that it would clear the agitator, it is preferred to displace the agitator bodily

from its normal position and out of the path of the valve. To this end, the agitator is journalled at its ends in bearings on the inner faces of the end walls of the converter valve and furthermore, these bearings are offset slightly from the axis of rotation of the valve, so that when the latter is rotated, the agitator swings bodily in an arcuate path about the axis of the converter valve.

As clearly shown in Figures 3 and 4, the cylindric shell portion of the agitator 9 rotates upon a shaft 26 projecting beyond each end of the agitator to form short stub-shafts. Now, the lower marginal portions of the inner faces of the end walls 14*a*, 14*a* of the converter valve 14 are recessed to form generally U-shaped notches 27, 27 (Figure 4) opening radially downward with their apexes terminating off-center from the axis of rotation of the converter valve. The apex of each notch 27 is rounded and forms one-half of the bearing for each stub end of the agitator shaft 26. Coacting with each bearing notch 27 is a lever 28 pivotally mounted on the inner face of the end wall of the valve member at a point 29 adjacent each V-notch 27 and itself having an arcuate notch 28*a* adapted to register with the rounded apex of said bearing notch to provide the other half of the bearing. And extending beyond the notch 28*a* is an operating finger 28*b* positioned near the suction mouth of the nozzle for access by the operator in case the agitator is to be removed. And finally, a spring 30, consisting of a length of spring wire bent in U-shape, is anchored at one end near the periphery of each end wall of the converter valve 14 and diametrically opposite the pivot point of each locking lever at 29, with its opposite end secured to each locking lever at a point offset from its pivot point. These springs act to hold the locking levers in position to retain the stub ends of the agitator shaft in their bearings, although it can be removed by rotating the levers 28 in a clockwise direction until the V-shaped bearing notches are uncovered thereby releasing the stub ends of the agitator shaft 26. Incidentally, the agitator assembly with its releasable mounting is a common arrangement except that in the present disclosure, the agitator moves bodily with the converter valve instead of being journalled in fixed bearings at the ends of the nozzle chamber.

Thus, it follows that in the act of rotating the converter valve, by using the port cover plate 17 as a handle, from its normal position, as shown in Figure 1, to its converting position, shown in Figure 5, the agitator 9 shifts bodily in a general upward and rearward direction, its actual path of movement being an arc of relatively small radius taken about the axis of rotation of the valve member 14. This displacement of the agitator is advantageous in that the brush and beater elements are raised so that the valve is free to traverse the suction mouth without having to increase its diameter to clear the agitator. And finally, the horizontal component of the bodily movement of the agitator during the converting operation is toward the driving pulley with the result that the driving belt 10 is slackened, thereby removing much of the tension from the belt. And under some circumstances the belt might well be slackened sufficiently to allow it to slip on the pulley, thus allowing the agitator to idle during the period of dusting tool operation.

And further in connection with the sealing of the suction mouth by the rotation of the valve member 14, it is desirable to maintain as tight an air seal as possible between the moving parts to prevent leakage of air around the valve member. Therefore, in addition to the felt washers at each end of the valve member as previously noted, there is also provided a strip 31 of felt between the converter valve and the front wall of the nozzle chamber, the latter being suitably recessed to provide a cavity for the sealing strip.

Referring lastly to the means for attaching the dusting tool hose to the cleaner after the suction mouth has been closed and sealed by the manual rotation of the valve member accompanied by the uncovering of the port in the top wall of the nozzle chamber, a suitable fitting is carried at one end of the dusting tool hose, this fitting being manifestly designed to fit into and make an air-tight connection with the port. Such a connection can be made in a variety of ways, but for the purpose of this disclosure a special fitting 32 (Figure 5) has been disclosed.

As previously explained, the port 18 is rectangular in shape and hence the port engaging portion of the fitting is designed to fit snugly therein with the remaining portion arranged at an angle thereto so that when attached, the hose will extend forwardly and upwardly from the top of the nozzle as clearly shown in Figure 5. Thus, with the extreme end of the fitting conforming to the rectangular contour of the port, a projecting lip 33 extends across its forward edge and bearing flanges 34, 34 part way along its sides. By first hooking the lip 33 beneath the rear edge of the port 17 and dropping the lateral flanges 34 into contact with the side edges thereof, a seating contact is effected and requiring only the latching of the fitting in place to complete the attachment. To secure the fitting in place, a spring latch member 35 comes into play, the same consisting of a U-shaped yoke which straddles the fitting midway of its ends with its lower extremities shaped to form latching detents 35*a* straddling the lower extremities thereof adjacent its rear edge. The yoke has limited pivotal movement through a relatively small arc and is yieldingly held in latching position by means of a leaf spring 36 attached to the underside of the yoke and bearing at its free end against the body of the fitting outwardly beyond the pivotal axis of the latch member. An operating lever 37, formed integral with the central portion of the yoke and extending lengthwise along the top surface of the fitting, is pressed inwardly to release the latching detents when it is desired to disconnect the fitting, said detents automatically springing into latching engagement beneath the front edges of the port as the fitting is forced to its seat to hold the same in place during dusting tool operation.

Once the connection has been made between the dusting tool hose and the port, the cleaner is ready to be operated for dusting tool cleaning, with the dirt-laden air now entering the nozzle chamber through the hose rather than through the suction mouth which is temporarily closed by the valve member.

To restore the cleaner to normal operation after cleaning has been completed with the use of the dusting tools, it is only necessary to disconnect the hose from the cleaner body in the manner stated and thence to swing the hinged port cover 17 upwardly and into the port. This movement obviously rotates the valve member into its normal position, uncovering the suction mouth and restoring the agitator to its normal

position with its driving belt again tightened for positive driving connection.

The present arrangement has several advantages, both structural and operative, over the more common methods of converting suction cleaners to dusting tool operation. The first, and perhaps the most obvious advantage, is the closing off of the suction directly at the nozzle mouth rather than at some point near the inlet to the fan chamber and thus making it unnecessary to provide auxiliary mechanism for elevating the nozzle as would otherwise be necessary. Another advantage of this arrangement is the location of the converter port on top of the cleaner body rather than at the side or underneath, thus making for convenience of operation and accessibility. And finally, there is the bodily displacement of the agitator due to its eccentric mounting on the rotative converter member with the attendant advantage of bringing about the retraction of the carpet-contacting portions of the agitator from the path of the converter valve, and the secondary advantage of loosening the belt, if not of disconnecting the agitator from its drive, is to reduce wear and conserve power.

To offset the advantages herein enumerated there might be suggested the difficulty of maintaining an air-tight seal between the converter member and the walls of the nozzle chamber. But this problem has been considered and effectively solved by locating the sealing members at points free from excessive wear and well protected against moving dirt particles.

Having set forth a preferred embodiment of the invention, I claim:

1. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means and having a downwardly facing suction mouth and a port in the outer wall thereof, a converter valve mounted in said nozzle chamber and rotative to and from a position to close off said suction mouth, and a closure plate for said port having hinged connection with said converter valve and serving as an operating member for simultaneously uncovering said port for the purpose described and rotating said valve into suction mouth closing position.

2. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means and having a downwardly opening suction mouth and an externally opening converter port, a rotative converter valve mounted in said nozzle chamber and operative to open and close said suction mouth, a supporting bracket mounted on said valve and adapted to extend radially therefrom in register with said port, a cover plate for said port having hinged connection with said bracket, said plate serving as an operating member to swing said valve into closed position in the act of shifting said plate bodily to uncover the port for the attachment of a dusting tool hose.

3. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means and having a downwardly opening suction mouth, a rotative valve member mounted in said nozzle chamber and shiftable to and from a position to close said suction mouth, and a rotary carpet-contacting member journalled in said nozzle chamber and operatively connected with said valve member for bodily movement out of carpet-contacting position in the movement of said valve member into suction mouth closing position for the purpose described.

4. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber having a downwardly opening suction mouth communicating with said suction-creating means, a converter valve mounted in said nozzle chamber and rotative to close said suction mouth, and a rotary agitator also mounted in said nozzle chamber and supported by said valve to rotate about a parallel axis offset from the axis thereof, whereby the same is shifted bodily from its carpet-contacting position in the movement of said valve into position to close said suction mouth.

5. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means through a connecting air passage and having a downwardly opening suction mouth, a rotative valve member mounted in said nozzle chamber and adapted to be shifted to and from a position to close said suction mouth, a rotary agitator mounted in said nozzle and extending lengthwise of said suction mouth, and bearings for said agitator offset from the axis of said valve member and movable therewith to shift said agitator bodily from said suction mouth in the movement of said valve member into suction mouth closing position for the purpose described.

6. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means and having a suction mouth and a port in the outer wall thereof, a rotative converter valve mounted in said nozzle chamber for opening and closing said nozzle mouth, a closure member for said port operatively connected to said valve and shiftable to expose said port for the attachment of a dusting tool hose in the movement of said valve into suction mouth closed position, and a motor-driven agitator mounted in said nozzle chamber and journalled in bearings carried by and offset from the axis of rotation of said valve.

7. In a suction cleaner, the combination of a casing including a fan chamber and a nozzle chamber communicating with said fan chamber, a motor-driven fan in said fan chamber, a converter valve mounted in said nozzle chamber and journalled to rotate about a horizontal axis and comprising end walls and an arcuate wall segment adapted to extend over the suction mouth of said nozzle chamber to completely close the same, a rotary agitator journalled in said converter valve with its axis of rotation parallel with but offset from the axis thereof whereby said agitator is shifted bodily out of carpet-contacting position in the movement of said converter valve to closed position.

8. In a suction cleaner, the combination of a casing including a fan chamber and a nozzle chamber communicating with said fan chamber, a motor-driven fan in said fan chamber, a converter valve mounted in said nozzle chamber to rotate about a horizontal axis and comprising transverse end walls and an arcuate valve member adapted to extend over the suction mouth of said nozzle chamber and close off the same, a rotary agitator journalled in bearings formed in the end walls of said converter valve with its axis of rotation parallel with and offset from the axis of said converter valve whereby said agitator is shifted bodily out of the path of said valve mem-

ber in the movement of said converter valve into closed position.

9. In a suction cleaner, the combination of a casing including a fan chamber and a nozzle chamber communicating with said fan chamber, a motor-driven fan in said fan chamber, a converter valve mounted in said nozzle chamber and journalled to rotate about a horizontal axis, said valve comprising an arcuate wall segment adapted to extend over the suction mouth of said nozzle chamber to completely seal off the same, and a belt-driven rotary agitator operatively connected with said motor-driven fan and extending lengthwise of said nozzle chamber suction mouth with carpet-contacting surface elements projecting transversely therethrough, said agitator being journaled at its ends in bearings in the end walls of said converter valve and offset radially from the axis of rotation thereof whereby in the rotation of said converter valve to closed position, said agitator is shifted bodily out of its normal operating position and in a direction to slacken its driving belt.

10. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means and having a downwardly opening suction mouth, a valve member mounted in said nozzle chamber and shiftable to and from a position over said suction mouth to completely close the same, said casing also having an externally opening port normally closed off from communication with said suction-creating means by said valve member, and a closure member for said port having operative connection with said valve member whereby the shifting of said closure member to open said port shifts said valve member into suction mouth closing position and establishes communication with said suction-creating means through said port, and vice versa.

11. In a suction cleaner, the combination of a casing including suction-creating means and a nozzle chamber communicating with said suction-creating means and having a downwardly opening suction mouth, a valve member mounted within said nozzle chamber for shifting movement to and from a position to completely close said suction mouth, said nozzle chamber also having an externally accessible port normally closed off from communicating with said suction-creating means by said valve member, and a closure member for said port operatively connected with said valve member whereby the movement thereof into port-opening position shifts said valve member into suction mouth closing position and establishes communication with said suction-creating means through said port.

12. In a suction cleaner, the combination of suction-creating means, a nozzle chamber communicating with said suction-creating means and having a downwardly opening suction mouth and an externally accessible converter port, a substantially semi-cylindrical valve member rotatively mounted in said nozzle chamber and normally positioned to close off said port from communication with said suction-creating means, and a closure member for said converter port having operative connection with said valve member whereby the manual displacement of said closure member from port closing position for the attachment of a hose extension swings said valve member across the suction mouth and simultaneously establishes communication through said hose extension with said suction-creating means.

13. In a suction cleaner, the combination of suction-creating means and a nozzle chamber communicating with said suction-creating means and having a downwardly opening suction mouth and an upwardly opening converter port, a substantially semi-cylindrical valve member extending lengthwise of said nozzle chamber and rotative about a horizontal central axis through an arc sufficient to extend over and close said suction mouth but normally forming the top wall thereof and closing off said port from communication with said suction-creating means, and a manually movable closure member for said converter port having operative connection with said valve member whereby the movement of said closure member in a direction to uncover said port for the attachment of a hose extension shifts said valve member into suction mouth closing position and establishes communication with said suction-creating means through said port and hose extension.

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