April 16, 1957 W. N. KEMNITZ 2,788,936

BLOWER CONNECTIONS FOR VACUUM CLEANERS

Filed Dec. 21, 1954 3 Sheets-Sheet 1

Fig. 5.

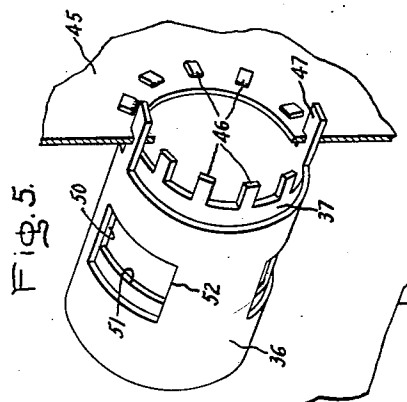


Fig. 1.

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Filed Dec. 21, 1954 3 Sheets-Sheet 2

Fig. 4.

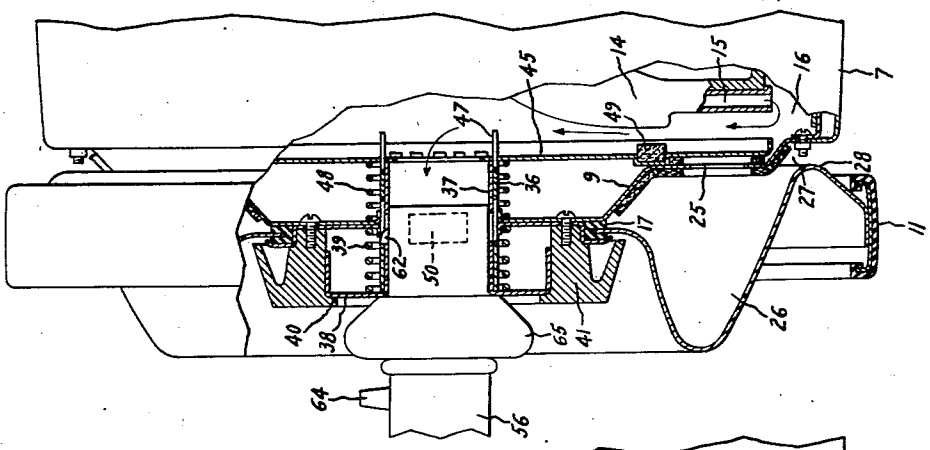


Fig. 3.

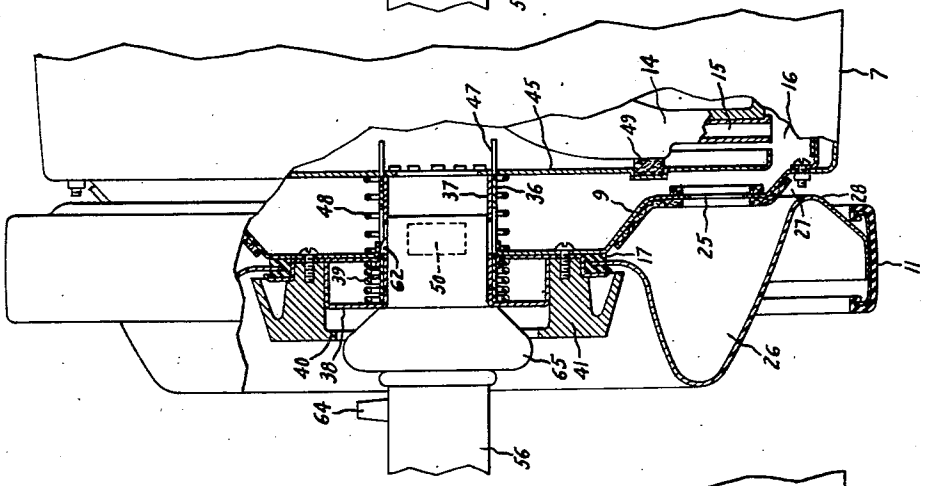
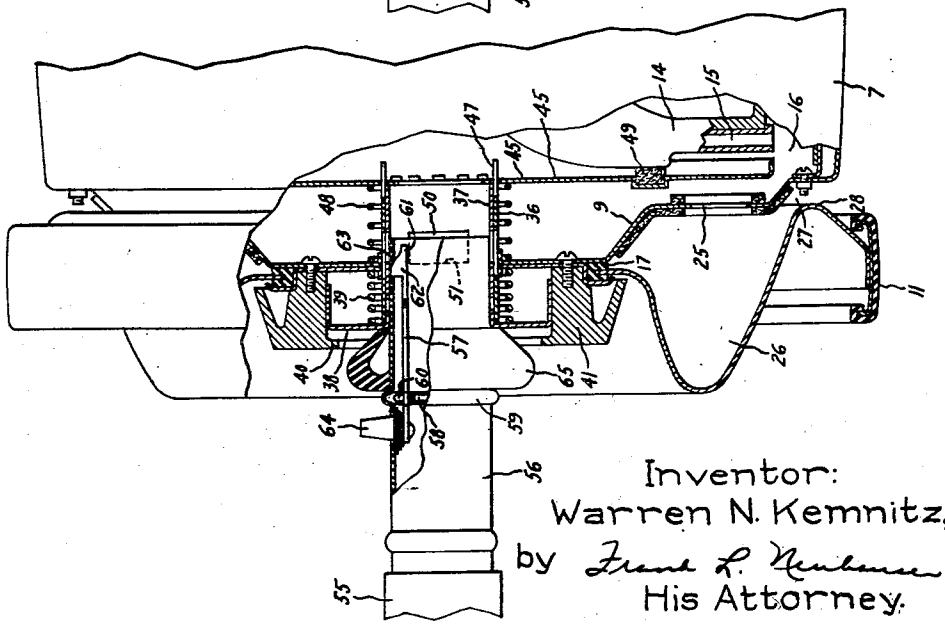


Fig. 2.



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Filed Dec. 21, 1954 3 Sheets-Sheet 3

Fig. 8.

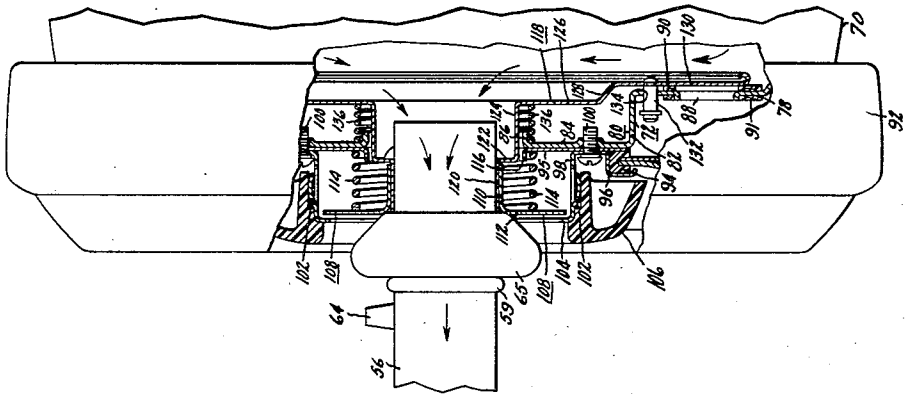


Fig. 7.

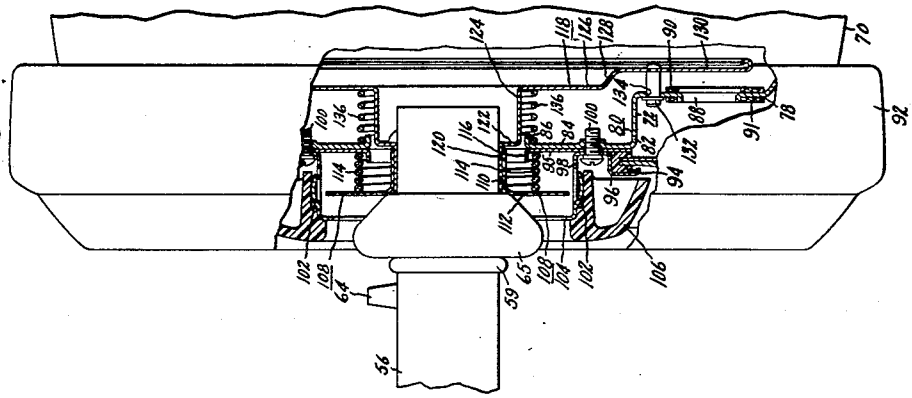
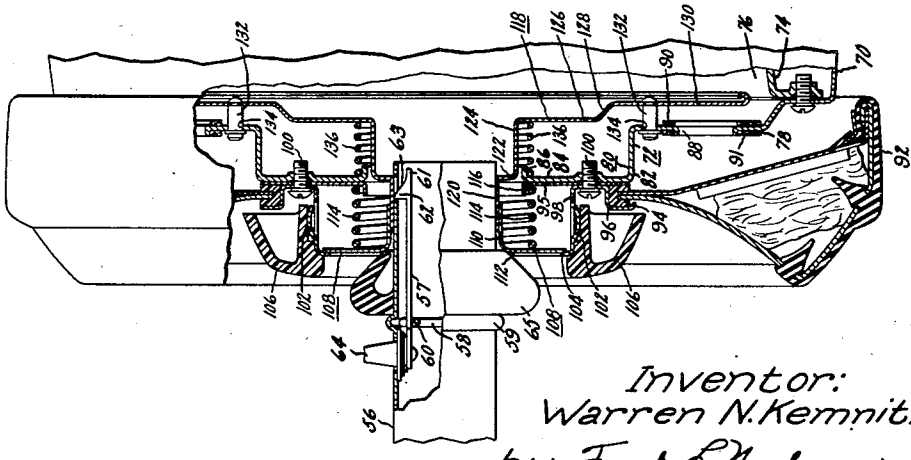


Fig. 6.



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2,788,936

BLOWER CONNECTIONS FOR VACUUM CLEANERS

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Application December 21, 1954, Serial No. 477,002

11 Claims. (Cl. 230—47)

The present application is a continuation-in-part of my copending application, Serial No. 394,380, filed November 25, 1953, now abandoned, and assigned to the assignee of the present application.

The present invention relates to vacuum cleaners of the type wherein the discharge opening for air flowing from the cleaner is in the form of passage means which extends circumferentially of the cleaner casing. Such discharge passage means is found, for example in vacuum cleaners of the so-termed canister or vertical tank type.

In connection with vacuum cleaners it is desirable to be able to attach the vacuum cleaner hose to the discharge side of the cleaner so that it may be used as a blower, and the general object of the present invention is to provide improved means whereby a hose may be attached to the discharge side of a vacuum cleaner of the type above referred to which is simple in structure, easy to use, and capable of being manufactured at low cost.

For a consideration of what I believe to be novel and my invention, attention is directed to the following specification and to the claims appended thereto.

According to a now preferred form of the invention, there is provided in connection with the discharge passage means of a vacuum cleaner, valve means for blocking the flow of air through such passage means and directing the air to a blower outlet opening to which the vacuum cleaner hose may be connected, the arrangement being such that the pressure of the air built up on the discharge side of the vacuum cleaner fan serves to assist in holding the valve means in its air blocking or what may be termed its closed position. Preferably the arrangement is such that the actuation of the valve means from its normal or what may be termed its open position to its closed position is effected by the hose coupling when it is positioned in the blower outlet opening.

In the drawing,

Fig. 1 is a top plan view, partly in section and partly broken away, of one form of a vacuum cleaner embodying the invention;

Figs. 2, 3 and 4 are detail views of the form of a vacuum cleaner shown in Fig. 1, partly in section, illustrating successive steps in the operation of connecting a vacuum cleaner hose to the blower outlet opening;

Fig. 5 is a detail perspective view of parts of the blower outlet opening structure viewed from the direction indicated by the section line 5—5, Fig. 1.

Figs. 6, 7 and 8 are detail views, similar to Figs. 2, 3 and 4, respectively, of another form of a vacuum cleaner embodying the invention.

Referring to the Figs. 1–5 of the drawings, 6 indicates the vacuum cleaner casing which is in the form of a cylinder comprising an annular side wall 7 and end walls 8 and 9. The casing is supported at its two ends by wheels 10 and 11. In the side wall of casing 6 is a suction inlet opening 12 in which a vacuum cleaner hose may be connected for normal cleaning. Suitably arranged in the casing are the usual power unit comprising an electric motor and a fan driven thereby and the vacuum cleaner

bag for filtering the dirt-laden air. These parts have not been illustrated as their specific structures form no part of the present invention; any suitable structure and arrangement of power unit and filtering means may be used. In Fig. 1, 13 indicates an annular wall attached to end wall 9 on which the power unit is supported and 14 indicates the discharge side wall of the fan housing which is annular and forms an annular passage means 15 through which air after entering through inlet 12 and passing through the filtering means and the fan is discharged to an annular air discharge chamber 16 defined by the peripheral portions of annular end wall 9 and fan side wall 14 and annular power unit supporting wall 13.

The disk portion of wheel 11 is shaped as shown in the drawing and has a central opening to the edge of which is attached a bearing ring 17 which turns in an outwardly facing annular bearing pocket defined by the peripheral portion of a disk 18 attached to end wall 9 by screws 19, such peripheral portion being provided with an axially extending annular wall 20 which forms the bottom wall of the pocket and an annular flange 21 on the edge of wall 20 which in conjunction with the adjacent portion of casing end wall 9 forms the two side walls of the bearing pocket. Wheel 10 may have a shape similar to that of wheel 11 and be journaled on end wall 8 in a similar manner or by other suitable means if desired.

In the peripheral portion of casing end wall 9 are a series of circumferentially spaced air discharge openings 25 through which air discharged by the vacuum cleaner fan to annular chamber 16 may flow to an annular area 26 between the disk portion of wheel 11 and end wall 9; and from area 26 the air may flow through an annular air discharge passage 27 defined by the portion 28 of the disk of wheel 11 and the opposed portion of casing end wall 9. Attached to the inner surface of end wall 9 around each opening 25 is a sealing pad 29 of suitable material such as felt and attached to its outer surface is a sheet of sound deadening felt insulating material 30, it having openings in line with opening 25.

In the normal operation of vacuum cleaner air entering the casing through a vacuum cleaner hose fastened in opening 12, after passing through the filtering means and the fan is discharged from the fan to annular chamber 16 from which it flows by way of openings 25, and annular discharge passage 27 to atmosphere, as indicated by the arrows in Fig. 1. My invention has to do specifically with improved means for blocking or shutting off the flow of air through annular openings 25 and annular discharge passage 27 and directing it to a blower opening to which a vacuum cleaner hose may be attached.

The blower opening is formed by a central passage in the disk portion of end wall 9 and in disk 18, the opening being defined by axially extending flanges 35, one on the end wall 9 and the other on disk 18. Mounted in the opening are two axially slidable concentric sleeves, and outer sleeve 36 which slides on flanges 35 and an inner sleeve 37 which slides on the inner surface of sleeve 36. Attached to the outer end of outer sleeve 36 is a spring retainer 38 which in substance forms a collar on the outer end of the sleeve and between such collar 38 and disk 18 is a helical spring 39 which serves to bias outer sleeve 36 and collar 38 to a position where the peripheral portion of the collar engages a stop shoulder 40 on a head 41 attached to end wall 9 by the screws 19. Head 41 has a surface 42 on which an inturned flange 43 on collar 38 slides. Collar 38 has a flange 44 which is located in outer sleeve 36 and has a thickness the same as inner sleeve 37 so that the inner surfaces of the flange and inner sleeve are in alignment.

Attached to the inner end of inner sleeve 37 is a valve disk 45 adapted to seat against pads 29 to close openings 25. In the present instance disk 45 is shown as being

attached to the end of sleeve 37 by ears 46 on the sleeve which extend through openings in the disk and are bent down against the inner surface of the disk as shown particularly in Fig. 5 where some of the ears are shown as having been passed through the disk and bent down while others, where the disk has been broken away, are shown prior to being bent down. Projecting axially from the inner edge of outer sleeve 36 are one or more guide fingers 47 (two being shown in the present instance) which slide in guide openings in valve disk 45. Valve disk 45 is biased to open position, i. e., to a position where it does not close openings 25, by a helical spring 48 which surrounds outer sleeve 36 between end wall 9 and the valve disk and holds the valve disk against wall 14 which functions as a stop for the valve disk. The valve disk is shown as having attached to it a ring 49 of suitable material such as felt which forms a cushion between the valve disk and the wall. For reasons pointed out hereinafter, in connection with the description of the operation of the invention, spring 39 is materially stronger than spring 48.

Inner sleeve 37 forms in substance a part of valve disk 45 which slides in outer sleeve 36 and it is provided with means which forms a shoulder or abutment adapted to be engaged by the latch of a vacuum cleaner hose connector for connecting the hose connector to the sleeve, i. e., to valve disk 45. In the present instance such shoulder or abutment is formed by means of a series of circumferentially spaced openings 50 in the sleeve, the outer edges 51 of which serve as a shoulder or abutment. Viewed from one aspect, edges 51 may be regarded as a series of circumferentially spaced shoulders or abutments, while viewed from another aspect, edges 51 may be regarded as an annular shoulder or abutment interrupted at spaced points by the material of the sleeve between the openings. In outer sleeve 36 in line with openings 50 are clearance openings 52 which are of sufficient size so that outer sleeve 36 will not interfere with a latch on the vacuum cleaner hose connection engaging a shoulder 51 as explained hereinafter.

In Fig. 2 there is shown in sectional view a vacuum cleaner hose connector for use with a vacuum cleaner embodying the invention, the latch construction shown being a known one. Referring particularly to Fig. 2, 55 indicates the end of a vacuum cleaner hose to which is attached a connector 56 which comprises a short length of metal tube of a diameter to fit either inlet opening 12 or the blower outlet opening. The latch means is shown as comprising a lever 57 held against the inner surface of connector 56 by a C-shaped spring 58 held in an annular groove 59 in the connector wall, the spring having a depression 60 in which the lever rests. At one end lever 57 has a fulcrum 61 which engages the inner surface of connector 56 and an adjacent catch nose 62 which extend through a slot in connector 56, there being a sloping surface 63 leading up the nose. At its other end it has a push button 64 which projects out through an opening in connector 56. Thus catch nose 62 is biased to project out through the opening in connector tube 56 by spring 58. It may be moved inwardly by direct pressure on the outer end of nose 62 or by pressing inwardly on push button 64 in which case lever 57 pivots around its fulcrum end 61. Surrounding connector tube 56 and suitably fixed to it is a sealing ring 65 of suitable material such as rubber which forms a collar on tube 56.

The operation of this form of the invention follows:

Normally the parts occupy the positions shown in Fig. 1, valve disk 45 being held in its open or unblocking position by spring 48 and outer sliding sleeve 36 being held with collar 38 against shoulder 40 by spring 39. When in these positions the inner end of outer sleeve 36 is spaced from disk valve 45 and the outer end of inner sleeve 37 is spaced from the edge of flange 44 as clearly shown in Fig. 1. Now the connector of a vacuum cleaner hose may be positioned in inlet opening 12 and the cleaner operated for cleaning in the usual way as already explained.

When the cleaner is to be used as a blower, the hose connector, instead of being positioned in inlet opening 12, is positioned in the blower opening. Fig. 2 shows the connector as it is being inserted into the blower opening, it being part way in. It will be seen that sealing ring 65 has engaged the collar 38 on the outer end of outer sleeve 36 and is pushing the sleeve inwardly, at the same time compressing spring 39, and that catch nose 62 which was pressed inwardly when the connector was first pushed into the blower opening is sliding along the inner surface of inner sleeve 37. When catch nose 62 moves beyond a shoulder 51, the catch nose snaps into engagement with the shoulder. This is shown in Fig. 3 where it will be seen that the catch nose is in engagement with a shoulder 51, the nose projecting also through a clearance opening 52 in outer sleeve 36. The purpose of the clearance openings 52 is to permit the catch nose 62 to project far enough through an opening 50 to insure good engagement with a shoulder 51 since the metal of sleeve 37 is fairly thin. Insofar as the operation of this form of the invention is concerned, the essential thing is that the catch nose shall firmly attach itself to inner sleeve 37. Also as shown in Fig. 3, spring 39 has been further compressed and flange 43 has been brought into engagement with end wall 9 which serves as a stop for limiting inward movement of the connector and outer sleeve 36. During this time the operator has been pushing the connector into the blower opening. The operator now releases the connector or ceases pushing on it whereupon spring 39 expands moving outer sleeve 36 back toward its original position. The sleeve in moving back carries the connector with it by reason of its engagement with sealing ring 65 and the connector carries inner sleeve 37 and disk valve 45 along with it since the catch nose is hooked into the inner sleeve, thus pulling the valve disk toward its closed position. Spring 39 being stronger than spring 48 moves the valve disk in opposition to spring 48 thus compressing further the spring 48. At the end of the outward movement the parts occupy the positions shown in Fig. 4. The outer sleeve 36 is back in its original position with flange 38 in engagement with stop shoulder 40. The connector is held in the blower opening by catch nose 62, and valve 45 is held in closed position where it covers openings 25 by spring 39, which serves also to hold spring 48 under compression. The cleaner is now ready for use as a blower and when running the air discharged into chamber 16 flows up along the rear wall of valve disk 45 and out through the blower opening as indicated by the arrows in Fig. 4.

It will be noted that when being used as a blower the air flows up along the rear or upstream side of the valve disk, i. e., the side opposite to the ports 25, so that the air pressure acts on the valve disk in a direction tending to move it toward its seat. This is an important consideration since it means that spring 39 needs to be only strong enough to effect the movement of the valve to closed position and need not be strong enough to not only move the valve disk to closed position but also to hold it there against the air pressure built up on the discharge side of the vacuum cleaner. The use of a lighter spring makes the insertion and removal of the hose connector easier. Also, since the air pressure acts to hold the valve closed, it is less likely to chatter or to leak than would be the case otherwise.

The hose connection may be removed from the blower opening by pressing down on pushbutton 64 to move catch nose 62 out of engagement with shoulder 51 and pulling the connector out of the opening. Removal of the catch nose from engagement with shoulder 51 releases inner sleeve 37 and valve disk 45 whereupon spring 48 moves the valve disk back to its Fig. 1 open position.

Outer sleeve 36 forms in substance a spring pressed

actuator for valve disk 45 which acts to pull the valve disk to closed position. When sleeve is pushed inwardly, spring 39 is compressed and the sleeve is connected to the valve disk through the intermediary of the hose connector so that when pressure on the sleeve is released the sleeve is moved outward by the spring thus pulling the valve disk to closed position. Or considered from another aspect, connector 36 is inserted into the blower opening and hooked into engagement with the valve disk, it at the same time putting spring 39 under compression so that when inward pressure on the connector is released the valve disk is pulled to closed position and held by spring 39.

Figures 6, 7 and 8 illustrate successive steps in the operation of connecting a vacuum cleaner hose connector to the blower outlet opening of another form of vacuum cleaner embodying the invention for the purpose of converting from circumferential air discharge to concentrated blowing. While Figures 6, 7 and 8 show only the portions of the cleaner which cooperate to permit this conversion, it should be understood that other cleaner components, similar to those disclosed in connection with the Fig. 1–5 form of invention, are provided to complete the cleaner.

In Figures 6, 7 and 8, the annular side wall of the cleaner casing is designated as 70 and illustrated as supporting a discharge end wall 72 and a power unit supporting wall 74. An annular discharge chamber 76 is formed by the power unit (not shown), supporting wall 74 and the adjacent peripheral portions of the discharge end wall 72. The discharge end wall 72 is generally disk-like, is joined at its periphery to the side wall 70 and has a series of offset portions which define a flat, annular valve seat 78 and a cup portion 80, which is in turn defined by cylindrical wall 82 and flat radial wall 84, which has a central opening formed by axial flange 86. Valve seat 78 has a plurality of circumferentially spaced openings 88 formed therein, having sealing pads 90 surrounding each opening on the upstream side of the end wall 72. The downstream side of the end wall 72 in the vicinity of the openings 88 is coated with a suitable sound deadening material 91.

Wheel 92, the only one of the two vacuum cleaner wheels illustrated, has a central annular bearing 94 which is supported in a bearing cavity formed by the peripheral portion of the bearing plate 95 and an offset portion 96 formed on the outer periphery of the bearing retainer 98. The radial wall 84 of the end wall 72, the bearing plate 95 and the bearing retainer 98 are secured together by a plurality of bolts 100. The bearing retainer 98 has a plurality of radially extending, spaced, spring fingers 102 and has an opening formed at its outer end by inwardly directed flange 104. The blower hub 106 seats on the outer end of the bearing retainer 98 and is firmly secured by the resilience of the spring fingers 102. Mounted within the bearing retainer 98 is a valve guide 108 having a central cylindrical portion 110 and a flat radial portion 112. The diameter of the portion 112 is greater than that of the opening formed by flange 104, and the valve guide is positioned on the upstream side of the flange 104. The bearing plate 95 is apertured centrally and has a flange 116 formed about the aperture. Disposed between the radial portion 112 of the valve guide and bearing plate 95 is the compression spring 114, which seats about the flange 116 of the bearing plate.

Valve disk 118 is generally disposed on the upstream side of the end wall 72 and comprises an inner tubular portion 120, which is slidably positioned within the cylindrical portion 110 of the valve guide 108, the offset inner radial portion 122 which merges into the outer tubular portion 124, which is of a larger diameter than inner tubular portion 120 but of less diameter than either of the openings in the wall 84 of the end wall 72 or the bearing plate 95, and which merges into the intermediate radial portion 126 which in turn is offset at 128 and merges into the outer radial portion 130.

Secured to the portion 130 and circumferentially spaced thereabout are a plurality of studs 132 which extend axially toward the downstream side of the cleaner and which constitute guide pins. Studs 132 extend through and are slidably received in openings 134 that are circumferentially spaced about the valve seat 78 of the end wall 72, and have enlargements formed on their free ends which cooperate to maintain the valve disk 118 mounted for slidable axial movement in that they constitute stops for defining the farthest position upstream that the valve disk 118 may move to. Positioned between the flange 86 of the wall 84 and the intermediate radial portion of valve disk 118 in the vicinity of where it joins the outer tubular portion 124 is a coil spring 136 which is substantially weaker than the spring 114. Spring 114 normally overpowers spring 136 and forces valve disk 118 to its upstream position.

The construction just described operates in a generally similar manner to the form of the invention illustrated in Figs. 1 through 5. In Figures 6, 7 and 8, Fig. 6 illustrates the position of the parts when they are disposed for normal circumferentially dispersed exhaust from the annular discharge chamber 76, through the openings 88 in the end wall 72 and out between the end wall 72 and the inner periphery of wheel 92, just as a hose connector is being inserted in the blowing opening. The parts of the hose connector are identical to those described with the reference to Fig. 1 through 5 form of the invention and, therefore, the reference numerals designating these parts are identical to those used in said figures.

In Figure 6, the hose connector 56 is shown after being inserted partially in the blower opening. The connector sealing ring 65 engages the valve guide 108 and moves it to the right (as viewed in Fig. 7) against the pressure of the spring 114 until the catch nose 62 of the hose connector latch clears the inner end of the tubular portion 120, moves radially outwardly, and seats against the offset radial portion 122. The latter position is shown in Figure 7 wherein it will be seen that the valve disk 118 is spaced from the end wall 72, the spring 114 is compressed and the condition of spring 136 is the same as that illustrated in Fig. 6 (relatively unstressed). Upon releasing the hose connector 56, the spring 114 expands and moves the valve guide 108 to the left toward its original position and carries the valve disk 118 to the left until the outer radial portion 130 of the valve disk contacts and closely embraces the valve seat 78 of the discharge end wall, thereby closing the openings 88. The latter occurs due to coupling which is effected by the catch nose 62 and the radial portion 122 and due to the greater strength of the spring 114 relative to the spring 136. This position is shown in Fig. 8 wherein it will be seen that the discharge air, as is indicated by the arrows, must flow on the upstream side of the valve disk 118 and through the tubular portion 124 and 120, into the hose and out through the hose. As was previously mentioned, the valve disk 118 is guided between its open and closed positions by its studs 132 which slide in the openings 134 of the discharge end wall. It should be observed that studs 132 in addition to being guide pins constitute the sole support for valve disk 118.

In view of the foregoing, it is believed that the form of the invention illustrated in Figures 6, 7 and 8 will be clear to those skilled in this art. While its operation is generally the same as that of the form shown in Figures 1 through 5, it is structurally simpler than said form and constitutes an alternative construction for accomplishing the purposes and objects of this invention.

In conclusion, it should be apparent that utilization of the pressure of the air on the discharge side of the vacuum cleaner fan for assisting in holding the valve disk on its seat is one important feature of both forms of my invention, since by such arrangement reliable operation of the

valve disk is obtained and trouble from leakage and valve chattering is avoided. At the same time such arrangement makes for easy valve operation. Also the use of the hose connection to effect the pulling of the valve disk to closed position is of advantage since by such arrangement no extra valve operating part is required, the closing of the valve being effected by the hose connector itself. In addition, the invention results in a mechanism which is simple in structure, reliable in operation, and simple and easy to use.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a vacuum cleaner, a casing, planar walls extending transverse to the direction of air flow and having spaced air discharge passage means which extend through said walls, a planar valve disk disposed transverse to the direction of air flow and adjacent to said walls and in advance thereof as regards the direction of air flow, said disk being movable relative to said walls and when in closed position adapted to block the flow of air through said passage means, means biasing said valve disk to open position, walls defining a blower opening through said first named walls and valve disk which at its inner end communicates with the area on the upstream side of said valve disk whereby when said valve disk is in closed position air flows along the upstream side of the valve disk to said blower opening and acts on the valve disk in a direction to help hold it in closed position, and means for pulling the valve disk to closed position including a part connected with said valve disk and adapted to be engaged by a vacuum cleaner hose connector, and a spring pressed actuator.

2. In a vacuum cleaner, a casing having an end wall provided with spaced air discharge passage means, a valve member in the casing in advance of said end wall as regards the direction of air flow for closing said passage means, means biasing said valve member to open position, walls defining a blower opening through said end wall, a sleeve connected to said valve member which slides in said blower opening, and means forming a shoulder on said sleeve adapted to be engaged by a latch member on a vacuum cleaner hose connector whereby the valve member may be pulled to closed position by outward movement of a hose connector in said blower opening.

3. The combination defined by claim 2 wherein there is provided in connection with the blower opening spring means which is compressed by the insertion of a hose connector into the blower opening and which when pressure on the hose connector is released moves it outward to effect movement of the valve member to closed position.

4. In a vacuum cleaner, walls forming an air discharge passage, a valve member located on the upstream side of said air discharge passage as regards the direction of air flow adapted to be moved into engagement with said walls to block flow of air therethrough, means biasing said valve member to open position, walls defining a blower opening into which a vacuum cleaner hose connector having a catch member thereon may be inserted, a part connected to said valve member slidably mounted in said blower opening, said part having an abutment adapted to be engaged by a catch member on a vacuum cleaner hose connector inserted into the blower opening, and a spring member adjacent to the blower opening which is put under compression by the insertion of a hose connector into the blower opening whereby when inward pressure on the hose connector is released, the spring member will pull the valve member to closed position.

5. The combination defined by claim 4 wherein said part is in the form of a sleeve and said abutment is formed by an opening in the sleeve.

6. In a vacuum cleaner, walls forming a blower opening, walls defining an air discharge passage, a valve member for blocking flow of air through the air discharge passage, means biasing the valve member to open position, two concentric sleeves slidably mounted in said blower opening one of which is connected to said valve member and the other being adapted to be engaged by a vacuum cleaner hose connector and moved inwardly by it when a hose connector is inserted in the blower opening, a spring which biases said other sleeve outwardly with respect to the blower opening, a stop for limiting outward movement of such other sleeve, and means forming an abutment in said one sleeve adapted to be engaged by a catch on a vacuum cleaner hose connector when inserted into the blower opening, whereby when a hose connector having a catch thereon is inserted into the blower opening the other sleeve will be moved inwardly to put said spring under compression and the connector catch will engage said abutment so that when pressure on the hose connector is released the spring will move the valve member to closed position.

7. In a vacuum cleaner, a casing having an end wall provided with spaced air discharge passage means, a valve disk in the casing in advance of said end wall as regards the direction of air flow for closing said passage means, means biasing said valve disk to open position, walls defining a blower opening through said end wall, said valve disk having a tubular portion which is disposed in said blower opening, means forming a shoulder on said portion adapted to be engaged by a latch member on a vacuum cleaner hose connector whereby the valve disk may be pulled to closed position by outward movement of the hose connector in said blower opening, and means for guiding said valve disk.

8. A device as defined in claim 7 wherein said guiding means comprises portions on said end wall and portions on said valve disk.

9. A device as defined in claim 8 wherein one of said guiding means portions comprises a plurality of guide openings and the other of said guiding means portions comprises a plurality of guide pins.

10. A device as defined in claim 7 wherein said guiding means comprises the sole support for said valve disk.

11. In a vacuum cleaner, a casing, walls which define air discharge passage means which extend circumferentially of the casing, a plurality of guide openings in said walls, a valve disk adjacent to said walls in advance thereof as regards the direction of air flow and having a plurality of guide pins slidably mounted in said guide openings, said valve disk being movable between an open and a closed position, said valve disk when in its open position permitting air to flow through said passage means and when in its closed position blocking the flow of air through said passage means, means biasing said valve disk to open position, walls defining a blower opening through said first-named walls, said valve disk including a tubular portion that is movably disposed within said blower opening, the portion of the valve disk surrounding the tubular portion being adapted to be engaged by a latch on a vacuum cleaner hose connector when the latter is inserted into said tubular portion whereby said valve disk may be moved to closed position by outward movement of said hose connector with respect to said blower opening.

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