Sept. 22, 1959 P. W. THOMPSON 2,905,267

SINGLE-STAGE VACUUM CLEANER

Filed Oct. 17, 1957 2 Sheets-Sheet 1

Fig. 1.

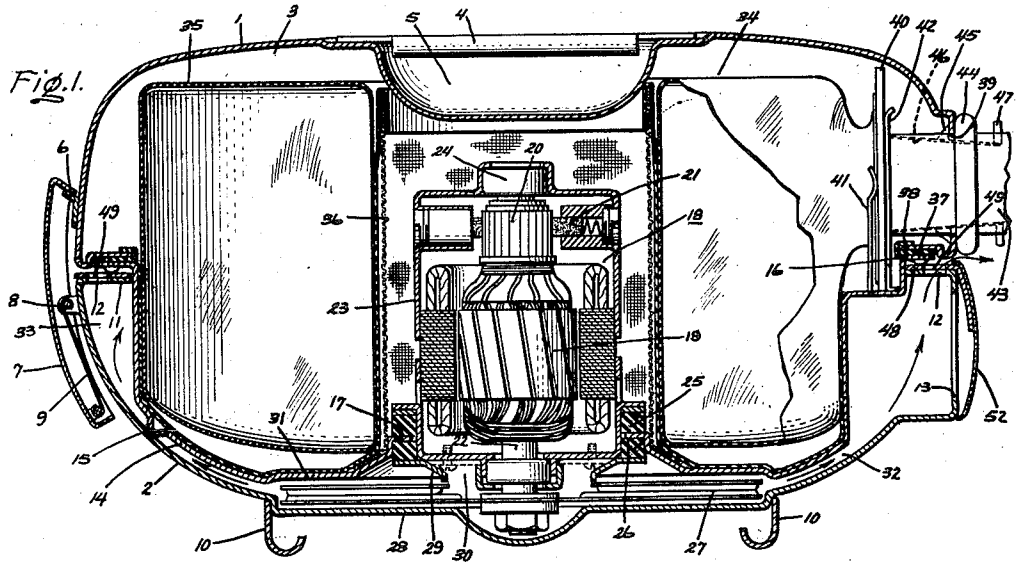


Fig. 2.

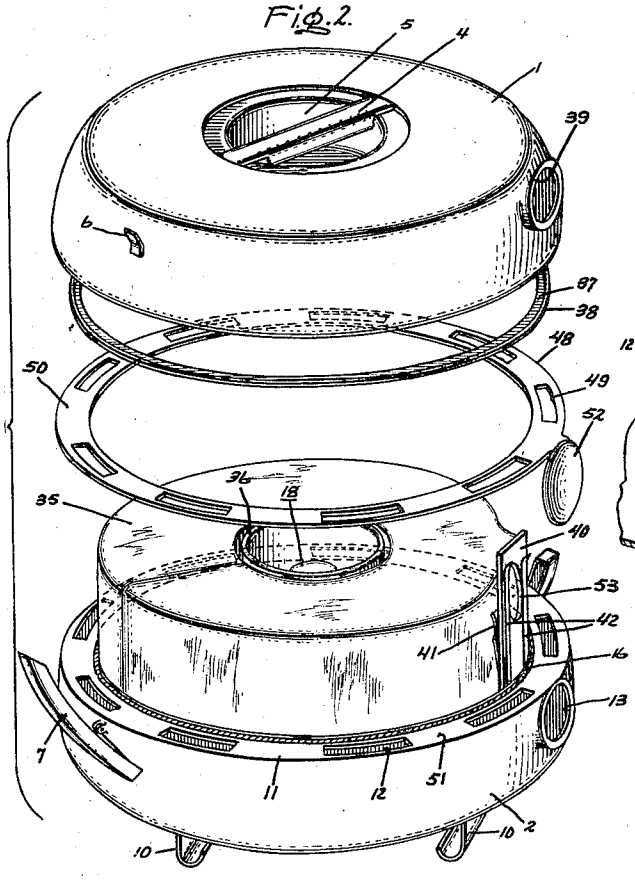
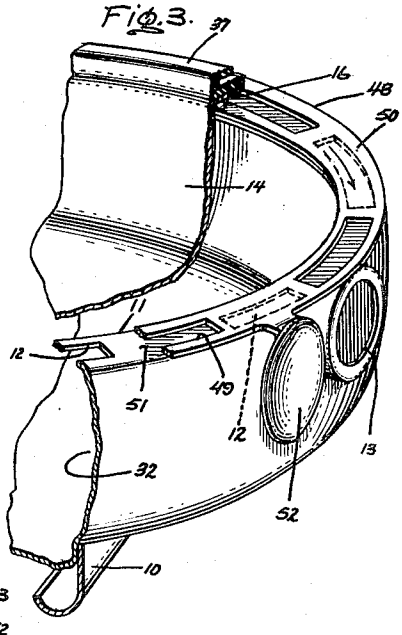


Fig. 3.



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SINGLE-STAGE VACUUM CLEANER

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Fig. 4.

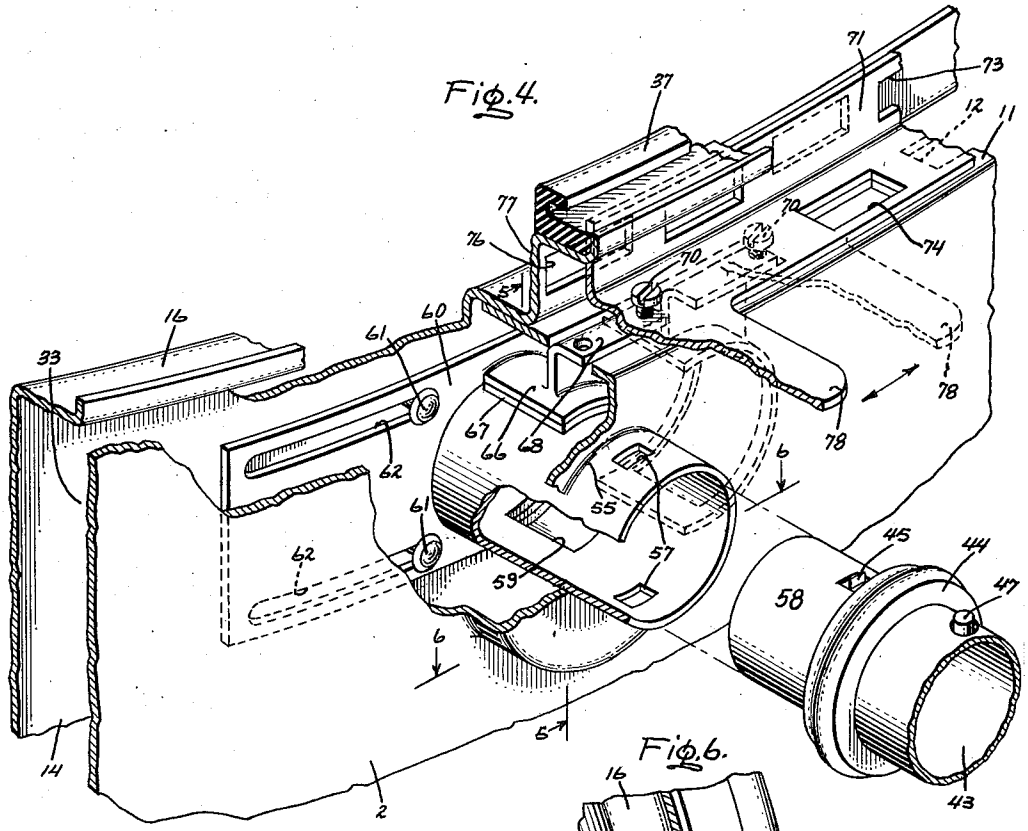


Fig. 5.

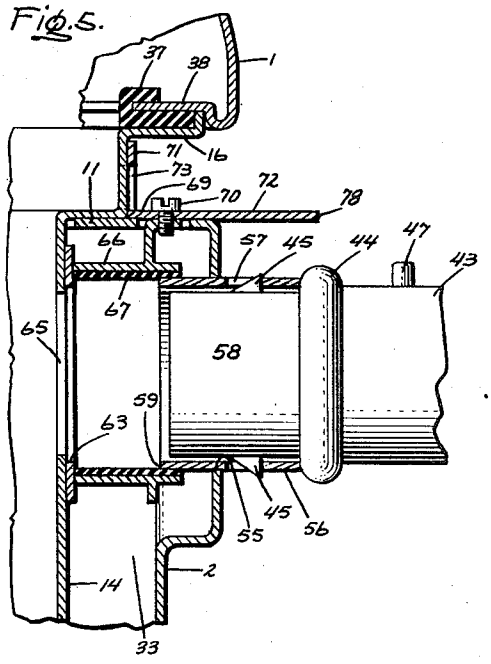
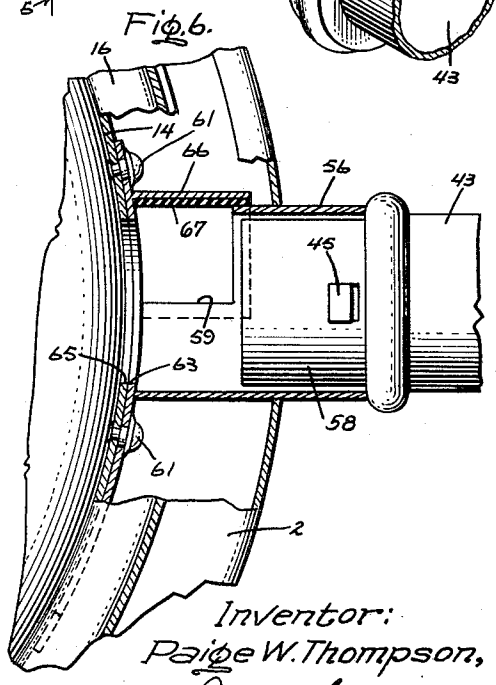


Fig. 6.



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2,905,267

SINGLE-STAGE VACUUM CLEANER

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Application October 17, 1957, Serial No. 690,652

10 Claims. (Cl. 183—37)

This invention relates to vacuum cleaning apparatus and more particularly to an improved canister-type vacuum cleaner.

Vacuum cleaners for home use have been the subject of much investigation and research over the years. However, it has not to date been found feasible to decrease their size and weight to a point where it is easy for the housewife to lift the vacuum cleaner and carry it with her wherever she wishes to clean in the house. One cause of this difficulty has been that vacuum cleaners of the canister and tank types have in the past generally had a two-stage fan arrangement which required more room and more weight than would be necessary for a single-stage construction. It is most desirable to cut the number of fan stages down to the minimum of one without adverse effect on the operation of the cleaner.

Another factor increasing the weight and volume of vacuum cleaners has been the requirement by the public of both blower and suction action. This has previously required relatively complex constructions involving considerable added cost in manufacture. It is important that the feature of quick and easy selection of either blowing or suction by the user be retained with, however, elimination of as many parts as possible to keep the weight and bulk of the cleaner as a whole down to a minimum as explained above.

It is accordingly an object of this invention to provide an improved vacuum cleaner which will incorporate all the required elements and which will provide good performance while utilizing a minimum number of components and taking up a minimum amount of space.

A further object of the invention is to provide a vacuum cleaner designed so that each element of the vacuum cleaner performs as effectively as possible. For instance, it is an object of the invention to provide a vacuum cleaner where the fan housing is formed partly by the outer vacuum cleaner housing and partly by the member which secures the motor in place within the casing.

A further object of the invention is to provide an improved arrangement for permitting selection of blower or suction action quickly and easily by use of a construction with involves a minimum number of components.

In one aspect thereof, the invention provides a vacuum cleaner which includes first and second casing members positioned to form an inclosure. The first casing member has a dish-like shape. An electric motor is positioned within the inclosure substantially concentric with and adjacent the inner surface of the first casing member. A radial type fan is mounted to be driven by the motor shaft. The fan is preferably of the single-stage type which permits the minimum number of elements and space to be used. A dished rigid sheet member is secured to the first casing member within the inclosure. The sheet member and the first casing member form between them a fan housing and diffusion chamber which communicates with the remainder of the inclosure only through the fan. The remainder of the

inclosure then forms a dust bag receiving chamber which extends around the motor and within the fan housing and diffusion chamber. The first casing member has an opening communicating with the fan housing and diffusion chamber to permit the escape of air moved by the fan; one of the two casing members has a second opening which communicates with the bag receiving chamber through which the air is drawn in by the fan.

The features of the invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself however, both as to its organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings.

In the drawings, Figure 1 is a side view, partly broken away and partly in cross section, of the improved vacuum cleaner of this invention;

Figure 2 is an exploded view in perspective of the improved vacuum cleaner;

Figure 3 is an enlarged fragmentary view in perspective of part of the apparatus shown in Figure 2;

Figure 4 is a fragmentary view in perspective showing a modified construction for selecting blower or suction action;

Figure 5 is a view along line 5—5 in Figure 4; and

Figure 6 is a view along line 6—6 in Figure 4.

Referring now to Figures 1, 2, and 3 of the drawings, there is shown a vacuum cleaner of the canister type which includes a pair of casing members 1 and 2 which cooperate as shown to from an inclosure 3. Casing member 2 has a generally dish-like shape while casing member 1 is in the form of a cover. The cover casing member 1 may have a suitable handle 4 provided in an indentation 5 to facilitate lifting of the cleaner. The two casing members are removably secured to each other by any desired means, such as, for instance, a combination of latch member 6 on cover 1 and engaging member 7 pivotally secured on pin 8 of casing member 2 by spring 9. The lower casing member 2 may be supported in any appropriate manner which permits it to be moved across a floor, such as, for instance, by runners 10.

Casing member 2 has its edge shaped into a re-entrant flange 11 with openings 12 spaced around the periphery thereof, as shown. Casing member 2 also has an opening 13. A member 14 of rigid sheet material having a substantially dished configuration is positioned within inclosure 3 and is rigidly secured to casing 2 in any appropriate manner, such as by spot welding it to casing 2 at a number of points 15, as shown. The sheet member 14 extends up beyond the re-entrant flange 11 of cover member 2 and terminates in an outwardly extending flange 16 which is above and spaced from flange 11. The edge of flange 11 engages the surface of sheet member 14 over the entire periphery of the vacuum cleaner so that together they form a chamber which is closed at its outer end except for openings 12 and 13.

Sheet member 14 has a central opening 54 which is bordered by the inwardly turned flange 17 thereof. A motor, generally indicated at 18, is positioned concentrically with opening 54 within inclosure 3. While its construction is not a part of the invention, motor 18 is generally of the alternating current series type with an armature 19, a commutator 20 and brushes 21. The functioning of such motors is well known in the art and thus will not be described herein other than to state that when the motor 18 is connected to a suitable source of electrical power, armature 19 and shaft 22 rotate. The motor parts are secured within a suitable housing construction 23 which includes bearing means, generally indicated at 24, for rotatably supporting the shaft 22. The

housing 23 has secured about it appropriate resilient mounting means 25 provided with a peripheral slot 26. Flange 17 of sheet member 14 is secured firmly within the slot 26. With this arrangement, the motor 18 is resiliently but securely mounted within the casing member 2 substantially concentric therewith by engagement of its resilient mounting 25 with flange 17 of member 14.

Mounted at the lower end of shaft 22 is a single-stage impeller 27 of the radial fan type. This impeller is positioned substantially concentric with and adjacent the inner surface of casing member 2. With this arrangement the flat portion 28, which has a diameter substantially greater than that of the motor and which forms the bottom of the dished configuration of casing member 2, provides a portion of the housing needed for the impeller 27. It can be seen that the dished configuration of the casing member 2 and the positioning of the impeller permit the use of an impeller of large diameter (substantially larger than the diameter of motor 18) and thus one which, for a given speed of rotation, will be a highly effective mover of air.

Member 29, which forms a part of the motor assembly 18, extends toward the inlet 30 of impeller 27 so as to form a rotating seal with the inner edge of the impeller. With this construction, there is now provided a fan housing which, on one side of impeller 27, is provided by portion 28 of casing member 2, and on the other side is provided primarily by portion 31 of sheet member 14 in combination with member 29. In addition to their other functions, members 2 and 14 cooperate to provide a diffusion chamber portion 32 and a plenum chamber 33 which communicates with openings 12 and 13. Thus, the casing member and the motor mounting member perform the added functions of completing the fan housing, the diffusion chamber, and the plenum chamber. In addition, the arrangement and configuration permit use of a large single-stage impeller which uses only a small portion of the inclosure 3. It will also be noted that the only connection of the diffusion and plenum chambers with the remainder of inclosure 3, which constitutes the space for the dust receiving bag and will henceforth be designated by the numeral 34, is through the motor assembly 18 and fan inlet 30.

Substantially filling the space 34 is a dust retaining bag 35 made of suitably porous paper, fabric or like material. The bag is generally toroidal; the radially outer surface is against the member 14 while the radially inner surface is against a screen 36 which is customarily (although not necessarily) provided about the motor assembly 18 as further protection from dust and dirt.

Flange 16 of sheet member 14 retains an annular gasket member 37 which in turn engages the top cover member 1 by engagement with an inwardly extending flange 38 thereof. This provides a tight seal for the top cover member with sheet member 14 so that, in effect, the only exit for air which has entered by chamber 34 through opening 39 in casing member 1 is through the fan inlet 30. Bag 35 positioned in chamber 34 has an opening 53 provided therein with a piece of stiff cardboard 40 secured about the opening. A clamping spring 41 is secured to sheet member 14 so that when the bag is properly inserted in chamber 34, the cardboard part 40 is clipped between spring member 41 and an upstanding portion 42 which is also secured to the sheet member 14. With this arrangement the opening 53 of bag 35 is secured substantially in alignment with opening 39. It is then simple matter to insert the end of a hose 43 through opening 39 until it extends into the opening 53. The extent to which hose 43 may be inserted is controlled in any well known manner such as by a resilient ring 44 secured to the hose; when the ring comes into abutment with casing member 1 further entry of the hose into the opening is precluded. The hose 43 is preferably secured in the opening by any appropriate means such as, for instance, latch members 45 which are secured on springs 46 and which may be depressed by a button 47 when it is desired to pull the hose back out of opening 39. Openings 39 and 13 are the same size so that when it is so desired hose 43 can be inserted in opening 13.

An annular ring member 48 is formed to lie snugly but slidably on flange 11. Ring 48 has openings 49 formed therein which are preferably of substantially the same dimensions as openings 12 and have spaces 50 between them similar to the spaces 51 between openings 12. Ring 48 is also provided with a closure cap 52 which can be used as a handle for moving ring 48 as shown by the arrow in Figure 3. When the ring is positioned so that cap 52 is next to opening 13, that is, opening 13 is uncovered, openings 49 and 12 are out of registry with each other and flange 11 and ring 48 combine to form a substantially complete closure. This causes opening 13 to be the only exit for the air moved by the impeller. Thus, when it is desired to use the vacuum cleaner as a blower, hose 43 is inserted in opening 13 and receives the entire output of the fan 27 with the air entering through opening 39, passing through the bag 35 and motor assembly 18, and then into the fan inlet 30.

When the ring 48 is moved until cap 52 covers opening 13 as shown in Figure 1, openings 49 and 12 coincide to provide an exit for the air around the entire vacuum cleaner, thus providing a large output area and permitting the fan to work very effectively. With this arrangement, the hose is secured within opening 39 as shown in Figure 1 so that the vacuum cleaner provides suction at the other end of the hose (not shown).

Referring now to Figures 4, 5, and 6, an alternative construction for selectively obtaining the blower-suction effect is illustrated. In the description of this modification, all parts not illustrated are the same as in Figures 1, 2, and 3; also, all parts which are illustrated and are the same as those of Figures 1, 2, and 3 have the same numerals. In this embodiment, the upper portion of the casing member 2 has an opening 55 with a tubular member 56 secured therein extending both outside and inside of the casing member 2, as shown. On the part of tubular member 56 which extends outside casing 2, a pair of oppositely positioned openings 57 are provided to receive the latch members 45 of the hose 43; when the hose, which has its end portion 58 of smaller diameter than the inside diameter of tubular member 56, is inserted in the tubular member, the latches 45 snap into the openings 57 to secure the hose in position.

Within the casing member 2, tubular member 56 is provided on one side thereof with an opening 59 of substantial proportions. Hose 43 is formed so that when gasket member 44 abuts against the end of tubular member 56 the inner end of the hose does not obstruct the opening 59. The open inner end of the tubular member 56 is positioned in slidable relation to a flat plate member 60 which is also mounted in slidable relation to member 14. The relative movement is effected by the engagement of rivets 61—which are secured to sheet member 14—in slots 62 formed in member 60. Member 60 has an opening 63 formed therein which, when the parts are in the position shown in Figure 4, is aligned with opening 65 in member 14 and with the open inner end of tubular member 56. When member 60 is moved to the right (as viewed in Figure 4) opening 63 is moved out of alignment with the tubular member and opening 65 which are therefore closed by the member 60.

Rigidly secured to member 60 and movable therewith is a curved member 66 which is preferably provided with a relatively soft sealing surface 67 of rubber or the like. With the parts in the position of Figure 4, surface 67 of part 66 fits over the opening 59 in tubular member 56 and closes that opening so that there is no direct communication between the space inside tubular member 56 and that in the plenum chamber 33.

A flange portion 68 is secured to part 66; through one of the openings 12 in flange 11, flange 68 is secured to a member 69 by suitable means such as screws 70.

Member 69 is annular, or ringshaped, and extends all the way around the vacuum cleaner. It is formed of two parts 71 and 72 at right angles to each other. Part 71 has openings 73 formed therein at intervals, and part 72 has openings 74 formed therein at intervals, openings 73 and 74 being offset from each other as shown in Figure 4. Part 72 slides on flange 11 of casing member 2 in response to manual actuation of handle 78 which is rigidly secured to member 69; in the position shown in solid outline in Figure 4 the openings 74 of part 72 and 12 of flange 11 coincide to connect the interior of the plenum chamber 33 to the atmosphere. In the position shown in dotted outline, the openings 74 and 12 are offset so as to shut off the openings 12 of flange 11.

Openings 76 are formed in upwardly extending portion 77 of sheet member 14 and are aligned with the openings 12 of flange 11. Part 71 is in slidable relation to portion 77; with this arrangement, in the position shown in solid outline in Figure 4, openings 73 of part 71 and 76 of portion 77 are out of alignment so that no opening remains. However, when the parts are moved to the position shown in dotted outline, openings 76 and 73 become aligned with each other to provide an opening through to the interior of the vacuum cleaner.

When the regular suction cleaning action is desired, the parts are set in the position shown in solid outline in Figure 4 and in Figures 5 and 6. In this position, the fan provided in the vacuum cleaner explained in connection with Figures 1 to 3 will pull the air in from hose 43 through the tubular member 56, through aligned openings 63 and 65, and into the interior of the cleaner where the air passes through the motor and fan and is forced out to the plenum chamber 33. Openings 74 and 12 are aligned so that the air may then escape all around the periphery of the vacuum cleaner. Part 66 keeps opening 59 in tubular member 56 closed to insure the proper passage of the air through the tubular member to the interior of the cleaner.

If blower action should be desired instead of suction action, the only operation necessary is to move handle 78 from the position shown in solid outline in Figure 4 to the position shown in dotted outline therein. With this arrangement, part 60 is moved to block opening 65. At the same time, part 66 has freed the opening 59. The movement of handle 78 has also caused alignment of openings 76 and 73 so that air can be pulled in by the fan through these aligned openings and then discharged into the plenum 33 as before. Now however, the openings 12 and 74 are no longer aligned so that air can not escape through those openings. Instead the only means of escape for the air is through the opening 59 and out through the tubular member 56 and the hose 43. Thus, the simple movement of handle 78 shown in Figure 4 effects the conversion from a suction unit to a blower unit.

It can thus be seen that the provision of either suction or blower action, at the discretion of the user, has been made with a minimum of simply formed parts.

While the invention has been explained by describing a particular embodiment thereof, it will be apparent that improvements and modifications may be made without departing from the scope of the invention as defined in the appended claims:

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

1. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted within said inclosure substantially concentric with and adjacent the inner surface of said first casing member, a radial type fan mounted to be driven by said motor substantially concentric therewith, a rigid sheet member of generally dished configuration secured to said first casing member within said inclosure, said sheet member and said first casing member forming between them a housing for said fan and a diffusion chamber connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust bag receiving chamber, said first casing member having an opening communicating with said fan housing and diffusion chamber, one of said casing members having an opening communicating with said bag receiving chamber.

2. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted substantially concentric with said first casing member within said inclosure, a rotatable shaft extending from said motor, a radial type fan mounted substantially concentric with said motor on said shaft, said first casing member having a central flat portion of substantially greater diameter than said motor, said fan being adjacent said inner surface of said flat portion and having a diameter substantially greater than the diameter of said motor, a rigid sheet member of dished configuration secured to said first casing member within said inclosure, said rigid sheet member and said first casing member forming between them a fan housing and diffusion chamber connected to the remainder of said inclosure only through said fan, the remainder of said inclosure having a substantially toroidal shape extending about said motor and forming a dust receiving chamber, said first casing member having an opening communicating with said fan housing and diffusion chamber, one of said casing members having an opening communicating with said bag receiving chamber.

3. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, a rigid sheet member secured to said first casing member within said inclosure, said rigid sheet member having substantially dished configuration with a central opening, an electric motor positioned within said sheet member opening and secured to said sheet member, a radial type fan drivably mounted to said motor and positioned concentric with and adjacent the inner surface of said first casing member, said sheet member and said first casing member forming between them the housing for said fan and further forming a diffusion chamber for air driven by said fan, said chamber being connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust bag receiving chamber of substantially toroidal form between said motor and said chamber, said first casing member having an opening communicating with said fan housing and diffusion chamber, one of said casing members having an opening communicating with said bag receiving chamber.

4. The vacuum cleaner of claim 3 in which said motor has a resilient mounting secured about it, said sheet member being secured to said resilient mounting and constituting the only support for said motor whereby said motor is resiliently positioned within said inclosure by said sheet member.

5. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted within said inclosure and having a rotatable shaft, a radial type fan mounted on said shaft substantially concentric with and adjacent the inner surface of said first casing member, a dished rigid sheet member secured to said first casing member within said inclosure, said first casing member having an inwardly turned flange around the periphery thereof, said sheet member extending up beyond said inwardly turned flange in contact therewith so as to form a closure and terminating in an outwardly extending flange spaced from said inwardly extending flange, said second casing member being secured to said sheet member outwardly extending flange, said sheet member and said first casing member forming between them a fan housing, diffusion chamber,

and plenum chamber which are connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust receiving chamber, said first casing member having an opening therein communicating with said plenum chamber, one of said casing members having an opening communicating with said bag receiving chamber.

6. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted within said inclosure and having a rotatable shaft, a radial type fan mounted on said shaft substantially concentric with and adjacent the inner surface of said first casing member, a dished rigid sheet member secured to said first casing member within said inclosure, said first casing member having an inwardly turned flange around the periphery thereof, said sheet member extending up beyond said inwardly turned flange in contact therewith so as to form a closure and terminating in an outwardly extending flange spaced from said inwardly extending flange, said second casing member being secured to said sheet member outwardly extending flange, said sheet member and said first casing member forming between them a fan housing, diffusion chamber, and plenum chamber which are connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust receiving chamber, said first casing member having a plurality of spaced openings formed in said flange thereof, said first casing member also having another opening communicating with said plenum chamber, an annular member overlying said flange and having a plurality of spaced openings formed therein, said annular member being movable relative to said casing members, the openings of said annular member and said casing member flange coinciding in one position of said annular member and being out of register in another position of said annular member so that there are no openings provided by the combination of said flange and said annular member, said second casing member having an opening communicating with said bag receiving chamber.

7. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted within said inclosure and having a rotatable shaft, a radial type fan mounted on said shaft substantially concentric with and adjacent the inner surface of said first casing member, said first casing member having an inwardly extending flange extending around the periphery thereof, a dished rigid sheet member secured to said first casing member within said inclosure, said sheet member extending up beyond said inwardly turned flange and being in contact therewith around the periphery of said vacuum cleaner, said sheet member and said first casing member forming between them a fan housing, diffusion chamber, and plenum chamber all connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust bag receiving chamber, said first casing member having a plurality of spaced openings formed in said flange thereof, said first casing member also having another opening communicating with said plenum chamber, an annular member overlying said flange and having a plurality of spaced openings formed therein, said annular member being movable relative to said casing members, the openings of said annular member and said casing member flange coinciding in one position of said annular member and being out of register in another position of said annular member so that there are no openings provided by the combination of said flange and said annular member, said second casing member having an opening communicating with said bag receiving chamber.

8. The vacuum cleaner of claim 7 in which a closure member for said other opening of said first casing member is secured to said annular member, said closure member being positioned over said other opening of said first casing member to close the same when said annular member and said flange have their openings coinciding with each other and being removed from said other opening in said first casing member when said annular member and said flange have their openings out of registry with each other.

9. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted within said inclosure and having a rotatable shaft, a radial type fan mounted on said shaft substantially concentric with and adjacent the inner surface of said first casing member, a dished rigid sheet member secured to said first casing member within said inclosure, said first casing member having an inwardly turned flange around the periphery thereof, said sheet member having a portion extending upwardly beyond said inwardly turned flange in contact therewith around the periphery of said vacuum cleaner so as to form a closure, said sheet member and said first casing member forming between them a fan housing, diffusion chamber, and plenum chamber all connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust receiving chamber, an opening in said first casing member, a tubular member extending from said first casing member opening into said plenum chamber, movable means providing communication between the inside of said tubular member and said plenum chamber in a first position and providing communication between the inside of said tubular member and said dust receiving chamber in a second position, said first casing member having a plurality of spaced openings formed in said inwardly turned flange thereof, said sheet member having a plurality of spaced openings formed in said upwardly extending portion thereof, an annular member overlying said inwardly extending flange and said upwardly extending portion, said annular member having two pluralities of spaced openings formed therein, said annular member being movable relative to said casing members, one of said pluralities of openings of said annular member and said plurality of openings of said casing member flange coinciding in one position of said ring and being of register in a second position of said ring so that there are no openings provided by the combination of said flange and said annular member, the second plurality of openings of said annular member and said plurality of openings of said sheet member upwardly extending portion coinciding in said second position of said annular member and being out of register in said first position of said annular member so that there are no openings provided by the combination of said upwardly extending portion and said annular member.

10. A vacuum cleaner comprising first and second casing members positioned to form an inclosure, said first casing member having a dished configuration, an electric motor mounted within said inclosure and having a rotatable shaft, a radial type fan mounted on said shaft substantially concentric with and adjacent the inner surface of said first casing member, a dished rigid sheet member secured to said first casing member within said inclosure, said first casing member having an inwardly turned flange around the periphery thereof, said sheet member having a portion extending upwardly beyond said inwardly turned flange in contact therewith around the periphery of said vacuum cleaner so as to form a closure, said sheet member and said first casing member forming between them a fan housing, diffusion chamber, and plenum chamber all connected to the remainder of said inclosure only through said fan, the remainder of said inclosure forming a dust receiving chamber, an opening in said first casing member, a tubular member extending from said first casing member opening into said plenum chamber, said tubular member having an opening in the side thereof communicating with said plenum chamber

and having an opening at the end thereof communicating with said dust receiving chamber, movable means closing said tubular member side opening and opening said tubular member end opening in the first position thereof and closing said tubular member and opening and opening said tubular member side opening in the second position thereof, said first casing member having a plurality of spaced openings in said flange thereof, said sheet member having a plurality of spaced openings formed in said upwardly extending portion thereof, an annular member overlying said first casing member flange and said sheet member upwardly extending portion and having two pluralities of spaced openings formed therein, said annular member being movable relative to said casing member by said movable means, one of said pluralities of openings of said annular member and said plurality of openings of said casing member flange being out of register in the first position of said movable means so that there are no openings provided

and coinciding in the second position of said movable means, said second plurality of openings of said annular member and said plurality of openings of said sheet member upwardly extending portion coinciding in the first position of said movable means and being out of register in the second position of said movable means so that there are no openings provided by the combination of said upwardly extending portion and said annular member.

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