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3,082,465

VACUUM CLEANING APPARATUS

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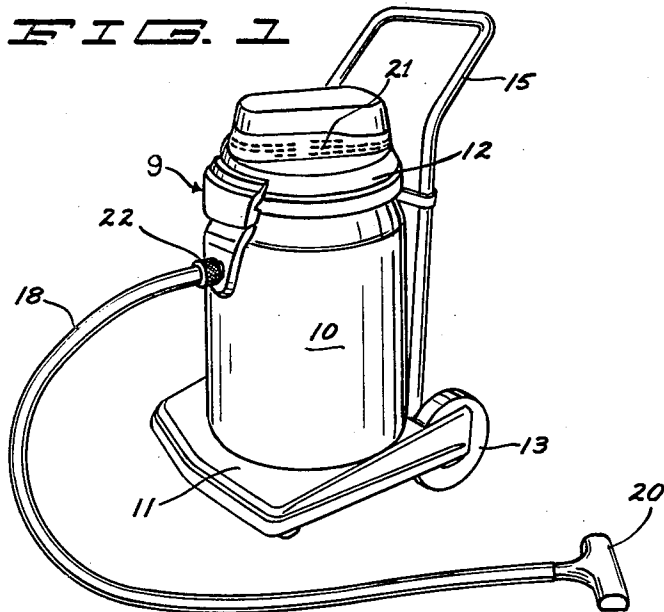
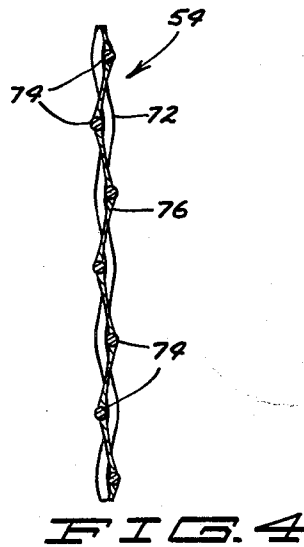
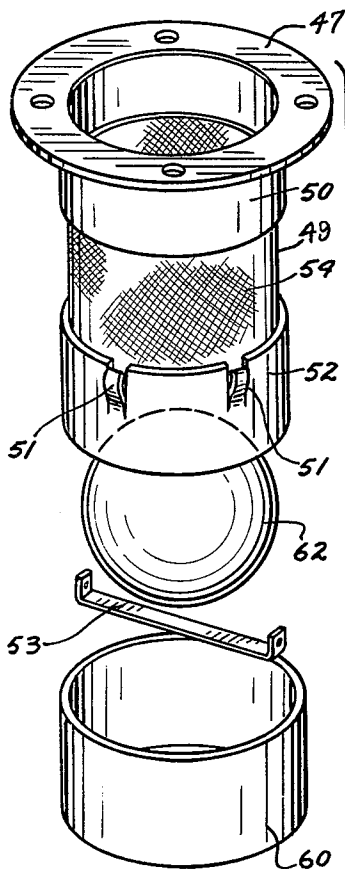
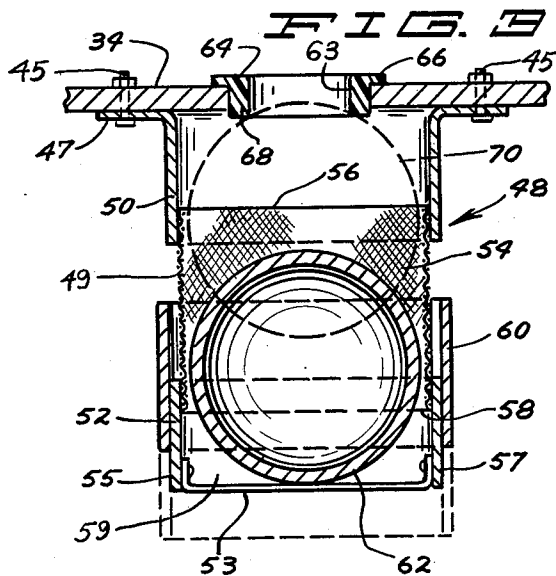


FIG. 5

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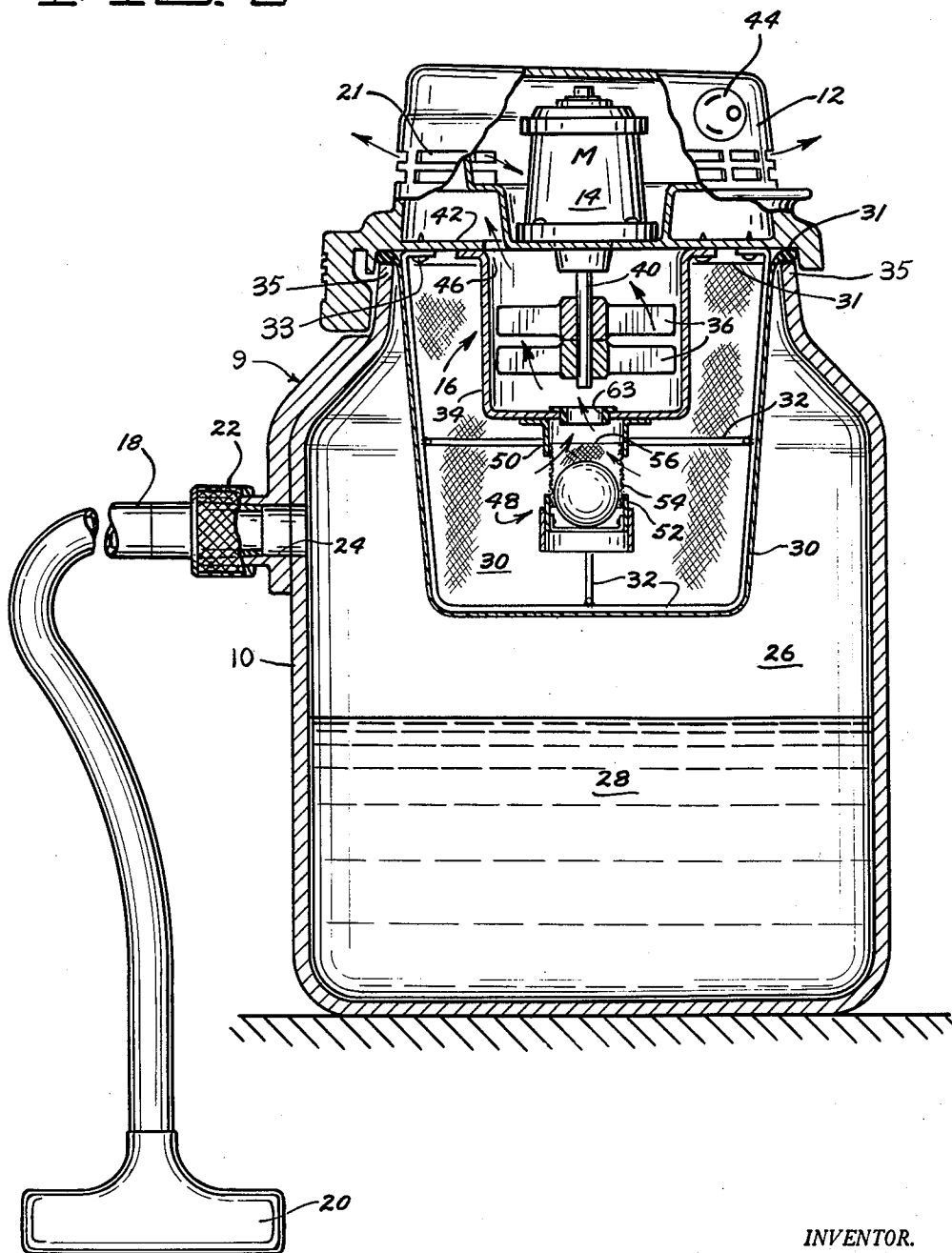
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2 Sheets-Sheet 2

FIG. 2



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VACUUM CLEANING APPARATUS

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9 Claims. (Cl. 15—327)

This invention relates to cleaning appliances and more particularly to cleaning appliances having vacuum means for picking up liquids such as cleaning solutions as well as dry materials.

It has previously been shown that cleaning appliances used in washing various articles such as floors, rugs, upholstery, walls, fixtures and the like can be provided with suction or vacuum means for picking up soapy solutions used in cleaning these articles. These appliances ordinarily include a motor driven blower, a liquid storage tank, a hose connected to the tank and a suitable pick up head attached to the free end of the hose. In operation, the cleaning solution is drawn into the pick-up head by the vacuum created by the blower and is stored temporarily in the liquid storage tank.

A serious problem in such appliances results from damage caused by moisture in the form of suds and foam which occasionally enters the inlet port of the blower. It has been found that even though the best available packing and sealing materials are used in the bearings of the motor and blower, moisture in the suds which occasionally pass into the blower will nevertheless eventually cause serious damage to the blower bearings, and in some cases will also cause damage to the drive motor.

It is therefore an important object of this invention to provide an improved vacuum cleaner for picking up both wet and dry materials including soapy cleaning solutions having means for reliably preventing the passage of soap suds and foam into the blower inlet port.

It is another object of the present invention to provide an improved vacuum operated device for picking up and temporarily storing cleaning solutions having means for automatically shutting off the blower inlet when a liquid storage tank is filled to capacity with liquids and also having means to shut off the air blower inlet in the event that moisture in the form of soap bubbles or suds is drawn towards the inlet.

It is a still further object of this invention to provide an improved vacuum cleaner of the type described which is rugged in construction, economical to manufacture and reliably prevents the passage of moisture in the form of soap bubbles and foams into the blower inlet port thereby preventing damage to the blower and motor parts.

With these objects in mind the invention provides an apparatus for preventing passage of soap suds into the blower of a vacuum cleaner comprising broadly a blower inlet enclosure communicating with the blower inlet port, at least one opening in the enclosure, a foraminous member such as a wire screen positioned in the opening whereby substantially all of the air passing into said blower normally passes through the foraminous member, a movable element associated with the enclosure, the movable element being normally located in a first position and movable to a second position responsive to a reduction in the amount of air flow through said enclosure opening due to obstruction of the apertures in said foraminous element, the movement of said movable element to the second position being adapted to cut off the flow of air into the blower. According to a preferred form of the invention, I provide a second inlet opening in the enclosure and a valve seat communicating with the blower inlet port whereby a portion of said valve element is adapted to move to a seated position against the valve seat

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responsive to a substantial increase in the flow of air through the second inlet port.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

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

FIG. 2 is a vertical sectional view of the cleaner of FIG. 1.

FIG. 3 is a vertical sectional view of the improved apparatus according to the present invention.

FIG. 4 is a greatly enlarged semi-diagrammatic sectional view taken through the screen illustrated in FIGS. 2, 3 and 5.

FIG. 5 is an exploded perspective view of the apparatus illustrated in FIG. 3.

Referring now to the drawings there is shown a vacuum cleaner 9 for picking up and temporarily storing solid materials and also liquid materials used in cleaning floors, rugs, upholstery, venetian blinds and other articles. The cleaner includes a cylindrical storage tank 10 having a power unit 12 positioned in the upper end thereof. The power unit 12 has rigidly mounted therein a drive motor 14 for operating a blower 16. The tank 10 is mounted on one side thereof pick-up hose 18. At the free end of hose 18 is attached a pick-up head 20 of known construction. The pick-up hose 18 is connected to the tank 10, the means of a conventional quick release hose connector 22. The pick-up head 20 and hose 18 communicate with the inside 26 of tank 10 through port 24. In operation, the vacuum created by blower 16 draws in dirt, dust or liquid cleaning materials such as a soap solution through the pick-up head 20. The material entering pick-up head 20 passes through hose 18, connector 22, port 24 and is temporarily stored in tank 10. As shown in FIG. 1 the vacuum cleaner 9 may be placed on a cart 11 including a pair of wheels 13 (only one wheel being visible), and a handle 15. The cart 11 enables the cleaner 9 to be easily moved from place to place as required.

Positioned between the blower 16 and the inside of the tank 10 is a porous filter element 30 such as a synthetic fiber bag to help prevent dirt and moisture from passing through the blower 16. The upper end of filter element 30 is secured to a sealing ring 31 which is interposed between the head 12 and the upper rim 35 of tank 10 thereby preventing leakage of air between the power head 12 and the tank. The filter element 30 is retained in position by means of an internal wire support 32 which is attached to the head 12 by screws 33. The blower 16 includes a blower housing 34 and impellers 36 secured to drive shaft 40 of the motor 14. The blower 16 is attached to the bottom of a plate 42 which comprises the lower surface of the power unit 12. The blower 16 draws air in through a blower inlet port 63 and exhausts the air through a blower outlet port 46. The air passing through port 46 then passes out of the power unit 12 through the ports 21.

Referring now particularly to FIGS. 3 and 5, there is shown the improved blower inlet construction according to the present invention. A blower inlet enclosure 48 is attached by any convenient means such as bolts 45 to the blower housing 34. The enclosure 48 comprises a pair of hollow enclosure members 50 and 52. Enclosure member 50 is provided with an outwardly extending mounting flange 47 and can be secured to blower 16 adjacent inlet port 63 by bolts 45 which pass through the flange 47. Positioned in a first enclosure opening 49 between members 50 and 52 is a foraminous member such as a wire screen 54 constructed of wires 72 and 74 (see FIG. 4) and which preferably extends around the entire circumference of the enclosure 48 over the first en-

sure opening 49. Screen 54 is preferably rigidly secured in the opening 49 by any convenient means such as welding to members 50 and 52 at 56 and 58. With the enclosure 48 is provided a movable element 62 such as a hollow ball formed from metal or plastic. Element 62 is spaced slightly from the sides of the chamber 43 and is therefore freely movable within the enclosure 48. To retain the element 62 within the chamber 43, there is provided a retainer 53 such as a metal strap which can be attached at opposite ends thereof to the opposite sides of member 52 by suitable fastening means such as rivets 55 and 57. As can be seen the lower end of member 52 is open and comprises a second enclosure opening 59.

Slidably mounted over the valve enclosure 48 is a control member 60. Member 60 is conveniently formed from a hollow cylindrical body of a slightly larger diameter than member 52 so that it can be easily moved up or down and securely retained at any selected position or setting to control the size of the primary valve inlet 49. A number of retainer elements 51 can be provided, if desired, on member 52 to project outwardly and frictionally engage the inside surface of member 60 to securely retain member 60 in the selected position.

When the control element 60 is moved downwardly to the dotted line position of FIG. 3, the first valve inlet 49 will be increased in size so that a relatively larger area of screen 54 is exposed and thus more air will pass there-through into the enclosure 48. As a result, the pressure differential across screen 54 will be reduced. If, however, the control element 60 is elevated to the solid line position of FIG. 3, the pressure differential across screen 54 will be increased.

While the blower inlet port 63 can be constructed in a variety of ways, I prefer to employ a circular rubber sealing element 64 having a radially projecting circumferential flange 66 at the upper end thereof and an annular valve seat 68 at the lower end against which a portion of movable element 62 will be seated under the conditions explained hereinbelow.

The operation of the invention will now be described.

It will be presumed for the purposes of this description that a wet material, such as a soapy cleaning solution has already been spread over the article being cleaned. When it is desired to pick up the cleaning solution, the motor 14 is energized causing the impeller blade 36 to rotate thereby creating relatively low pressure condition within the tank 10, pick-up hose 18 and pick-up head 20. The air drawn into pick-up head 20 carries with it the cleaning solution from the article being cleaned. This liquid passes through port 24 into tank 10 and is stored at 28. Occasionally, however, suds or foam will form or accumulate in the space between the filter element 30 and the blower 16. Prior to the use of the improved apparatus of the present invention these suds were often drawn into the inlet port 63 and over a period of time would cause severe moisture damage to motor and impeller bearings. Because of the relatively narrow space between the movable valve element 62 and the member 52, substantially all of this foam will be carried with the air traveling through the screen 54 toward blower inlet 63.

As the suds impinge against the screen 54, the film 76 is formed in the openings of screen 54, as shown in FIG. 4. This will, of course, obstruct the apertures in the screen and hence increase the pressure differential across the screen 54. The resultant pressure reduction on the inside of the enclosure 48 will in turn force an increased amount of air to enter through the second port 59. The movable element 62 is thereby caused to move with the stream of air passing through port 59 until it takes the dotted line position 70 illustrated in FIG. 3. In this position, a portion of the movable valve element 62 is held against the seat 68 due to the suction created by the blower thereby closing the blower inlet port 63. When the port 63 is closed, the soap film, foam and suds are, of course, prevented from passing into the blower. Conse-

quently, damage to the blower and motor parts from the moisture of the suds which would otherwise be drawn in through port 63 is eliminated.

After the ball has sealed port 63, as described above, the motor and blower will, of course, continue to operate. The operator can then turn off the drive motor 14 for a short time. After the motor has been turned off the valve element 62 will fall away from port 63 to its original position at the lower end of enclosure 48. The soap film obstructing the openings in the screen 54 will dissipate in a short time after which the motor can again be started and the cleaning operation continued.

It will be understood that the conditions under which the movable element 62 becomes seated against the port 63 will vary in accordance with a number of factors among them being the speed and volume of air drawn into the blower, the weight and size of the valve element, the total open area of the screen 54 and the size of the port 63. To enable apparatus of this invention to operate satisfactorily under various circumstances, the control element 60 can be moved manually up or down over the opening 49 to any selected position thereby controlling the area of the screen 54 through which air will pass. This adjustment enables the sensitivity of the apparatus to be changed, as desired.

While the movable element 62 is gravitationally held away from the seat 68 according to the preferred form of the invention, it will be understood that other means such as a spring may be employed for this purpose if desired.

The invention successfully prevents the soap suds and foam which occasionally form in the cleaning solution from passing into the blower of the cleaner. It is adjustable for various different conditions, requires relatively few parts and can be economically manufactured. Moreover, by providing that the movable valve element 62 will float on the surface of water, for example, by making it in the form of a hollow ball, it will rise when the level of the accumulated fluid 28 rises to a position near the top of the tank thereby automatically shutting off the air intake when the tank is filled to capacity with liquids. It should be noted that the movable valve element 62 thus serves a dual purpose.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. An apparatus for preventing damage by suds and foam to the blower and motor of a vacuum cleaner having a blower, said blower having an inlet port and a pick-up head communicating with said port comprising, in combination, an enclosure attached to said cleaner, said enclosure communicating with said inlet port, said enclosure having an opening therein communicating with said pick-up head, a foraminous member positioned in said opening whereby air drawn into said blower is adapted to enter said enclosure through said foraminous member, a movable element associated with said enclosure, said movable element being normally disposed in a first position allowing air to flow freely through said foraminous member into said inlet port, means forcibly retaining said movable element in said first position, said element being movable to a second position against the force of said means responsive to obstruction of said foraminous member whereby the air flow through said foraminous member is substantially reduced, the force exerted by said means and the size of the openings in said foraminous member being adjusted relative to each other such that a soap film from said suds will remain substantially lodged within the openings of the foraminous member while a pressure differential exists thereacross sufficient to move said element against said force, the movement of said movable element to said second position being adapted to prevent the flow of air into said inlet port.

2. A vacuum cleaner comprising a tank for storing

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water and suds picked up by said cleaner, a power head connected to said tank, said power head having a motor connected thereto and a blower operatively connected to said motor, said blower having an inlet port therein communicating with said tank, an enclosure connected to said vacuum cleaner, said enclosure communicating between said inlet port and said tank, first and second inlet openings in said enclosure, a foraminous member positioned in said first inlet opening, said foraminous member having a plurality of apertures therein, a movable element normally positioned in said second opening, means yieldably retaining said movable element in said second opening, the force exerted by said means and the size of the apertures in said foraminous member being adjusted relative to each other such that a soap film from said suds will remain substantially lodged within the apertures of the foraminous member while a pressure differential exists thereacross sufficient to move said element against said force, whereby obstruction of said apertures in said foraminous member causes a pressure reduction within said enclosure and which in turn causes said movable element to move from said second opening to a second position adapted to obstruct the passage of air into said blower.

3. A vacuum cleaner comprising a storage tank for storing liquid cleaning products, a power head connected to said tank, said power head including a motor and a blower operatively connected to said motor, said blower having an inlet port therein communicating with said tank, a pick-up head communicating with said tank, an enclosure in said cleaner, said enclosure communicating with the inlet port of said blower, at least a portion of said enclosure comprising a foraminous member having a plurality of apertures therein, a movable element mounted within said enclosure, said enclosure having an opening therein, means forceably retaining said movable element between said opening and said blower inlet port, the air entering said blower inlet port normally passing through foraminous member, the force exerted by said means and the size of the apertures in said foraminous member being adjusted relative to each other such that a soap film from said suds will remain substantially lodged within the apertures of the foraminous member while a pressure differential exists thereacross sufficient to move said element against said force, whereby said pressure differential across said foraminous member will cause said movable element to move from said opening against said force to a seated position in said inlet port thereby interrupting the air flow into said blower.

4. An apparatus for preventing passage of soap suds into the blower of a vacuum cleaner having a blower, said blower having an inlet port therein, said apparatus comprising in combination a blower inlet enclosure communicating with said blower inlet port, a valve seat communicating with said blower inlet port, at least a portion of said enclosure comprising a foraminous member, said foraminous member having a plurality of apertures therein, the air passing into said blower normally passing through said apertures, a movable valve element associated with said enclosure and operatively associated with said valve seat, means normally biasing said valve element away from said valve seat, said movable valve element being operatively associated with said foraminous member to move toward said valve seat against said means responsive to a substantial reduction in air flow through said foraminous member, said movable valve element being normally retained in a first position by said means and movable to a seated position upon said valve seat responsive to a reduction in the amount of air flow through said foraminous member due to obstruction of the apertures therein, the movement of said movable valve element to the seated position being adapted to cut off the flow of air into said blower and a movable control member connected to said enclosure, said control member being selectively movable to vary the open area of said foraminous member.

5. A vacuum cleaner comprising a tank for the storage of liquid cleaning products, a power head mounted at the

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top of said tank, a filter element positioned between said power head and said tank, a hose connected to said tank, a pick-up head connected to the free end of said hose and communicating through said hose with the interior of said tank, a motor rigidly connected to said power head, a blower operatively connected to said motor, said blower having an inlet port therein communicating with the interior of said tank and an enclosure secured to said blower, said enclosure communicating with said inlet port and the interior of said tank, a first and second inlet opening in said enclosure, said first inlet opening having a screen member positioned therein, said screen member having a plurality of apertures therein, a movable element positioned within said enclosure, said movable element normally obstructing substantially all of the air flow through said second opening, means yieldably retaining said element in a position obstructing the passage of air through said second opening, the air flowing into said inlet port normally entering said enclosure through said screen member, the force exerted by said means and the size of the apertures in said screen member being adjusted relative to each other such that a soap film from said suds will remain substantially lodged within the apertures of the foraminous member while a pressure differential exists thereacross sufficient to move said element against said force, whereby the obstruction of said apertures in said screen member by said suds creates a pressure differential across the surface of said screen member and a reduced pressure condition within said enclosure causing said movable element to move from the normal position within said second opening to a second position obstructing the flow of air into said inlet port.

6. A vacuum cleaner comprising a storage tank, said storage tank having an opening therein at the upper end thereof, a pick-up head communicating with said tank, a motor rigidly secured to said cleaner, a blower operatively connected to said motor, said blower having an inlet port communicating therewith, an enclosure communicating with said inlet port, said enclosure extending downwardly from said inlet port, said enclosure comprising first and second hollow cylindrical members and a cylindrical wire screen positioned between said first and second hollow cylindrical members and said wire screen having a plurality of apertures therein, said enclosure having an opening therein at the lower end thereof, a spherical element movably positioned within said enclosure, means for yieldably retaining said movable element in a position obstructing said opening, retainer means for holding said movable element within said enclosure, the force exerted by said means and the size of the apertures in said screen being adjusted relative to each other such that a soap film from said suds will remain substantially lodged within the apertures of the screen while a pressure differential exists thereacross sufficient to move said element against said force, substantially all of the air entering said enclosure normally passing through the apertures in said wire screen, the obstruction of said apertures in said wire screen being adapted to cause said movable element to move away from said opening to a seated position against said inlet port whereby the flow of air into said blower is obstructed.

7. A vacuum cleaner according to claim 6 wherein a hollow cylindrical control member is slidably mounted over said enclosure and is adapted for movement over said wire screen to a plurality of selected positions whereby the open area of said screen may be adjusted as desired.

8. An apparatus for preventing the passage of soap suds into a blower of a vacuum cleaner, including a tank for storing liquids, said apparatus comprising a valve enclosure, a portion of said enclosure comprising a foraminous member having a plurality of apertures therein communicating between said enclosure and said tank, said enclosure having a first port therein between said enclosure and said blower and a second port therein between said enclosure and said tank, a valve seat communicating be-

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tween said first port and said enclosure, a movable valve element within said enclosure, said valve element being normally gravitationally retained in a position obstructing the passage of air flow through said second port, the air passing into said blower being thereby disposed to pass normally through said apertures of said foraminous member and about said movable valve element, retainer means for supporting said movable valve element within said enclosure, the weight of said movable element and the size of the said apertures in said foraminous member being adjusted relatively to each other such that a soap film from said suds will be retained within the apertures of said foraminous member while a pressure differential exists thereacross sufficient to raise said movable valve element against the force of gravity, said valve element being movable upwardly against the force of gravity to a seated position on said valve seat to thereby obstruct the flow of air through said first port responsive to an increase to the amount of air flowing through said second port due to obstruction of said apertures by said soap film and the suction created by said blower being adapted to retain said movable valve element against said valve seat to thereby interrupt further flow of air into said blower from said enclosure whereby the passage of suds or foam into said blower is prevented.

9. An apparatus for preventing the passage of soap suds into the blower of a vacuum cleaner having a blower, said blower having an inlet port therein, said apparatus

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comprising in combination a blower inlet enclosure communicating with said blower inlet port, a valve seat communicating with said inlet port, at least a portion of said enclosure comprising a foraminous member, said foraminous member having a plurality of apertures therein, the air passing into said blowing normally passing through said apertures, said enclosure having an inlet opening therein, a movable valve element associated with said enclosure, said movable valve element being normally located in a first position and movable to a seated position against said valve seat responsive to a reduction in the amount of air flowing through said foraminous element and a substantial increase in the flow of air through said inlet opening, the movement of said movable valve element into said seated position being adapted to cut off the flow of air into said blower and a movable control element connected to said enclosure, said control element being selectively movable to vary the open area of said foraminous member.

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