

Feb. 16, 1937.

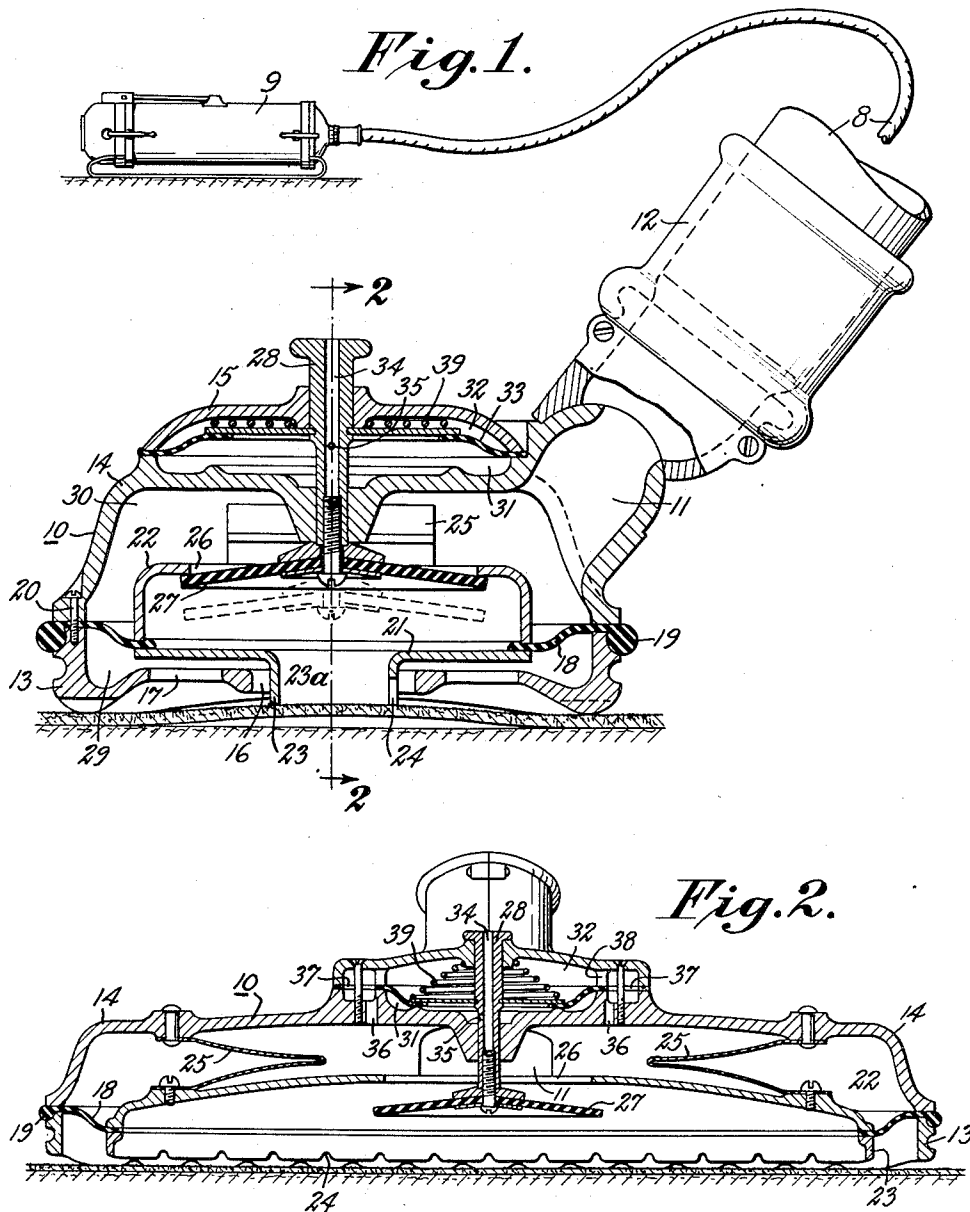
F. J. R. KARLSTRÖM

2,070,834

SUCTION NOZZLE

Filed April 20, 1935

2 Sheets-Sheet 1



INVENTOR,

Fredrick Johan Robert Karlström
BY

J. S. Hedlund
ATTORNEY.

Feb. 16, 1937.

F. J. R. KARLSTRÖM

2,070,834

SUCTION NOZZLE

Filed April 20, 1935

2 Sheets-Sheet 2

Fig. 3.

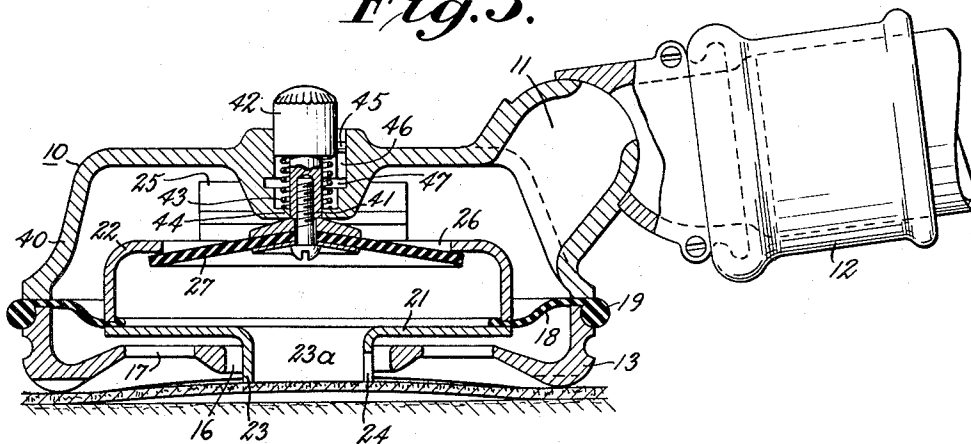


Fig. 4.

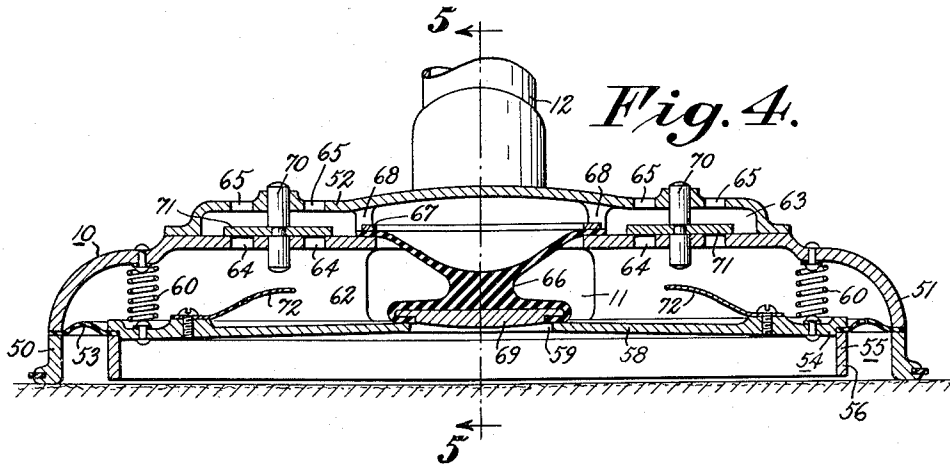
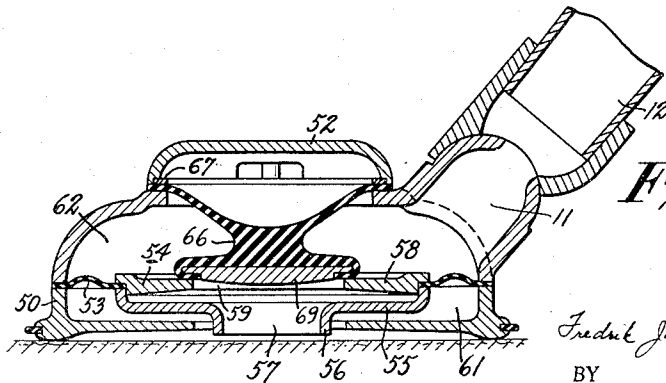


Fig. 5.



INVENTOR,

Fredrik Johan Robert Karlström

BY

J. J. Hedlund
his ATTORNEY.

UNITED STATES PATENT OFFICE

2,070,834

SUCTION NOZZLE

Fredrik Johan Robert Karlström, Stockholm,
Sweden, assignor to Electrolux Corporation,
Dover, Del., a corporation of Delaware

Application April 20, 1935, Serial No. 17,381

19 Claims. (Cl. 15—13)

My invention relates to vacuum cleaners and more particularly to an improved suction nozzle for use in connection with vacuum cleaning apparatus. Still more particularly, my invention relates to a nozzle including an agitator operable by air flow through the nozzle.

One of the objects of my invention is to provide a nozzle of this type wherein the agitator member is secured to a flexible diaphragm which is caused to move by the variation in the pressure of the air acting thereon. This movement is utilized to open and close one or more valves which are arranged to cause the aforesaid variation in air pressure.

A further object of my invention is to provide a nozzle of this type wherein the agitator member may be automatically rendered inoperative, whenever the nozzle is placed on a hardwood floor or the like.

A still further object of my invention is to provide a nozzle having an agitator which may be manually rendered inoperative at will.

Further objects and advantages of my invention will be apparent from the following description considered in connection with the accompanying drawings, which form a part of this specification and on which:

Fig. 1 is a cross-sectional view of one embodiment of my invention;

Fig. 2 is a cross-sectional view taken on the line 2—2 of Fig. 1, but with a valve member in a different position;

Fig. 3 is a cross-sectional view of another embodiment of my invention;

Fig. 4 is a cross-sectional view of a further embodiment of my invention; and

Fig. 5 is a cross-sectional view taken on the line 5—5 of Fig. 4.

Referring more particularly to Figs. 1 and 2, reference character 10 designates generally a hollow member formed with an opening 11 adapted to be connected to a source of suction, such as the vacuum cleaner unit 9, by means of handle member 12 and flexible hose 8. Handle 12 may be pivotally connected to hollow member 10 in order that it may be lowered towards a horizontal position if it is desired to operate the mouth-piece under furniture or the like, as shown in my Patent No. 2,031,957, issued February 25, 1936. Hollow member 10 comprises a lower part 13, an intermediate part 14 and an upper part 15. Lower part 13 is formed with an elongated intake opening 16 and, if desired, with further openings 17. Clamped between lower member 13 and intermediate member 14 is a flexible diaphragm

18. The outer edge of diaphragm 18 may be formed with a bead 19 which not only adds strength to the diaphragm but provides a bumper extending around the nozzle so that, if the latter is accidentally brought into contact with furniture, no damage will result. Parts 13 and 14 may be secured together by a plurality of screws 20 which extend through holes formed in the diaphragm adjacent the edge thereof. The more central part of the diaphragm is formed with an elongated opening and the inner edge of the diaphragm bounding this opening is clamped between the lower part 21 and the upper part 22 of an agitator member. Lower part 21 is formed with downwardly extending walls 23 which bound an opening 23a and extend through the elongated intake opening 16. The lower edges of walls 23 may be formed with grooves 24, shown more particularly in Fig. 2. Springs 25 are secured at one end to intermediate part 14 of the hollow member and at the other end to the upper part 22 of the agitator and serve to movably support the agitator within the hollow member.

Upper part 22 of the agitator is formed with a preferably circular opening 26. A valve member 27 made of flexible material, such as rubber, is secured to a hollow spindle 28. Spindle 28 is reciprocally supported within the top of intermediate part 14 and the upper part 15 of the hollow member 10. With the parts in the position shown in Fig. 1, valve member 27 serves to close the opening 26 in the upper part 22 of the agitator. It will thus be seen that the diaphragm 18 and the agitator serve to divide the hollow member into a lower chamber 29 and an intermediate chamber 30 and that valve member 27 controls communication between these two chambers.

The space between the top of intermediate part 14 and upper part 15 of the hollow member may be termed a control chamber and is divided into an atmospheric compartment 31 and a suction compartment 32 by means of a flexible diaphragm 33. Compartment 31 is permanently in communication with the atmosphere through the bore 34 of spindle 28 and a hole 35 formed in the spindle below the diaphragm. Compartment 32 is permanently in communication with chamber 30 by means of passageways 36 formed in the top of intermediate part 14, holes 37 formed in the edge of diaphragm 33 and passageways 38 formed in upper member 15. A coil spring 39 is retained within compartment 32 between the top thereof and diaphragm 33. Each turn of spring 39 is of different diameter so that,

when the spring is compressed, the turns may nest one within the other.

The operation of the above described embodiment is as follows:

5 If the nozzle is placed on a rug or the like, the opening 23a bounded by walls 23 is sealed to a considerable extent, and when air is exhausted from chamber 30 through handle 12 and hose 8 by the vacuum cleaner 9, a partial vacuum is
10 produced in chamber 30. This vacuum also prevails in chamber 32 due to the fact that this chamber communicates with chamber 30 through the passageway formed at 36, 37 and 38. This reduction in pressure is sufficient to permit the
15 atmospheric pressure prevailing in chamber 31 to move the diaphragm 33 to the full line position shown in Fig. 1 against the action of spring 39. This upward movement of the diaphragm causes spindle 28 to move upwardly and valve member
20 27 closes the opening 26 in the upper part 22 of the agitator member. Chamber 30 is now completely closed from the atmosphere and the low pressure produced therein causes diaphragm 18 and the agitator member connected thereto to
25 move upwardly. During a part of this movement the outer edge of flexible valve member 27 remains in contact with upper part 22 of the agitator and opening 26 remains sealed. However, further upward movement of the agitator
30 pulls it away from the valve member and communication between chamber 30 and the interior of the agitator is established through opening 26. This immediately reduces the vacuum prevailing in chamber 30, and produces a partial vacuum
35 in chamber 29 underneath the diaphragm and springs 25, which were stressed by the upward movement of the agitator, now forces the agitator down. Air is drawn into chamber 30 through the interior of the agitator and passes
40 through handle 12 to the vacuum cleaner unit. When the agitator moves downwardly to the position shown in Fig. 1, it again contacts the outer edge of valve member 27 and opening 26 is again sealed. This permits the pressure existing in
45 chamber 29 to increase and that prevailing in chamber 30 to decrease and the cycle just described is repeated.

The agitator member is hence caused to move up and down at a high rate of speed and the
50 walls 23 thereof rapidly strike the object being cleaned and thus dislodge dirt adhering thereto. This dirt is picked up by the air stream passing in to the hollow agitator member and is carried through the handle 12 and hose 8 to the vacuum
55 cleaner unit 9.

As long as the opening 23a is sealed to the extent that it is by a rug or the like, the pressure in chamber 32, although it varies rapidly due to the opening and closing of passage 26, never
60 reaches a value sufficiently high to cause diaphragm 33 in the control chamber to move valve member 27 downwardly. However, in the event that the nozzle is placed on a hardwood surface, or other surface which does not sufficiently seal
65 the opening 23a, the reduction in pressure occurring within chamber 30, and consequently within chamber 32, is not sufficient to overcome the force of spring 39 and the spindle 28 and valve member 27 remain in the lower position shown by
70 the dot-dash lines in Fig. 1. Consequently, valve member 27 does not seal the opening 26, with the result that no variations in the pressure acting on the diaphragm 18 are produced and consequently, the agitator member is not moved up and
75 down. This is desirable because, if the agitator

member continues to operate when the nozzle is on a hardwood floor or the like, it not only produces a highly undesirable noise, but might mar the floor if the walls 23 are made of metal. It will be seen that the arrangement above described operates automatically to render the agitator member inoperative when the nozzle is used on a hard surface.

The embodiment shown in Fig. 3 is similar to that shown in Figs. 1 and 2, except that the agitator member is rendered inoperative manually instead of automatically. In this embodiment, the hollow member 10 comprises a lower member 13, similar to that shown in Figs. 1 and 2, and an upper member 40 which may be secured to the
10 lower member in the same manner that intermediate member 14 in Figs. 1 and 2 is secured. Valve member 27 is supported on the lower end of a spindle 41 slidably mounted in the top of upper part 40. The upper end of spindle 41 is provided with a hand grasp member 42 and a spring 43 is retained between member 42 and a shoulder 44. Spring 43 tends to hold the spindle and the valve member in the upper position shown in Fig. 3. Member 42 is provided with a pin 45 arranged to slide in an axial groove 46. The lower end of axial groove 46 communicates with a circumferential groove 47.
15

When it is desired to render the agitator inoperative, member 42 is pressed downwardly against the action of spring 43 until pin 45 sliding in groove 46, reaches circumferential groove 47. Thereafter, a slight rotation of member 42 in either direction moves pin 45 into the circumferential groove and spindle 41 and valve 27 are retained in the lower position. In this position valve member 27 is ineffective to seal opening 26 in the agitator.
20

When the valve member is in its upper position, as shown in Fig. 3, the operation of the device to produce rapid movement of the agitator is the same as that described in connection with the embodiment shown in Figs. 1 and 2.
25

In the nozzle shown in Figs. 4 and 5 the hollow member 10 comprises a lower portion 50, an intermediate portion 51 and an upper portion 52. A diaphragm 53 is clamped between portions 50 and 51 and the inner edge of the diaphragm is secured to an agitator member 54. Agitator member 54 comprises a lower part 55 having
30 downwardly extending walls 56 bounding an opening 57, and an upper part 58 formed with a preferably circular opening 59 therethrough. Coil springs 60 serve to support the agitator member within the hollow member 10. Diaphragm 53 and agitator member 54 serve to divide hollow member 10 into a lower chamber 61 and an intermediate chamber 62.
35

An upper or control chamber 63 is formed between intermediate part 51 and upper part 60 52. Passageways 64 connect chambers 62 and 63 together, while passages 65 connect chamber 63 with the atmosphere. A valve member 66 formed of rubber, or other resilient material has an upper disc-shaped portion, the outer edge of which is clamped between the top of part 51 and a ring 67. Ring 67 is held in place by means of projections 68 on upper part 52. The upper part of valve member 66 is thus exposed to the pressure existing within chamber 63. The lower end of valve member 66 cooperates with opening 59 so as to provide a closure therefor. The lower end of valve member 66 may be provided with a disc 69 of metal or other rigid material for reenforcing purposes.
40
45
50
55
60
65
70
75

Pins 70 are slidably mounted in intermediate part 51 and upper part 52 adjacent to passages 64 and 65. A valve plate 71 is secured to each of pins 70. These plates serve to close passages 64 when the pins are in their lower positions and serve to close passages 65 when the pins are in their upper positions. Passages 64 and 65 and valve plate 71 thus comprise two-way valve means for connecting chamber 63 selectively with the atmosphere and with chamber 62. Resilient arms 72, secured to agitator 54 are arranged to bear against the lower ends of pins 70 and to raise the latter when the agitator is raised.

15 This embodiment operates as follows:

With the parts in the respective positions, as shown in Figs. 4 and 5, a reduced pressure is produced in chamber 62 due to the exhaustion of air therefrom through handle 12. This causes diaphragm 53 and agitator 54 to be moved upwardly by the pressure of the atmosphere acting on the lower sides thereof. This movement of the agitator compresses springs 60 and also tends to flatten out the disc-shaped portion of valve member 66. At this time the upper end of the valve member is subjected to the atmospheric pressure prevailing in chamber 63 and the lower end of valve member is likewise subjected to atmospheric pressure, which prevails underneath diaphragm 53 and within the hollow agitator member. Continued upward movement of the agitator causes arms 72 to strike and lift pins 70. Plates 71 are moved upwardly with the pins so as to uncover passages 64 and to close passages 65. Consequently, the reduced pressure prevailing within chamber 62 is communicated to chamber 63 and acts on the upper end of valve member 66. Inasmuch as atmospheric pressure continues to act on the lower end of the valve member, the pressures acting on opposite ends of the valve member are unbalanced and the valve member is drawn more or less up into chamber 63 and uncovers the opening 59 in the agitator. Chamber 62 is now in communication with the atmosphere through opening 59 and the pressure in chamber 62 is accordingly raised while the pressure in chamber 61 is reduced. Springs 60 are thus able to force the agitator member downwardly, whereby arms 72 permit pins 70 to fall so that plates 71 close passages 64 and open passages 65. Atmospheric pressure is thus again admitted to chamber 63 and valve member 66, due to its resiliency, takes its original shape and hence again closes opening 59 and the cycle is repeated. The result is that the agitator member 54 is vibrated rapidly and serves to dislodge dust adhering to the surface being cleaned. This dust is picked up by the air stream passing into the nozzle through the hollow agitator and the opening 59 in the top thereof and is carried through the hollow handle 12 to the vacuum cleaner unit.

While I have shown and described three more or less specific embodiments of my invention, it is to be understood that this has been done for purposes of illustration only and that the scope of my invention is not to be limited thereby, but only by the appended claims, when viewed in the light of the prior art.

70 What I claim is:

1. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator

75 located in said member in the path of air flow

between said openings and movable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air therethrough, and means operative by movement of the first mentioned means for increasing and decreasing flow of air through said passage to cause fluctuations in the pressure acting on said first mentioned means.

2. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air therethrough, and a valve member operative by movement of said means for increasing and decreasing flow of air through said passage to cause fluctuations in the pressure acting on said means.

3. In a suction nozzle, a hollow member having an inlet opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and oscillatable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air therethrough, and a valve member associated with said passage and operative upon movement of said means in one direction to open said passage and upon movement of said means in the opposite direction to close said passage.

4. In a suction nozzle, a hollow member having an inlet opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable in vertical direction due to variations of air pressure acting thereon, said means being formed with a passage for flow of air therethrough, and a valve member associated with said passage and operative upon upward movement of said means to open said passage and operative upon downward movement of said means to close said passage.

5. In a suction nozzle, walls forming a hollow member having an inlet opening and an opening adapted to be connected to a source of suction, an agitator member, means for movably supporting said agitator in said hollow member adjacent to said inlet opening, a flexible diaphragm secured to said agitator and said walls, said agitator and said diaphragm forming a partition in said hollow member between said openings movable in response to variations in air pressure acting thereon, said partition being formed with a passage for flow of air therethrough, and a valve member associated with said passage and operative by movement of said partition for increasing and decreasing flow of air through said passage to cause fluctuations in the pressure acting on said partition.

6. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member and movable due to variations in air pressure acting thereon, and means for simultaneously decreasing the pressure on one side of said diaphragm and increasing the pressure on the other side of said diaphragm and alternately, for simultaneously increasing the

pressure on said one side and decreasing it on said other side.

7. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member and movable due to variations in air pressure acting thereon, and means operative by movement of the first mentioned means in one direction for decreasing the pressure on one side of said diaphragm and increasing the pressure on the other side of said diaphragm and operative by movement of said first mentioned means in the opposite direction for increasing the pressure on said one side and decreasing it on said other side of said diaphragm.

8. In a suction nozzle, a hollow member having an intake opening adapted to be partially sealed by a surface to be cleaned and an opening adapted to be connected to a source of suction, a movable diaphragm in said member, an agitator member secured to said diaphragm and movable therewith, means for increasing and decreasing the air pressure acting on said diaphragm to cause movement thereof, and means responsive to an increase in pressure caused by unsealing said intake opening within said member for rendering the last mentioned means inoperative.

9. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, a diaphragm in said member movable in response to variations in pressure acting thereon, an agitator member secured to said diaphragm and movable therewith, valve means operable by movement of said diaphragm for increasing and decreasing the pressure acting on said diaphragm, and means for rendering said valve means inoperative.

10. In a suction nozzle, a hollow member having an intake opening adapted to be partially sealed by a surface to be cleaned and an opening adapted to be connected to a source of suction, a diaphragm in said member movable in response to variations in pressure acting thereon, an agitator member secured to said diaphragm and movable therewith, valve means operable by movement of said diaphragm for increasing and decreasing the pressure acting on said diaphragm, and means responsive to an increase in pressure caused by unsealing said intake opening within said member for rendering said valve means inoperative.

11. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air therethrough, a valve member operative by movement of said means for increasing and decreasing flow of air through said passage to cause fluctuations in the pressure acting on said means, and means for moving said valve member to an inoperative position.

12. In a suction nozzle, a hollow member having an intake opening adapted to be partially sealed by a surface to be cleaned and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable due to variations in air pressure acting thereon, said

means being formed with a passage for flow of air therethrough, a valve member operative by movement of said means for increasing and decreasing flow of air through said passage to cause fluctuations in the pressure acting on said means, and means responsive to an increase in pressure caused by unsealing said intake opening within said hollow member for moving said valve member to an inoperative position.

13. In a suction nozzle, a hollow member having an inlet opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and oscillatable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air therethrough, a valve member associated with said passage and operative upon movement of said means in one direction to open said passage and upon movement of said means in the opposite direction to close said passage, and means for moving said valve member to a position such that said passage is continuously open.

14. In a suction nozzle, a hollow member having an inlet opening adapted to be partially sealed by a surface to be cleaned and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and oscillatable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air therethrough, a valve member associated with said passage and operative upon movement of said means in one direction to open said passage and upon movement of said means in the opposite direction to close said passage, and means responsive to an increase in pressure caused by unsealing said intake opening within said hollow member for moving said valve member to a position such that said passage is continuously open.

15. In a suction nozzle, a hollow member having an inlet opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable in vertical direction due to variations of air pressure acting thereon, said means being formed with a passage for flow of air therethrough, a valve member associated with said passage and operative upon upward movement of said means to open said passage and operative upon downward movement of said means to close said passage, said valve member being mounted for upward and downward movement, and means for moving said valve member downwardly to a position such that said passage is continuously open.

16. In a suction nozzle, a hollow member having an inlet opening adapted to be partially sealed by a surface to be cleaned and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable in vertical direction due to variations of air pressure acting thereon, said means being formed with a passage for flow of air therethrough, a valve member associated with said passage and operative upon upward movement of said means to open said passage and operative upon downward movement of said means to close said passage, said valve member being mounted for upward and downward movement, and means responsive to an increase

in pressure caused by unsealing said intake opening within said hollow member for moving said valve member downwardly to a position such that said passage is continuously open.

5 17. In a suction nozzle, a hollow member having an intake opening and an opening adapted to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow
10 between said openings and movable due to variations in air pressure acting thereon, said means being formed with a passage for flow of air there-
through, a movably mounted valve member co-
operable with said passage and operative by
15 movement of said means for increasing and decreasing flow of air through said passage to cause fluctuations in the pressure acting on said means, said hollow member being formed with a control
20 chamber, a second diaphragm dividing said chamber into two compartments, one of said compartments being connected to the atmosphere and the other of said compartments being connected to the interior of said hollow member whereby said
25 second diaphragm is subjected on one side to the pressure in said hollow member and on the other side to the constant pressure of the atmosphere, resilient means tending to move said second diaphragm against the pressure of the atmosphere, and means connecting said second diaphragm
30 with said valve member for moving said valve member out of cooperative relation with said passage upon a substantial equalization of the air pressures acting on opposite sides of said second diaphragm.

35 18. In a suction nozzle, a hollow member having an intake opening and an opening adapted

to be connected to a source of suction, means including a flexible diaphragm and an agitator located in said member in the path of air flow between said openings and movable due to varia- 5
tions in air pressure acting thereon, said means being formed with a passage for flow of air there-
through, a valve member associated with said
passage for increasing and decreasing the flow
of air through said passage to cause fluctuations
10 in the pressure acting on said means, said hollow member being formed with a control chamber, and two-way valve means operable by movement of the first mentioned means for connecting said
chamber selectively with the atmosphere and with
15 the interior of said hollow member, the valve member associated with said passage being responsive to a decrease in pressure in said control chamber to increase the flow of air through said
passage and being responsive to an increase in
20 pressure in said control chamber to decrease the flow of air through said passage.

19. In a suction nozzle, a hollow body having an intake opening and an opening adapted to be connected to a source of suction, structure in-
cluding a movable member located in said body 25
in the path of air flow between said openings, said member being movable due to variations in air pressure acting thereon, an agitator connected to said movable member for movement there-
by, said structure being formed with a passage 30
for flow of air therethrough, and means operative by movement of said movable member for increasing and decreasing flow of air through
said passages to cause fluctuations in the pressure
35 acting on said movable member.

FREDRIK JOHAN ROBERT KARLSTRÖM.