ABSTRACT: This invention relates to a multipurpose vacuum cleaner nozzle having a suction inlet which is movable over a porous object like a rug to remove dirt therefrom. A brush is mounted on the nozzle at the vicinity of the suction inlet for movement between upper and lower positions, the brush in its lower position being below the suction inlet and operable to remove dirt from a nonporous object like a floor. The suction inlet becomes operable to remove dirt from a porous object when the brush is in its upper position above the suction inlet.

The brush is moved between its upper and lower positions by pneumatically operated mechanism having a control chamber connected by a passageway to a region of the nozzle in which the air normally is at a partial vacuum. A valve, which is connected in the last-mentioned passageway, is kept in its closed position by a sensing member when it probes a nonporous object over which the nozzle is moved and is actuated to its open position by the sensing member when it probes a porous object over which the nozzle is moved.

When the valve is open and the air in the chamber is at a first pressure which is a partial vacuum, the pneumatically operated mechanism functions to move the brush to its upper position against the biasing action of spring means. When the valve is closed and the air in the chamber is at a second higher pressure, which can be ambient air at atmospheric pressure, the mechanism functions to move the brush to its lower position with the biasing action of the spring means.
MULTIPURPOSE VACUUM CLEANER NOZZLE

BACKGROUND OF THE INVENTION

1. Field of the Invention
This invention relates to a multipurpose vacuum cleaner nozzle having a suction inlet and a brush mounted for movement on the nozzle between upper and lower positions, the brush in its upper position being above the suction inlet and in its lower position below the suction inlet. When the brush is in its upper position the suction inlet is rendered operable to remove dust and dirt from porous objects like carpets and rugs. When the brush is in its lower position the brush is rendered operable to remove dust and dirt from nonporous objects like floors.

2. Description of the Prior Art
In known multipurpose nozzles of the kind heretofore provided the brush is moved pneumatically between its upper and lower positions by mechanism which includes a rubber diaphragm to which the brush is connected, such diaphragm forming a wall of a space in communication with the path of air flow of the nozzle which is at a partial vacuum. Due to the subatmospheric pressure in the nozzle, which varies in accordance with the physical characteristics of the object over which the nozzle is moved, the diaphragm will flex to its upper or lower position and move the brush to its upper or lower position on the nozzle.

The diaphragm is biased to its lower position by a spring which is so adjusted that the brush can be shifted on the nozzle solely due to changes in the physical characteristics of the object over which the nozzle is moved. With a nozzle of this type, the vacuum-producing ability of the vacuum cleaner connected to the nozzle should not vary within too wide limits. If the suction ability of the vacuum cleaner should decrease to an abnormally high extent, as when the dust bag of the vacuum cleaner becomes clogged with dust and dirt, the partial vacuum or suction pressure produced in the air flow path of the nozzle can become too small to effect movement of the brush between its upper and lower positions in the nozzle.

SUMMARY OF THE INVENTION
This invention relates to a multipurpose vacuum cleaner nozzle which can be employed for different kinds of cleaning. It is an object of the invention to provide an improved multipurpose vacuum cleaner nozzle having a number of operating surfaces available and each one of which automatically becomes operable to perform a specific kind of cleaning depending upon the physical characteristics of the object to be cleaned.

This is accomplished by providing a nozzle having a suction inlet which is primarily suitable to remove dirt from a porous object like a rug. A brush is mounted on the nozzle at the vicinity of the suction inlet for movement between upper and lower positions on the nozzle, in its lower position being below the suction inlet and operable to remove dirt from a nonporous object like a floor. The suction inlet becomes operable to remove dirt from a porous object when the brush is in its upper position above the suction inlet.

The brush is moved between its upper and lower positions by pneumatically operated mechanism having a control chamber connected by a passageway to a region of the nozzle in which the air normally is at partial vacuum. A valve, which is connected in the last-mentioned passageway, is kept in its closed position by a sensing member when it probes a nonporous object over which the nozzle is moved and is actuated to its open position by the sensing member when it probes a porous object or which the nozzle is moved.

When the valve is open and the air in the chamber is at a first pressure which is a partial vacuum, the pneumatically operated mechanism functions to move the brush to its upper position against the biasing action of resilient means. When the valve is closed and the air in the chamber is at a second higher pressure, which can be ambient air at atmospheric pressure, the mechanism functions to move the brush to its lower position with the biasing action of the resilient means.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing,
FIG. 1 is an end view, partly in section, of a vacuum cleaner nozzle embodying the invention;
FIG. 2 is a view similar to FIG. 1 showing parts in different positions with respect to one another;
FIG. 3 is a fragmentary vertical sectional view illustrating the relative positions of control details when the parts of the nozzle are positioned with respect to one another in the manner shown in FIG. 1;
FIG. 4 is a view similar to FIG. 3 illustrating the relative positions of control details when the parts of the nozzle are positioned with respect to one another in the manner shown in FIG. 2;
FIG. 5 is a fragmentary vertical sectional view taken at line 5-5 of FIG. 2; and
FIG. 6 is a fragmentary horizontal sectional view taken at line 6-6 of FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT
Referring to the drawing, the vacuum cleaner nozzle 10 embodying the invention includes an outlet socket 11 adapted to be connected to a source of supply of air at a partial vacuum, such as a vacuum cleaner, and a vertically extending passageway 12a terminating in an opening defining a suction inlet 12. The nozzle 10, which is in the form of a hollow body, is provided with elongated spaces 13 at opposing sides of the passageway 12a, the spaces 13 being connected to one another at their ends by end spaces 13', as seen in FIG. 5.

A diaphragm 15, which is formed of elastomeric material like rubber, for example, is fixed between the top and bottom parts 10a and 10b of the nozzle 10 and includes an enlarged peripheral edge portion 35 which serves as a bumper to protect objects which the nozzle 10 may strike when it is being moved over a floor or carpet being cleaned. The diaphragm 15 defines the bottom walls of the spaces 13 and 13'. To the diaphragm 15 are fixed brushes 16 which are movable between upper and lower positions and extend downward through openings 18 in the bottom plate 19 of the nozzle. The brushes 16 are biased downward to their lower positions by helical springs 17 which are held between the top walls of the spaces 13 and the diaphragm 15.

When the nozzle 10 is being moved over a nonporous surface like a floor, for example, the air in spaces 13 will be at atmospheric pressure, as will be explained presently, and the springs 17 are rendered operable to move the diaphragm 15 and brushes 16 downward, as shown in FIGS. 1 and 3. When the nozzle 10 is being moved over a porous surface like a rug, for example, the air in the spaces 13 will be at subatmospheric pressure or a partial vacuum, as will be explained presently, whereby the diaphragm 15 will flex upward against the biasing action of the springs 17 to raise the brushes 16 to their upper positions shown in FIGS. 2 and 4.

In accordance with this invention the position of the brushes 16 on the nozzle 10 is controlled by a valve 20 which is regulated by a sensing member 24,25 that probes the object over which the nozzle 10 is being moved. The valve 20 comprises a valve disc or member 22 which is movable toward and from its seat 23 and biased toward its closed position by a coil spring 21. The sensing member 24,25 comprises an elongated rod 24 which is fixed at its upper end to the valve member 22. The lower end of the rod 24 acts against the flat bottom 26 of a cap-shaped part 25 having an outward flange 25' which is supported about an opening 25" in the bottom plate 19 of the nozzle 10.

The nozzle 10 is supported by rollors or wheels 27 which function to hold the nozzle 10 at one level with respect to a nonporous surface like a floor, for example, as shown in FIGS. 1 and 3. In FIGS. 1 and 3 the bottom 26 of the part 25 is
spaced from a nonporous surface with the part 25 seated in the opening 25° of the bottom plate 19 and the valve member 22 in its closed position. The rollers 27 are of such thickness that they will sink into a porous surface like a rug, for example, as shown in FIGS. 2 and 4. In FIGS. 2 and 4 the bottom 26 of the part 25 rides in physical contact with the porous surface and is lifted by the surface, whereby the rod 24 will be raised against the action of the spring 21 to move the valve member 22 from its seat 23 and establish communication between spaces 39 and 40. Since the part 25 is loosely held at the bottom plate 19 it can tip in all directions and follow different inclinations of the surface over which it is being moved.

The seat 23 is formed at the bottom of a knob 28 threadedly connected to the valve 20. By turning the knob 28 the vertical position of the seat 23 can be raised and lowered to determine when the valve member 22 moves to and from its closed position on the seat 23. The knob 28 is provided with a pair of sealing members 34 of annular form, as seen in FIGS. 3 and 4. The valve 20 is formed with a plurality of openings or channels 29, 30, 31, 32 and 33.

The vacuum cleaner nozzle 10 described above operates in the following manner. When cleaning a nonporous object like a floor, for example, as shown in FIGS. 1 and 3, the wheels 27 function to hold the bottom plate 19 of the nozzle 10 spaced from the floor to form a gap therebetween. This gap is selected so that the cup-shaped part 25 will not contact the object being cleaned. Under these conditions the valve disc 22 will be held against its seat 23 and the valve 20 will be closed. Under these conditions the air in the spaces 13 will be at atmospheric pressure.

Ambient air can flow to the spaces 13 in a path of flow which includes the opening 33 and space 36 which is ring-shaped and extends about the valve part 20a and is in direct communication with the spaces 13. The opening 33 may be referred to as a leakage passageway for ambient air to flow into space 36 and from the latter into the spaces 13. Ambient air also can pass into the spaces 13 through the passageway 24 in which the rod 24 is located, space 39 and opening 29 in the valve part 20a.

Under the conditions just described, there will be no pressure difference on the opposing sides of the diaphragm 15 and the springs 17 will bias the diaphragm 15 downward and move the brushes 16 below the suction inlet 12 into an operative position on the object being cleaned. If it is desired to employ the brushes 16 to clean a porous surface like a carpet, for example, this can be accomplished by manually adjusting the knob 28 to shift the seat 23 vertically upward which in turn will raise the rod 24. The knob 28 is adjusted sufficiently so that the lower end of the rod 24 will not act on the bottom 26 of the cup-shaped part 25.

When cleaning a porous object like a carpet, for example, the wheels 27 will sink into the porous object so that the cup-shaped part 25 will move over the surface of the object in contact therewith. This will raise the rod 24 and valve disc 22, thereby lifting the latter from its seat 23. Under these conditions, air in the spaces 13 will be at subatmospheric pressure or a partial vacuum. This is so because the spaces 13 will be in communication with the passageway of the air outlet socket 14 which is adapted to be connected to a source of supply of air at a partial vacuum. This communication is established by a path of flow which includes opening 29, spaces 39 and 40, openings 30 and 31, annular space 37,38 and opening 32. Air in the spaces 13 now will be at subatmospheric pressure and at a partial vacuum in spite of the fact that ambient air can leak through opening 33 into space 36 and also can leak through passageway 24 into space 39. This will cause the diaphragm 15 to flex upward against the action of the springs 17 and move the brushes 16 to their upper positions above the suction inlet 12, as shown in FIG. 2. The brushes 16 can be maintained in their upper positions when the nozzle 10 is being moved over a nonporous surface like a floor, for example, by manually adjusting the knob 28 to move the seat 23 to its lowest position. Under these conditions the lower end of the rod 24 will remain in contact with the cup-shaped part 25 and the valve disc 22 will be in its wide open position with respect to the seat 23.

The diaphragm 15 also can serve as a seal between the upper and the lower parts 10a and 10b of the nozzle 10. With this construction the diaphragm advantageously can be formed so that a portion thereof will serve as a flap valve which cooperates with a seat like the seat 23. In such arrangement the rod 24 will act upon the bottom of the flap valve while the top of the flap valve will be acted upon by an adjustable spring like the spring 21.

We claim:
1. A multipurpose vacuum cleaner nozzle comprising:
a. a hollow body having vertically disposed walls which forms a downward extending first passageway and terminates in an opening defining a suction inlet, said body also having an air outlet socket adapted to be connected to a source of supply of air at a partial vacuum and means providing a path of flow for air between the suction inlet and outlet socket, b. means disposed exteriorly of said wall means at the vicinity of said suction inlet, said means having vertically disposed bristles depending downward therefrom, c. first means for mounting said first passageway means operable to move said bristles means relative to said hollow body from its lower position to its upper position responsive to air in said zone at a first pressure which is a partial vacuum and operable to move said means relative to said hollow body to its lower position responsive to air in said zone at a second higher pressure, f. the tips of said bristles being at a level above that of said suction inlet when said means is in its upper position on said hollow body and at a level below that of said suction inlet when said means is in its lower position on said hollow body, g. fourth means providing a second passageway for air between said path and said zone, h. valve means in said second passageway which is movable between closed and open positions, i. control means operable to move said valve means from and toward its closed position responsive to the physical characteristics of the object adapted to be cleaned by the nozzle and over adjusts said means to reciprocate on said body between upper and lower positions, d. second means defining a zone, e. third means for rendering said first mounting means operable to move said means relative to said hollow body from its lower position to its upper position responsive to air in said zone at a first pressure which is a partial vacuum and operable to move said means relative to said hollow body to its lower position responsive to air in said zone at a second higher pressure, f. the tips of said bristles being at a level above that of said suction inlet when said means is in its upper position on said hollow body and at a level below that of said suction inlet when said means is in its lower position on said hollow body, g. fourth means providing a second passageway for air between said path and said zone, h. valve means in said second passageway which is movable between closed and open positions, i. control means operable to move said valve means from and toward its closed position responsive to the physical characteristics of the object adapted to be cleaned by the nozzle and over adjusts said means to reciprocate on said body between upper and lower positions, j. control means defining said zone being so constructed and formed that, during normal operation of said nozzle when said outlet is connected to a source of supply of air at a partial vacuum, the air in said zone will be at the first pressure, which is a partial vacuum when said valve means is open, and at the second higher pressure when said valve means is moved from its open toward its closed position.
2. A vacuum cleaner nozzle as set forth in claim 1 in which said first means for mounting said said means operable to move said means relative to said hollow body to its upper position when said valve means is open and the air in said zone is at the first pressure which is a partial vacuum.
3. A vacuum cleaner nozzle as set forth in claim 2 in which said hollow body includes structure providing a chamber which is outside said path of air flow and in communication with said zone and defined in part by said flexible diaphragm means.
4. A vacuum cleaner nozzle as set forth in claim 3 in which said structure providing said chamber includes said wall means.
5. A vacuum cleaner nozzle as set forth in claim 2 which includes:
   a. resilient means functioning to bias said flexible diaphragm means and render the latter operable to move
said brush means relative to said hollow body to its lower position when said valve means is closed and the air in said zone is at the second higher pressure,
b. the air in said zone at the first pressure, which is a partial vacuum when said valve means is open, functioning to overcome the biasing action of said flexible diaphragm means by said resilient means to move said brush means relative to said hollow body to its upper position.

6. A vacuum cleaner nozzle as set forth in claim 1 including means for supporting said hollow body for movement over the object adapted to be cleaned, said supporting means functioning to hold said body at one level with respect to the object when the latter is nonporous and hard like a floor, for example, and at a lower level with respect to the object when the latter is porous like a carpet, for example, said control means functioning to move said valve means from its closed toward its open position when said supporting means holds said body at the lower level with respect to the object and functioning to move said valve means from its open toward its closed position when said supporting means holds said body at the one level with respect to the object.

7. A vacuum cleaner nozzle as set forth in claim 6 in which said valve means comprises structure providing a valve member and a seat therefor, said valve member being vertically movable downward toward its seat and upward therefrom, said control means including a part which is vertically movable and operatively connected at its upper end to said valve member, the lower end of said part being adapted to physically contact the object to be cleaned and be moved thereover, said part assuming one vertical position with respect to said valve seat when its lower end contacts a porous object like a carpet, for example, and a second higher vertical position with respect to said valve seat when its lower end contacts a nonporous object like a floor, for example.

8. A vacuum cleaner nozzle as set forth in claim 7 in which said structure providing said valve member and seat therefor includes means for shifting the vertical position of said seat.

9. A vacuum cleaner nozzle as set forth in claim 7 in which said hollow body includes a bottom wall having an opening, a cup-shaped element having an outward extending flange at its open end which is held on said bottom wall at the opening therein, said control means part including said cup-shaped element which serves at its lower end and a vertically disposed rod connected at its upper end to said valve member, and means for resiliently biasing said valve member toward its closed position.

10. A multipurpose vacuum cleaner nozzle comprising
   a. a hollow body having vertically disposed wall means which forms a downward extending first passageway and terminates in an opening defining a suction inlet, said body also having an air outlet socket adapted to be connected to a source of supply of air at a partial vacuum and means providing a path of flow for air between the suction inlet and outlet socket,
   b. brush means disposed exteriorly of said wall means at the vicinity of said suction inlet, said brush means having vertically disposed bristles depending downward therefrom,
   c. first means for mounting said brush means to reciprocate on said body between upper and lower positions,
   d. second means defining a zone,
   e. third means for rendering said first mounting means operable to move said brush means relative to said hollow body to its upper position responsive to air in said zone at a first pressure which is a partial vacuum and operable to move said brush means relative to said hollow body to its lower position responsive to air in said zone at a second higher pressure which is at or approaches atmospheric pressure,
   f. the tips of said bristles being at a level above that of said suction inlet when said brush means is in its upper position on said hollow body and at a level below that of said suction inlet when said brush means is in its lower position on said hollow body,
   g. fourth means providing a second passageway for air between said path and said zone,
   h. valve means in said second passageway which is movable toward and from its closed position, and
   i. control means operable to move said valve means either toward its closed or open position responsive to the physical characteristics of the object being cleaned by the nozzle and over which said body is being moved.

11. A vacuum cleaner nozzle as set forth in claim 10 in which said second means defining said zone includes wall structure having an opening for ambient air to flow into said zone.

12. A vacuum cleaner nozzle as set forth in claim 10 in which said valve means includes a valve member and a seat therefor, said valve member being vertically movable downward toward its seat and upward therefrom, said control means including an elongated part which is vertically movable and operatively connected at its upper end to said valve member, said hollow body including means providing an upright passageway through which said part extends and in which it is guided, said passageway serving as an opening for ambient air to flow into said zone, the lower end of said part being adapted to physically contact the object to be cleaned and be moved thereover, said part assuming one vertical position with respect to said valve seat when its lower end contacts a porous object like a carpet, for example, and a second higher vertical position with respect to said valve seat when its lower end contacts a nonporous object like a floor, for example.