United States Patent

[11] 3,633,239

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[21] Appl. No. **2,197**
[22] Filed **Jan. 12, 1970**
[45] Patented **Jan. 11, 1972**

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[54] **PUSHBUTTON VACUUM SELECTOR**
6 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** ..... **15/327 R,**
15/339, 15/421, 137/599, 137/601, 137/637
[51] **Int. Cl.** **A47l 9/00**
[50] **Field of Search** ..... 15/327 A,
327 E, 327 R, 339, 375, 419, 421; 251/326

[56] **References Cited**
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3,440,681 4/1969 Hixson et al. ..... 15/421 X
3,353,452 11/1967 Beck et al. 137/624.2

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ABSTRACT: A slide valve pushbutton vacuum selector for use in a vacuum cleaner to choose between low, intermediate and high suction. The selector closes or opens selectively two vent openings in the vacuum chamber enclosure of the vacuum cleaner by means of three interlocked slide valves which are double hinged such that the pushbutton ends of the valves point at an angle to the surface having the vent openings in order to facilitate access and ease of operation of the pushbutton selector.

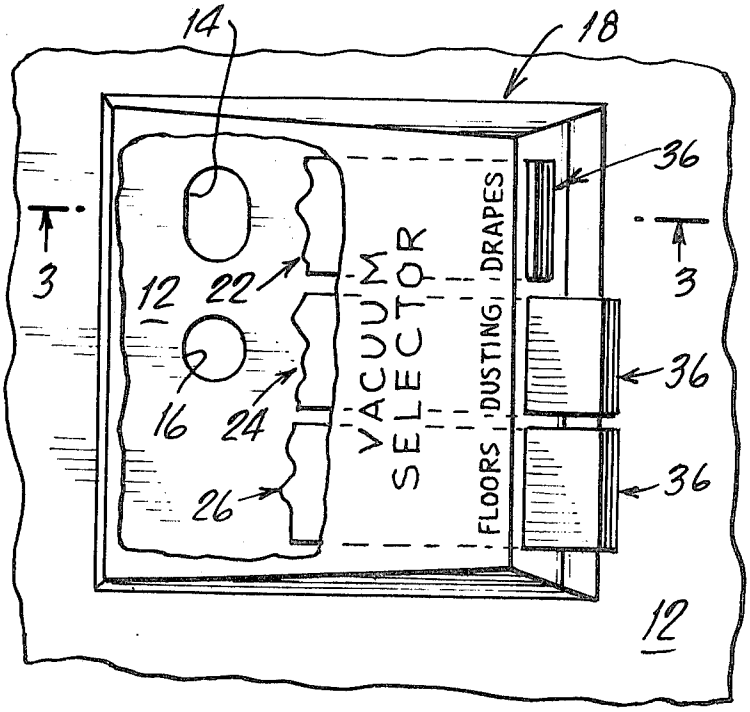
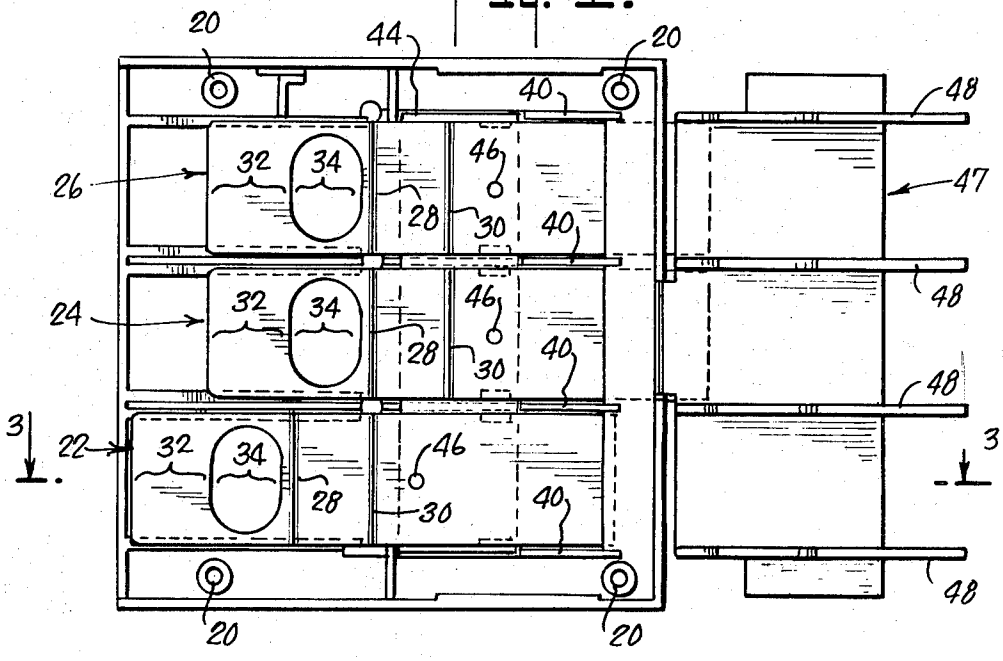


Fig. 1.



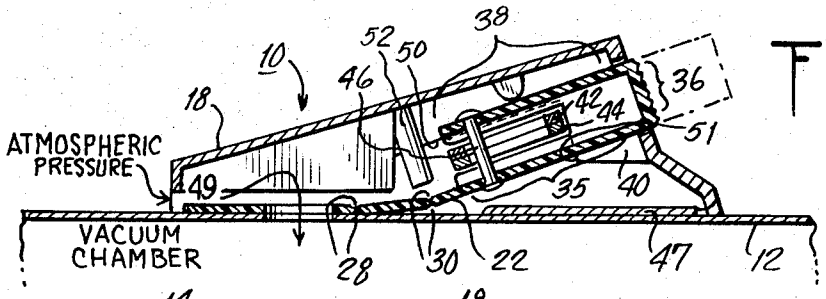


Fig. 3.

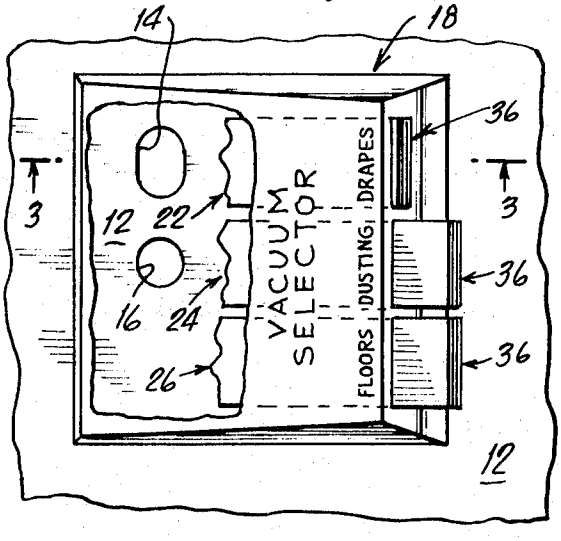


Fig. 2.

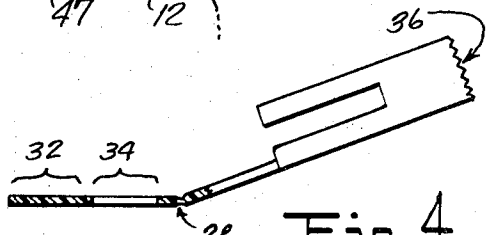


Fig. 4.

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PUSHBUTTON VACUUM SELECTOR

BACKGROUND OF THE INVENTION

The invention is in the field of devices for controlling fluid flow across a surface or a wall separating two spaces having different fluid pressures, and particularly relates to pushbutton selectors for different flow rates and to vacuum and suction level selectors for vacuum cleaners.

In vacuum cleaners, the means generating vacuum usually includes a motor operating at constant speed and tending to maintain constant vacuum level. However, different vacuum and suction levels are required for different types of cleaning (e.g., floors, dusting, drapes) and a common means to vary suction has been a C-ring encircling partially an apertured or slotted portion of the vacuum cleaner wand. As the C-ring is rotated, the aperture or slot in the wand may be completely closed for maximum suction, or it may be partially or fully opened for lower suction. With this type of vacuum control means, there is usually no positive indication of the type of suction at which the cleaner is operating, the C-ring is vulnerable to unintentional displacement in the course of cleaning and may have to be readjusted repeatedly, and undesirable air leaks may develop around it.

In fluid flow control in general, pushbutton flow rate or flow path selectors used in the past (Beck et al., U.S. Pat. No. 3,353,452) have been of relatively complex construction and operation and the pushbutton slide valves used have been rigid and straight.

It is an object of the present invention to provide a pushbutton selector which is relatively simple and inexpensive, gives positive indication of the type of suction at which the vacuum cleaner is operating, maintains securely the chosen suction level, and facilitates access and pushbutton operation by having the pushbutton ends of the slide valves point at an angle to the surface with vent openings.

It is a further object of the invention to provide suction control means for a vacuum cleaner which establishes and maintains predetermined suction levels which are readily identifiable and repeatedly selectable in exact duplication, without need for repeated fine adjustments by the vacuum cleaner user.

SUMMARY OF THE INVENTION

A pushbutton slide valve selector for selecting one of several flow rates between two spaces at different fluid pressures separated by a wall having one or more vent openings. In a particular application, the selector controls the vacuum level in the vacuum chamber of a vacuum cleaner by means of selectively opening or closing one or more openings for venting the vacuum chamber to atmospheric pressure. The openings may be of fixed size.

The selector includes a housing affixed to the surface or wall dividing the two different fluid pressure spaces. For example, the selector housing may fit over the top of the canister enclosing the vacuum chamber of a vacuum cleaner, and one or more vent openings in the canister top may be provided. The selector housing encloses and confines to specific sliding paths one or more slide valves, depending on the number of vent openings. Each slide valve is an oblong (usually rectangular) piece of substantially flat material, and terminates at one longitudinal end in a pushbutton which may be integrally formed with the flat portion of the valve. Near the other longitudinal end of each slide valve, there is a continuous area large enough to cover the vent opening with which the valve is to cooperate. Next to the continuous area, there is an aperture which may be aligned with the vent opening by means of moving the slide valve.

Each valve is confined by the housing to a sliding path overlapping a vent opening. In one valve position along the sliding path, the vent opening for that valve is closed off by the continuous area of the valve; in another position, the vent opening and the aperture in the valve coincide to allow venting airflow. A particular advantage of the invented pushbutton selector is that while the apertured portions of the slide valves remain flat against the wall having the vent openings for the purpose of providing flow control, the pushbutton ends are raised and point at an angle to the wall in order to facilitate access to the pushbutton portions of the slide valves for convenience of manual operation. In order to allow operation at this angled relationship, each slide valve has two parallel hinge lines which are perpendicular to the length of the valve and allow for double flexing in the course of moving a valve along its sliding path.

A particular advantage of having at least one hinge line in each shell valve is to allow the apertured portion of the valve to conform intimately to the shape and contour of the surface or wall having the vent openings so as to facilitate sealing the openings and preventing undesirable leaks. This sealing is most important when it is desired to provide maximum fluid pressure differential across the surface or wall by closing all vent openings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a bottom elevational view of a pushbutton slide valve selector with an open housing flap.

FIG. **2** is a top elevational view of the pushbutton slide valve selector with a partial cutout showing vent openings.

FIG. **3** is a side sectional view along lines **3—3** of FIGS. **1** and **2** and includes a showing of a double hinged slide valve.

FIG. **4** is a partially sectional and partially side elevational view of a slide valve having a single hinge line.

DESCRIPTION OF PREFERRED EMBODIMENTS

The pushbutton selector generally indicated at **10** is designed to be affixed to a surface or wall, such as surface or wall **12**, which separates two spaces at different fluid pressure, and is designed to serve in controlling the rate of fluid exchange between the two spaces.

In one particular embodiment, the pushbutton selector **10** is affixed to a wall **12** of the canister of a vacuum cleaner which conventionally includes a motor generating vacuum inside a vacuum chamber whose enclosure is the canister. The vacuum chamber is connected by means of a flexible hose or a wand or both to a cleaning nozzle.

The vacuum generating means (i.e., the fan motor inside the canister) usually operates at constant speed and tends to maintain a steady vacuum level. In order to vary the vacuum level for the purpose of providing optimized vacuum for different types of cleaning, the vacuum chamber defined by the canister enclosure may be selectively vented to atmospheric pressure by means of one or more vent openings. By varying the area or the number of the vent openings, the vacuum level may be varied from a maximum (for types of cleaning such as floor cleaning which require maximum suction) to considerably less than maximum vacuum (for types of cleaning such as drape cleaning which require low suction).

The wall **12** (which may be the top canister wall) has vent openings **14** and **16**, visible in the cutout view of FIG. **2**, which vent the vacuum chamber to atmospheric pressure. The vent opening **14** is larger than the vent opening **16**; hence the vacuum drop is greater when opening **14** is vented than when opening **16** is vented.

The pushbutton selector **10** serves to selectively close or open vent openings **14** and **16**. It includes a housing **18** integrally made of thermoplastic or other suitable material and affixed to the wall **12** by means of four screws **20**. The housing **18** partially encloses and confines to fixed sliding paths three slide valves **22**, **24** and **26** of oblong or rectangular shape and made of suitable flat material such as thermoplastic. Each of the slide valves **22**, **24** and **26** has two hinge lines **28** and **30** which may be integrally formed by means of score lines running perpendicularly to the length of the slide valves. Each slide valve is thus divided by the hinge lines **28** and **30** into three portions which may be angled with respect to each other in a plane normal to the hinge lines **28** and **30**. A first portion

of each slide valve **22**, **24** and **26** is defined as the portion between the hinge line **28** and the left-hand end (as in the drawings) of each slide valve. Each first portion includes a continuous area **32** and an aperture **34**. Each continuous area **32** is large enough to cover completely either of the vent openings **14** and **16**; each aperture **34** is larger than the vent openings **14** and **16** in order to allow maximum airflow through the vent openings even if only approximately aligned therewith. A second portion of each of the slide valves **22**, **24** and **26** is defined as between the hinge lines **28** and **30** and is a continuous area which may be in a plane at an angle to the plane of the first portion. A third portion is defined as the portion to the right (as in the drawings) of the hinge line **30** and includes a first section **35** which is a flat piece extending as a continuation of the second portion but at an angle thereto, a second section **36** extending normally from the right-hand end of the first section **35** and serrated or roughened for easier pushbutton operation, and a third section **38** extending back toward the hinge line **30** and parallel to the first section **35** but spaced therefrom by the length of the second section **36**.

The slide valves **22**, **24** and **26** are confined to parallel sliding paths in the housing **18** particularly by means of ribs **40** which are integral with the housing **18** and which flank the pushbutton ends of each valve.

The slide valves **22**, **24** and **26** are interlocked so that only one at a time may be pushed in to the position in which the slide valve **22** is shown in the drawings. The position in which the slide valve **22** is shown is defined as a first valve position, as opposed to the shown position of the slide valves **24** and **26** which is defined as a second valve position.

The interlocking mechanism includes conventional cam plates **42** and **44** which have conventional cam slots and slide with respect to each other and with respect to the slide valves **22**, **24** and **26**. A rivet **46** connects the sections **35** and **38** of the pushbutton end of each valve by extending perpendicularly to said sections, and passes through the cam slots of the cam plates **42** and **44**. As one of the slide valves **22**, **24** and **26** is pushed into its first position, whichever other slide valve is in its first position is pushed out to its second position by means of the cam plates **42** and **44** which are acted upon by the rivet **46** of the slide valve being pushed in and act upon the rivet **46** of the slide valve being pushed out.

The housing **18** has a hinged flap **47** with integral ribs **48** each in the same plane as one of the ribs **40**. The flap **47** serves to keep the slide valves **22**, **24** and **26** in their proper places while the pushbutton selector **10** is being affixed to the wall **12**, and also serves to provide separation between the slide valves, as they move along their sliding paths and—more importantly—to confine the cam plates **42** and **44** to a parallelepiped space defined by cutouts **50** along the lengths of the two central ribs **40** as top plane (as in FIG. **3**), by the two outside ribs **40** as two opposite sides, and by the wall **51** of the cutouts **50** of the two central ribs **40** and integral stops **52** as another pair of opposing walls, and by the tops of the ribs **48** of the flap **47** as bottom plane of the parallelepiped.

As seen in FIG. **2**, there is not vent opening for the slide valve **26**; that valve is used only for the purposes of providing an interlocking mechanism which can move both slide valves **22** and **24** to their second positions when the slide valve **26** is pushed into its first position. In effect, the slide valve **26** is a switch means for placing both slide valves **22** and **24** in their second positions. For production simplicity and for esthetic reasons, all three slide valves are identical, but the only essential function of the slide valve **26** is its cooperation with the interlocking mechanism including the cam plates **42** and **44**. The first and second portions of valve **26** may thus be omitted entirely.

As another embodiment, the slide valve used as slide valves **22**, **24** or **26** may have a single hinge line, as shown in FIG. **4**. The valve of FIG. **4** has a first portion similar to the first portion of the valves **22**, **24** and **26** of FIGS. **1–3** and including a continuous area **32** and an aperture **34**. However, it has only one hinge line **28** and only single line flexing is possible for the purpose of allowing the pushbutton end of the valve to point at an angle to the wall **12** for ease of access and operation.

In operation, when the pushbutton selector **10** is used in conjunction with a vacuum cleaner, the pushbutton **26** may be labeled FLOORS, the slide valve **24** may be labeled DUSTING and the slide valve **22** may be labeled DRAPES. When it is desired to operate the vacuum cleaner at maximum suction, the slide valve **26** is pushed in to its first position (all the way to the left, as shown in the figures). The interlocking mechanism then causes both slide valves **22** and **24** to be in their second positions, with their continuous areas **32** covering the vent openings **14** and **16** and preventing any airflow therethrough. It should be appreciated that at that time the continuous areas **32** of the slide valves **24** and **26** are held tightly pressed against the wall **12** because of the differential between atmospheric pressure and the lower pressure inside the vacuum chamber of the cleaner.

When it is desired to operate at intermediate suction, as for example for dusting, the slide valve **24** is pushed in to its first position at which its aperture **34** is aligned with the vent opening **16** to allow airflow into the vacuum chamber through an air passage **48** which has an inlet between the left-hand (as in the drawing) end of the housing **18** and the wall **12**. The air inflow through the air passage **49** and the vent opening **16** reduces the vacuum inside the vacuum chamber and thus reduces the suction at the vacuum cleaner nozzle. At that time both slide valves **22** and **26** are pushed out to their second positions by means of the interlocking mechanism.

When it is desired to operate at low suction, as for example for cleaning drapes, the slide valve **22** is pushed into its first position such that its aperture **34** is aligned with the vent opening **14** to allow airflow therethrough. Because the vent opening **14** is larger than the vent opening **16**, the airflow rate is now greater, and the vacuum inside the chamber, as well as the suction at the cleaning nozzle, are reduced further.

What is claimed is:

1. For use in a vacuum cleaner including means for generating and maintaining vacuum in an enclosed vacuum chamber connected for airflow with a cleaning nozzle,

wherein the improvement is in pushbutton vacuum selector means for selectively venting the vacuum chamber to reduce the vacuum therein and thus to reduce the suction at the cleaning nozzle, comprising,

a. means for defining at least one vent opening in the vacuum chamber enclosure;

b. at least one slide valve of oblong shape and of flat flexible material, with a pushbutton at one longitudinal end, with at least one hinge line perpendicular to the length of the slide valve for allowing flexing of the valve, and with a continuous area and means defining an aperture in a first portion defined as the portion between said at least one hinge line and the longitudinal end opposite the pushbutton end, such that said first portion of the slide valve may be flat against the vacuum chamber enclosure while the rest of the slide valve may be separated from the enclosure and at an angle thereto when the valve is flexed along said at least one hinge line; and

c. housing means affixed rigidly with respect to the vacuum chamber enclosure for holding said first portion of the slide valve pressed against the outside surface of the vacuum chamber enclosure, for defining for said first portion of the slide valve a sliding path overlapping the vent opening, said sliding path including a first position at which the vent opening and the slide valve aperture are aligned to allow airflow between the vacuum chamber and the surrounding space, and a second position at which the vent opening is covered by the continuous area of said first portion of the slide valve, and for defining for the pushbutton end of the slide valve a sliding path which is at an angle with the sliding path of said first portion of the slide valve.

2. A vacuum cleaner as in claim **1** including:

a. means defining a total of two vent openings of different opening areas;

b. a total of two slide valves, the first portion of each confined to a path overlapping one vent opening.

3. A vacuum cleaner as in claim 1, including a total of two hinge lines, parallel to each other, and both perpendicular to the length of the slide valve, said hinge lines dividing the valve into three portions which may be angled with respect to each other in a plane normal to the hinge lines.

4. A vacuum cleaner as in claim 2, including:

a. a third slide valve confined to a sliding path parallel to the sliding paths of the other two slide valves and having a first and a second positions in line with respectively the first and second positions of the other two slide valves; and

b. interlocking means operatively connected with the three slide valves for allowing only one valve to be in its first position at a time.

5. A vacuum cleaner as in claim 2, including interlocking means operatively connected with the two slide valves for allowing only one slide valve to be in said first position at a time.

6. A vacuum cleaner as in claim 5, including switch means for moving both slide valves to their second positions at which the vent openings are covered by said continuous areas.

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