United States Patent

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[54] **MULTIPLE INTERLOCKED VALVE CONSTRUCTION**
7 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **137/637.1,** 15/339
[51] **Int. Cl.** **F16k 11/22**
[50] **Field of Search** ..... 137/637.1, 637; 15/421, 331, 339, 334, (Inquired)

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ABSTRACT: A bleeder valve for vacuum cleaners comprises a housing including a body portion having three longitudinally spaced ports laterally venting, and a stem portion having three longitudinally slidable laterally spaced vanes therein adapted to seal respective ones of said ports. Each of the sliding vanes includes four cutout portions, certain of the perimeters of which being predetermined camming type surfaces and respective ones of which being in lateral alignment to constitute four sets of three laterally aligned cutout portions. The stem portion further has four transverse bores each opening at the top of the stem portion to receive a reciprocative plunger therein, each plunger being of a sufficient lateral dimension to be received in each of the laterally aligned cutout portions of each respective set, each set being coincident with a respective bore. The camming type surfaces of the cutout portions are designed so that only one plunger may be in actuated position at any one time, and, by actuation of any of the four plungers, a predetermined, selective opening or closing of the three ports by their respective vanes may be accomplished for negative pressure control in the vacuum cleaner.

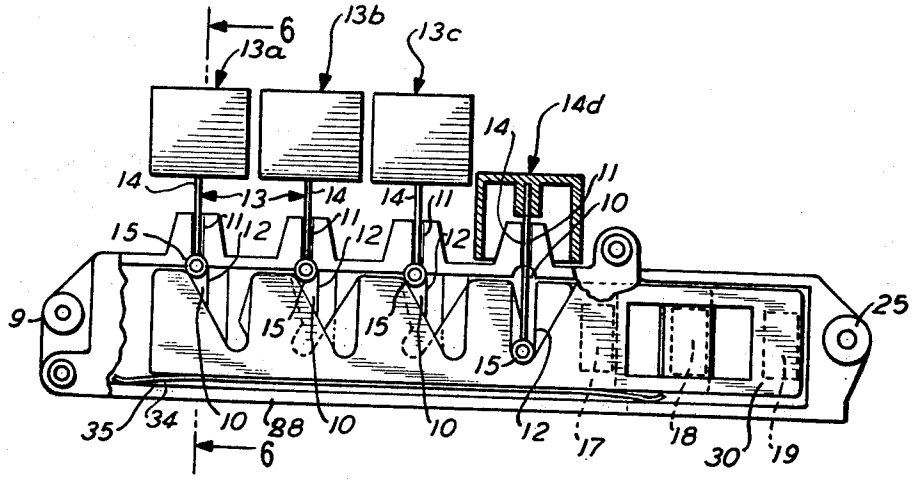


FIG. 1

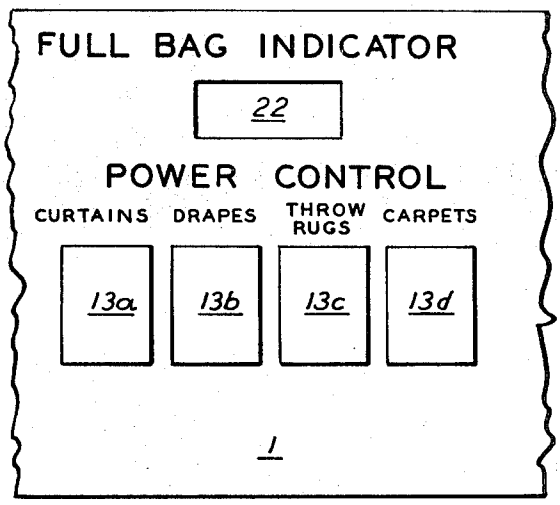


FIG. 6

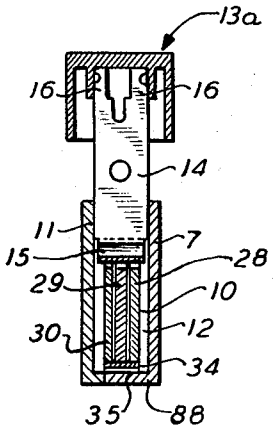


FIG. 2

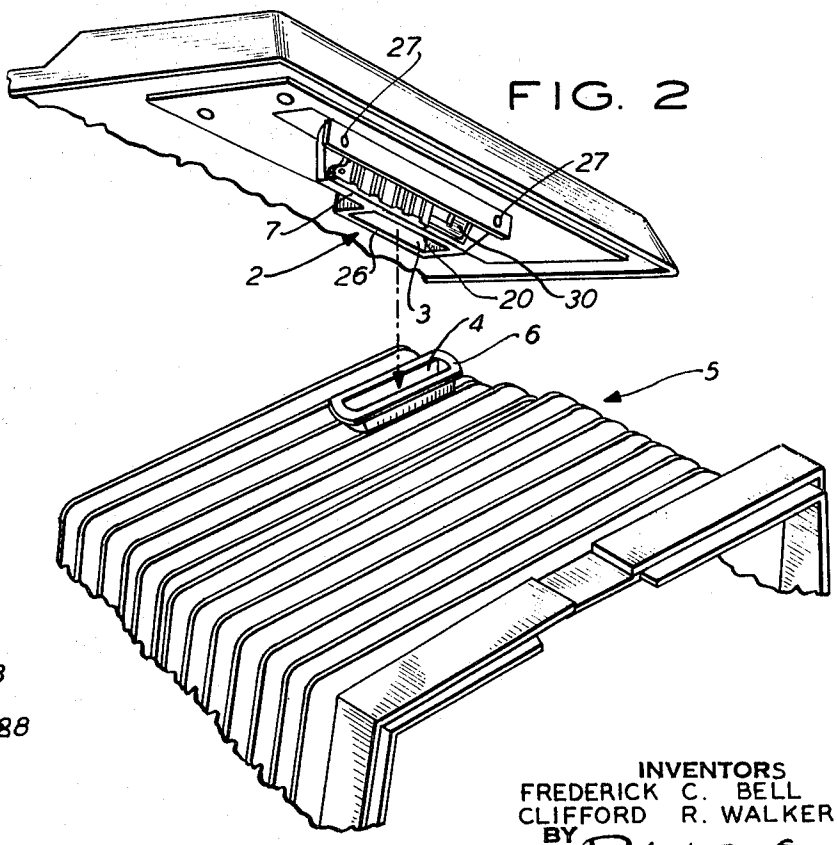
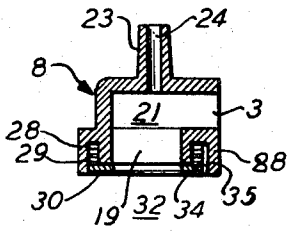


FIG. 5



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FIG. 3

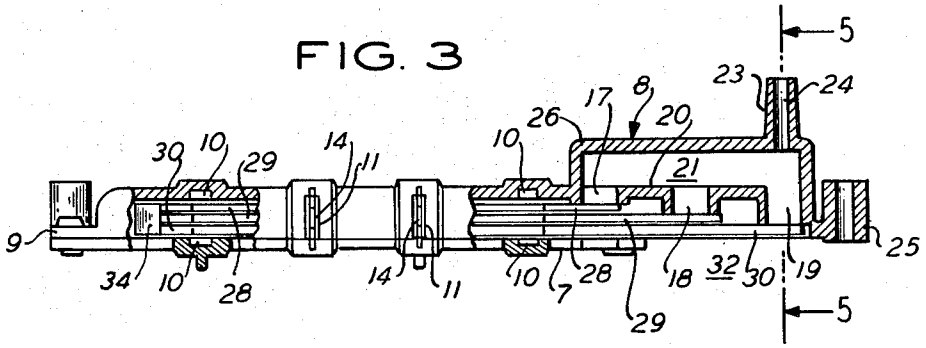


FIG. 4

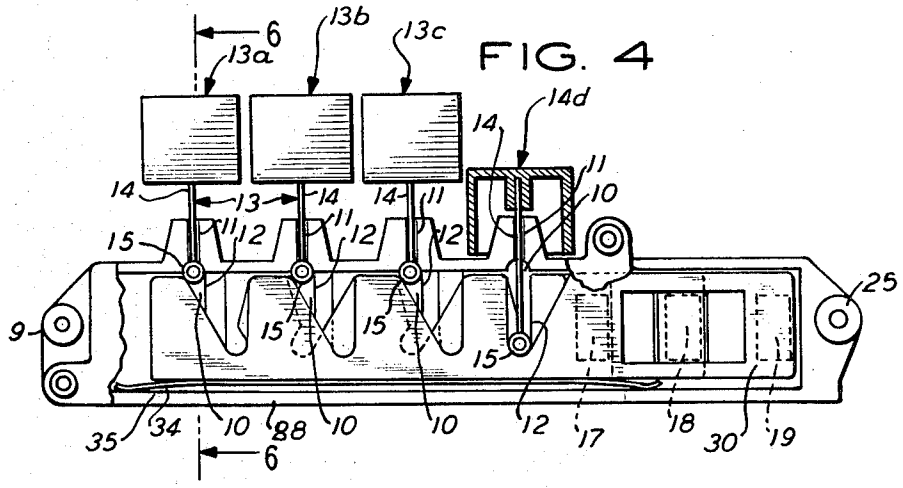
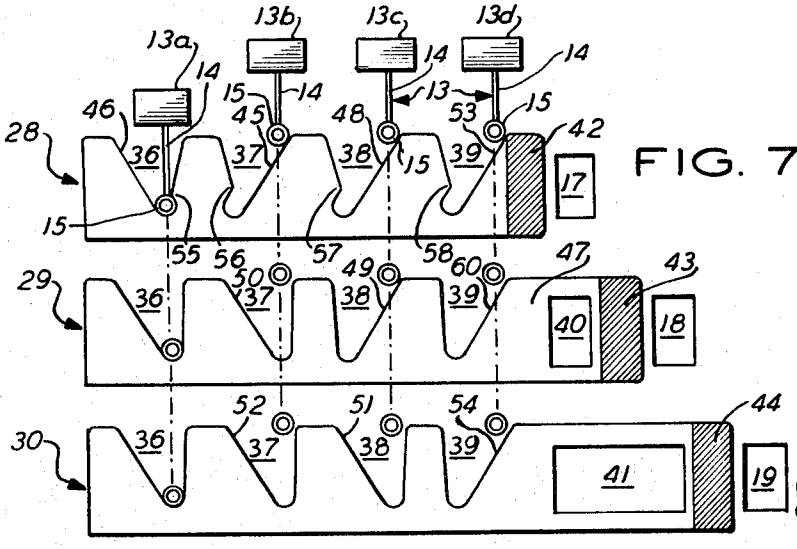


FIG. 7



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MULTIPLE INTERLOCKED VALVE CONSTRUCTION

CROSS REFERENCES TO RELATED APPLICATIONS

This application discloses subject matter related to subject matter disclosed in application Ser. Nos. 827,004 and 827,010, filed on May 22, 1969 and on May 22, 1969, respectively, the former application and the instant application being component disclosures of the latter application. Each of the related applications is assigned to the same assignee as the instant application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to the field of pressure control valves. More particularly, this invention relates to the field of vacuum cleaners and a negative pressure control valve for its vacuum chamber housing wherein a predetermined bleeding of higher pressure may be utilized to control the negative pressure in the vacuum chamber.

2. Description of the Prior Art

The prior art discloses numerous variations in valves for pressure control from the broad category of pressure relief valves to bleeder valves in vacuum cleaners for negative pressure control. The latter prior art, for example, includes a slide valve located somewhere in the vacuum cleaner negative pressure side, which valve includes an opening to atmosphere and a sliding valve head which may be slidingly moved over a desired portion of the opening to control the vacuum suction. The prior art, however, has not provided an efficient valve for controlling negative pressure by bleeding at the vacuum chamber itself where the most direct control can be effected. Also, the prior art has not provided pushbutton control of a predetermined nature with button designations which make most effective the vacuum cleaning operation for various uses such as curtains, throw rugs, carpets et cetera. Thus, for example, in circumstances where prior art sliding bleeder valves have been used, the user of the vacuum cleaner had no instruction other than trial and error to ascertain the amount of bleeding of pressure which would provide the most efficient cleaning for the various operations such as curtains, throw rugs, carpets, et cetera. The present invention has overcome the problem of inaccurate bleeding for vacuuming purposes by providing a plurality of designated, predetermined bleeder positions which permit, at each succeeding operation of the same kind, the same precise bleeding control of negative pressure at the vacuum chamber without trial and error.

SUMMARY OF THE INVENTION

The present invention is directed in the preferred embodiment toward a bleeder valve for pressure control which comprises a housing having a plurality of ports, and a plurality of vanes slidable therein to selectively open or close respective ones of said ports, the housing also having a plurality of plungers slidable transverse to the sliding direction of the vanes, each plunger being adapted to actuate the vanes to provide predetermined pressure control. The interaction of plungers and vanes is accomplished through sets of vane cutout portions having camming type surfaces and slidingly movable by cam type means on the plungers.

It is therefore an object of the present invention to provide an efficient bleeder valve construction for predetermined pressure control.

It is also an object of the present invention to provide pushbutton control of a bleeder valve so that predetermined operational control by the user may be easily, efficiently and repeatedly accomplished.

It is also an object of the present invention to provide pushbutton control for a bleeder valve with a plurality of predetermined pressure control positions with only one position operable at a time.

It is also an object of the present invention to provide an efficient vacuum cleaner negative pressure control with pressure bleeding at the vacuum chamber.

These and other objects, features and advantages of the present invention will become more apparent when viewing the following description and claims in the light of the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top view of the vacuum cleaner control panel broken away in part showing the pushbutton arrangement for the plungers;

FIG. 2 shows an exploded view of the underside of the control panel as it relates to the gasket lined opening of the vacuum chamber;

FIG. 3 is a part plan view and part longitudinal section of the bleeder valve construction;

FIG. 4 is a side elevational view, cutaway in part and sectional in part;

FIG. 5 is a cross-sectional view of FIG. 3 taken along lines 5–5 of FIG. 3;

FIG. 6 is a cross-sectional view of FIG. 4 taken along lines 6–6 of FIG. 4; and

FIG. 7 is a schematic view of the slide vanes, plungers and ports in exploded lateral alignment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawing with reference numerals, in FIG. 1 the top of the control panel, generally designated at 1, is shown with the four pushbuttons 13*a*, 13*b*, 13*c* and 13*d* adapted to actuate respective ones of the plungers generally designated at 13 in FIG. 4.

As can be seen in FIG. 2, the underside of the control panel and the underside of the valve housing are shown, the valve housing being generally designated at 2. The valve housing has an opening 3 therein which is adapted to be placed in fluid flow communication with an opening 4 in the vacuum chamber generally designated at 5. The opening 4 is surrounded by a gasket 6 to seal the low pressure side within the vacuum chamber to the underside of the valve housing.

Looking now at FIG. 3, the valve housing comprises a stem portion 7 and a body portion designated generally at 8. The stem and body portions include respective connector portions 9 and 25 which, as shown in FIG. 2, connect the valve housing to the control panel by fastening means 27. The stem portion also includes four plunger receiving bores 10 of equal dimension which, as seen in FIG. 4, comprise a reduced portion 11 and an enlarged portion 12. Each of the bores 10 receive a plunger 13 which, as seen in FIGS. 4 and 6, comprises a leg portion 14 and, at its lower end, a rebent foot portion 15, the portion 15 acting as cam-type means as hereinafter described. It can thus be noted that the plungers 13 may freely reciprocate in bores 10 with reduced portions 11 limiting the upward plunger stroke by contact with foot portions 15 and with the vanes 28, 29 and 30 limiting the downward plunger stroke by contact with the portions 15 at the bottoms of the cutout portions 36, 37, 38 and 39. The leg portion of the plunger terminates with a pair of coplanar flanges 16 which extend through the top part of the control panel and are adapted to be received within the pushbuttons.

The body portion 8 of the valve housing 2, as shown in FIGS. 3 and 7, includes three ports 17, 18, and 19 extending through inner wall 20 thereof and communicating with a large cavity generally designated at 21 which in turn communicates at 3 with vacuum chamber opening 4 and through a bore 24 in a tapered spigot 23, as best shown in FIG. 5, with the FULL BAG INDICATOR generally designated at 22 in FIG. 1. As the name implies, the INDICATOR 22 indicates to the user the fullness of content of the vacuum cleaner bag as a readout of the negative pressure in the vacuum chamber under conventional principles. The basic principle, of course, is that the negative pressure is inversely proportional to the fullness of the bag.

As seen in FIG. 3, the stem portion 7 also includes three vanes slidable therein and described in more detail hereinafter with respect to FIG. 7, The vanes 28, 29, and 30 are laterally positioned with respect to one another and increase in longitudinal dimension from vane 28 to vane 30. The vanes 28, 29 and 30 are shown in FIG. 3 closing each of the ports 17, 18 and 19, respectively, to provide maximum negative pressure in the vacuum chamber. The opening 4 in the vacuum chamber and the gasket 6 which seals the opening 4 to the valve housing are positioned with respect to the valve housing such that the perimeter 26 and wall 20 surrounding opening 3 of cavity 22 rest on the top of gasket 6. Thus, the wall 20 acts as a barrier separating the high-pressure side—exposed to atmospheric pressure and generally designated at 32—of the portion 8 from the low low-pressure side at 21 as shown in FIGS. 3 and 5. Selective opening or closing of the ports 17, 18 and 19 by their respective vanes provides a predetermined bleeding of the higher pressure at 32 into the vacuum chamber through cavity 21 and openings 3 and 4.

The vanes are controlled selectively by actuation of any one of the plungers 13, the vanes being biased toward the plungers by a leaf spring 34 which rests on the top 35 of base 88 and assists in providing a track for the vanes.

Now looking to FIG. 7, the vanes are shown in exploded laterally displaced position. Each of the vanes has four cutout portions generally designated at 36, 37, 38 and 39 with varying perimeters to be discussed hereinafter. Two of the vanes 29 and 30 also include openings 40 and 41, respectively, which are adapted to overlie the ports 18 and 19 respectively. Each of the vanes 28, 29 and 30 has a sealing area 42, 43, and 44, respectively, which is adapted to overlie a respective port 17, 18 and 19 in port closed position. Each of the plungers 13 and its foot portion 15 in particular is of a lateral dimension to be received within each of the laterally aligned cutout portions of a respective set simultaneously, each set being coincident with only one bore 10 in operation.

Thus, as seen in FIG. 7, plunger 13*a* has been actuated and is shown received in each of the laterally aligned cutout portions 36. In this position, i.e., when plunger 13*a* is actuated, each of the ports 17, 18 and 19 are open providing maximum bleeding of the external atmosphere at 32 to the vacuum chamber 5. This first predetermined control position, as shown in FIG. 1 is, for example, for the cleaning of curtains.

When plunger 13*b* is actuated, the vane 28 is moved to the right with sealing area 42 overlying port 17 and closing same. Vanes 29 and 30, on the other hand, are not moved by plunger 13*b* because of the configurations of their cutout portions 37 so that the ports 18 and 19 remain open thereby permitting a second predetermined negative pressure control, useful, for example, in cleaning drapes. It should be noted that the vane 28 is forcibly moved to the right as the foot portion 15 of plunger 13*b*, acting as a cam-type means, rides down surface 45, and a plunger 13*a* is restored to its original unactuated position by camming-type surface 46 which forces the rebent foot portion 15 of the plunger 13*a* upwards to its unactuated position.

When plunger 13*c* is actuated, it rides down surfaces 48 and 49 of aligned cutout portions 38 or either of them depending on their prior positions, and restores plunger 13*b* to its original unactuated position. The latter is accomplished by movement of vane 29 to the right (assuming vane 28 is already to the right) as plunger 13*c* rides down surface 49 to thereby force plunger 13*b* upward along camming type surface 50 of the cutout portion 37 of vane 29. With plunger 13*c* in actuated position ports 17 and 18 will be respectively closed by sealing portions 42 and 43, thus leaving port 44 as the only port open to bleed external atmospheric air at 32 into chamber 5 to provide a third predetermined degree of pressure control for use with throw rugs, for example.

It should here be noted that when plunger 13*a* is actuated and ports 17, 18 and 19 are open, openings 40 and 41 of vanes 29 and 30, respectively, overlie port 17 to maintain it open. Nothing overlies port 19 in this position. However, when plunger 13*c* is actuated and both vanes 28 and 29 have been moved to the right, the portion 47 of vane 29 overlies seal 42 which in turn overlies port 17 to provide a more effective sealing relationship to close port 17.

When plunger 13*d* is actuated all three vanes 28, 29 and 30 are moved to the right as the foot portion 15 of plunger 13*d* rides down surface 54 of cutout portion 39. In this position seals 42, 43 and 44, respectively, close ports 17, 18 and 19. Plunger 13*c* is restored to its initial unactuated position by surface 51 of cutout portion 38 of vane 30. The latter position—with all ports closed—represents the fourth predetermined selection available to a user and provides maximum negative pressure for objects such as carpets.

It should also be noted that vane 28 includes for each of its cutout portions 36, 37, 38 and 39, respectively, a surface having a projection 55, 56, 57 and 58 which precludes the unintentional restoration to unactuated position of any of the plungers without the intended actuation of another plunger. Also, it should be noted that in each actuation of a plunger not all of the vanes will move but certain ones, which were already in the proper predetermined position, will remain in that position, and only those which were not in the desired predetermined position will be moved. Also, one or more camming-type surfaces of aligned cutout portions may restore a plunger to unactuated position, as, for example, will occur to plunger 13*b*, if previously actuated, by surfaces 50 and 52 when plunger 13*d* is actuated moving vanes 29 and 30 to the right. Finally, it should be noted as a generalization that to provide a control range from all ports closed to all ports open the number of plungers required is one greater than the number of bleeding ports.

Since the preferred embodiment may be modified in numerous ways within the scope of the present invention, e.g., by changing the disclosed contours of the cutout portions, by changing the numbers of plungers, ports and vanes, by reversing the high and low-pressure side of the valve housing, et cetera, the preferred embodiment should be view as illustrative and not in a limiting sense.

We claim:

1. A valve construction comprising a housing having a flow passage therethrough, said passage including a closure member having a plurality of longitudinally spaced and laterally venting ports therethrough providing flow communication between fluids on both sides thereof, said housing having a longitudinal slot and a plurality of laterally spaced sliding vanes therein, each vane having a sealing area adapted to close a respective port, at least one of said vanes having an opening therethrough spaced from said sealing area and adapted to overlie at least one of said plurality of ports, said housing having a plurality of transverse bores each bore receiving a respective reciprocative plunger therein and each of said bores being coincident with a part of each of said vanes so that upon movement of a plunger within its respective bore toward said vanes, selected ones of said vanes are actuated to open or close their respective ports.

2. The construction set forth in claim 1 wherein each of said plurality of vanes has a plurality of cutout portions therein adapted to receive a part of respective plungers therein for actuation of said vanes.

3. The construction set forth in claim 2 wherein said cutout portions have predetermined perimeters, and said plungers reciprocate within said housing and actuate movement of said selected ones of said vanes by contact with the predetermined perimeters of said cutout portions.

4. The construction set forth in claim 2 wherein said plurality of vanes equals the number of ports and the plurality of cutout portions on each vane, of bores and of plungers is one greater than the number of ports.

5. The construction set forth in claim 2 wherein respective ones of said plurality of cutout portions are in substantial lateral alignment to form sets of cutout portions, and said sets are coincident with respective ones of said plurality of bores and plungers, each of said cutout portions has a predetermined perimeter, and each of said plungers is adapted to

reciprocate within its respective bore and to move selective ones of said vanes.

6. The construction set forth in claim 5 wherein said perimeters include camming-type surfaces which on longitudinal movement are adapted to restore a previously moved plunger to its original position without its respective set so that only one plunger may be moved to actuate said vanes at any one time, certain of said perimeters have projections to preclude unintentional restoration of any plunger to original position, and each of said plungers are manually operable by pushbutton means.

7. A suction cleaner defining a structural chamber containing a fluid at a pressure lower than ambient, said chamber having a valve construction comprising a housing having a flow passage therethrough, said passage including a closure member having a plurality of longitudinally spaced and laterally venting ports therethrough providing flow communication between said fluid and ambient, said housing having a longitudinal slot and a plurality of laterally spaced sliding vanes therein, each vane having a sealing area adapted to close a respective port, at least one of said vanes having an opening therethrough spaced from said sealing area and adapted to overlie at least one of said plurality of ports, said housing having a plurality of transverse bores each bore receiving a respective reciprocative plunger therein and each of said bores being coincident with a part of each of said vanes so that upon movement of a plunger within its respective bore toward said vanes, selected ones of said vanes are actuated to open or close their respective ports.