

[54] **FLOW CONTROL ASSEMBLY**  
 [75] Inventor: **Augustine A. Souza**, San Jose, Calif.  
 [73] Assignee: **Robert N. Noyce**, Los Altos, Calif.  
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*Primary Examiner*—C. J. Husar  
*Assistant Examiner*—Leonard Smith  
*Attorney, Agent, or Firm*—Limbach, Limbach & Sutton

[52] **U.S. Cl.**..... 137/525.1, 417/478, 417/566,  
 417/567.  
 [51] **Int. Cl.**..... **F16k 15/16**  
 [58] **Field of Search** ..... 417/568, 566, 567, 478,  
 417/479, 480; 137/525.1

[57] **ABSTRACT**

An integral one piece flow control assembly is described having a hollow cylindrical main body defining a passage therethrough and a pair of lip members extending inwardly and longitudinally of said main body to a terminal end for controlling the flow through the passage. The lip members have a peripheral portion connected to the inner surface of the body and a central body portion extending from the peripheral portion to a terminal end portion defining a normally closed slit opening. Each lip member is curved inwardly toward the axis of the main body. Pressure in one direction presses the slit closed, and pressure in the opposite direction opens the slit. A pair of such flow control assemblies oriented in the same direction within a passage provide an inexpensive pump.

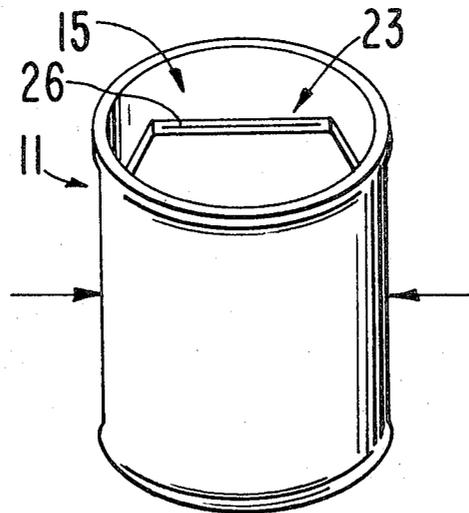
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**2 Claims, 9 Drawing Figures**



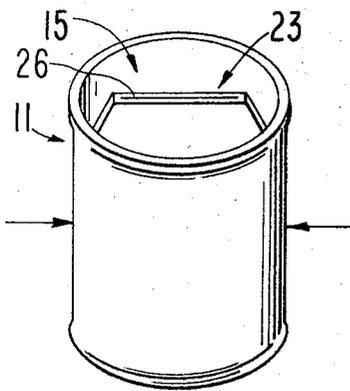


FIG. 1

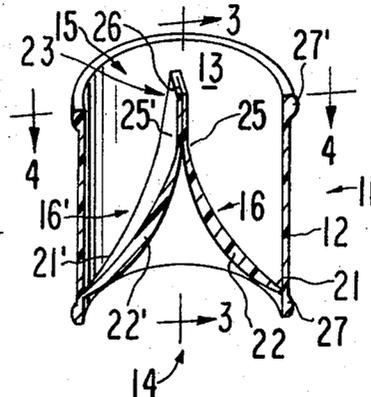


FIG. 2

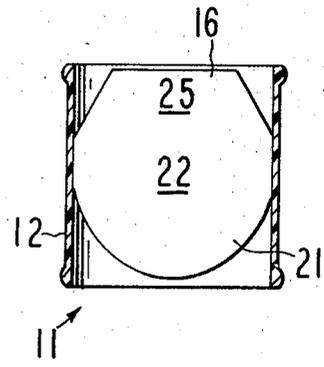


FIG. 3

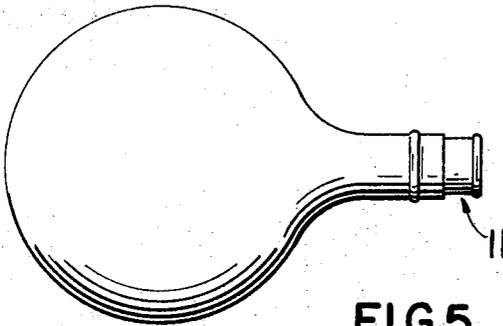


FIG. 5

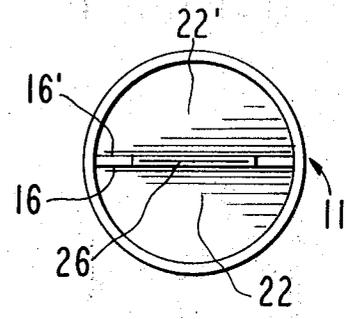


FIG. 4

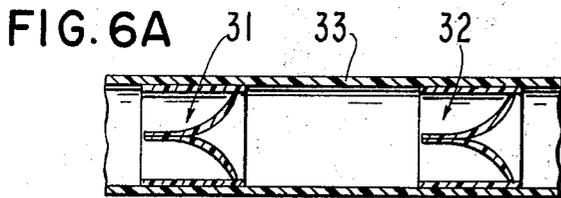


FIG. 6A

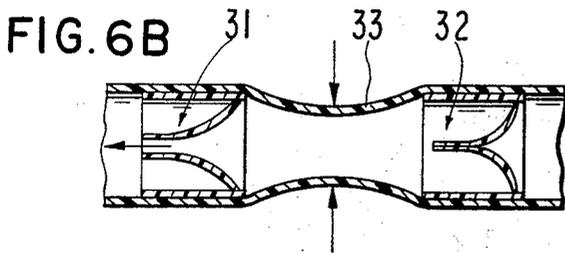


FIG. 6B

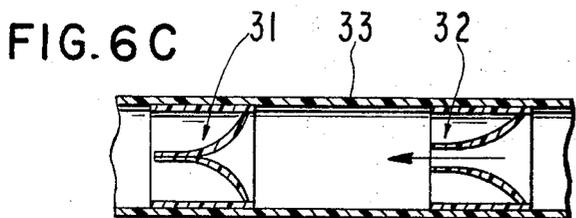


FIG. 6C

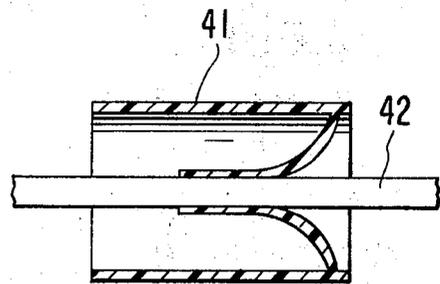


FIG. 7

INVENTOR.  
AUGUSTINE A. SOUZA  
BY  
*Limbach, Limbach and Fulton*  
ATTORNEYS

## FLOW CONTROL ASSEMBLY

The present invention is directed to a flow control assembly and more particularly to an inexpensive valve.

### BACKGROUND

Many simple valve structures have been proposed in the past for sealing simple structures such as inflated toy balloons. Since the balloon itself is so inexpensive, the valve structure also must be simple and inexpensive to be practical. Valve structures previously disclosed typically utilize different materials in the body of the assembly and at the sealing portion of the valve in order to obtain a good seal for the valve. Since the separate portions of these structures must be assembled for use, there is a minimum cost in their manufacture which has prevented their widespread use. The construction of certain other valve assemblies has been sufficiently complicated so that the valve could not be manufactured cheaply enough for use as an inexpensive throw away valve.

### THE PRESENT INVENTION

The objective of the present invention is to provide a simple, one piece flow control assembly which can be simply and inexpensively manufactured.

In accordance with the present invention a valve or flow control assembly is provided having a hollow cylindrical main body defining a flow passage therethrough and a pair of lip members extending inwardly and longitudinally of the main body from a peripheral portion connected to the inner surface of the body around substantially 180° to a terminal end portion defining a slit opening between lip members. Each lip member is curved inwardly toward the axis of the main body between the peripheral portion and the slit opening whereby pressure against the concave side of the lip members presses these lip members together sealing the slit closed and pressure on the opposite side opens the slit.

A valve structure in accordance with this invention can provide a good way check valve, a pressure release valve, or a pressure reducing valve.

In accordance with another aspect of the present invention the main body and lip members are integrally formed together of a plastic material at least partially flexible such as a polyvinyl chloride. With this construction a two way valve can be provided. With fluid pressure applied against the concave side of the lip members thereby closing and sealing the slit opening, the cylindrical main body can be squeezed along a line parallel to the length of the slit opening for effectively deforming the lip members and opening the slit. This provides a valve assembly that will automatically close in response to fluid pressure directed therethrough in only one direction but which can also be opened under the application of such pressure.

Other features of the present invention insure a good seal at the slit. In accordance with one aspect of the present invention the lip members are provided with generally flat portions which are adjacent their terminal ends and which are free from direct connection to the main body so that the lips are free to flex in response to fluid pressure either to open or close the slit. Additionally minor deformation of the cylindrical main body or failure of the main body to return to its precise

original shape after deformation will not prevent achieving the desired seal at the lips. However, gross deformation of the main body will transmit the deformation through the lips to open the slit as desired.

In accordance with another aspect of the present invention the thickness of the lip members is greater in the central portion thereof than in the flat portion adjacent the terminal ends, again assuring that the terminal ends of the lips are sufficiently more flexible than the remainder of the body to provide the good seal desired.

In accordance with still another aspect of the present invention a pair of valve structures constructed in accordance with the present invention can be oriented in the same direction within a fluid passage to serve as a pump when the passage is deformed successively to open and close the valves.

These and other features and advantages will become more apparent upon a perusal of the following specification taken in conjunction with the accompanying drawings wherein similar characters of reference refer to similar structures in each of the several views.

### DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of apparatus in accordance with the present invention.

FIG. 2 is a view similar to FIG. 1 cut away in section to see the inside of the assembly.

FIG. 3 is an elevational sectional view of the structure shown in FIG. 2 taken along line 3—3 in the direction of the arrows.

FIG. 4 is an end view of the structure shown in FIG. 1 taken along line 4—4 in the direction of the arrows.

FIG. 5 illustrates the present invention operating in one of its many uses.

FIGS. 6A, B and C are schematic side elevational sectional views of an assembly provided with two valve structures showing the operation thereof to serve as a pump.

FIG. 7 is a schematic elevational sectional view showing another use for the present invention.

While it will be appreciated from the above and the following that there are many diverse uses for the structure in accordance with the present invention, the structure is ideally suited for use as a two way valve, and accordingly the invention will be described with reference to FIGS. 1-5 as a two way valve.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1-4 a two way valve 11 constructed in accordance with the present invention is illustrated. The assembly is of one piece formed such as by injection molding and of a plastic material such as polyvinyl chloride that is at least partially flexible. The valve includes a hollow cylindrical main body 12 providing a passage 13 between a first open end 14 and second open end 15.

A pair of lip members 16 and 16' is provided within the main body 12 and normally permits only one way flow of fluid or gas through passage 13 from the first end 14 to the second end 15. The valve can be manipulated as described below to permit flow in the opposite direction.

The lip members 16 and 16' include peripheral portions 21 and 21', respectively, joined to the inner sur-

face of the main body member, each around substantially 180° of that inner surface, and at diametrically opposed points on the inner surface of the main body member 12 these peripheral portions 21 and 21' are joined together thereby forming a complete seal around the inside surface of the main body. A central body portion 22 and 22' for the respective lip members extends from the peripheral portion inwardly and longitudinally of the main body to the terminal end 23 of the lip members, and this central body portion curves inwardly toward axis of the main body between the peripheral portion and the terminal end 23.

The terminal end 23 is spaced longitudinally within the main body a distance beyond the point where the peripheral portions 21 and 21' of the lip members meet, and the lip members are free from attachment to the main body over this distance so that the lip members 16 and 16' include generally flat end portions 25 and 25' adjacent the terminal end 23. Additionally the width of the lip members of these flat end portions 25 and 25' is reduced so that the terminal end is free from contact with the main body.

The lip members are sealed together along their outside edge over the flat end portions 25 and 25' but are not sealed at the terminal end so that a slit like, normally closed opening 26 is provided at the terminal end 23 with this opening positioned on a line intersecting the axis of the main body in a plane normal to the axis. As best shown in FIG. 2 the central body portions 22 and 22' of the lip members 16 and 16' are thicker than the flat end portions 25 and 25' to aid in producing the desired seal at the terminal end 23.

In the embodiment illustrated the main body 12 is provided with enlarged rims 27 and 27' at the first and second ends 14 and 15 to aid in attachment to other members. In the embodiment illustrated it is preferred to have the terminal end 23 of the lip members within the main body, but as will be pointed out below, there are certain embodiments of the present invention where it is desirable to have the terminal end 23 project beyond the end of the main body.

The assembly can be utilized as a two way valve such as for closing a toy balloon as illustrated in FIG. 5. For operation of the device it will be appreciated that air or fluid directed from the first end 14 into the main body 12 forces the flat end portions 25 and 25' adjacent the terminal end 23 of the lips apart to widen opening 26 for passage of the air or fluid through passage 13. However, once the pressure at the first end 14 is reduced below that at the second end 15, the pressure on the large area central body portions of the lip members causes the central body portions to converge toward one another forcing the flat end portions 25 and 25' together thereby closing and sealing the slit opening 26. This seal is maintained until the pressure at the first end 14 is increased or until the main body is deformed so as to open the slit opening 26.

When a force is applied to the main body in a line parallel to the slit opening 26 and in the region of the central body portions 22 and 22' preferably in an axial plane containing the line of slit opening 26, the central body portions 22 and 22' of the main body are deformed outwardly thereby reducing the length of the slit opening 26 and opening the slit for passage of air or fluid. Upon release of this pressure the lip members will return to their previous position and seal the opening 26.

One inch valves of PVC No. 40 and PVC No. 60 have been constructed in accordance with this invention and successfully operated. The particular valves include main body thicknesses of 0.06 inch with the central body portion of the lip members 0.08 inch thick formed on a 0.687 inch radius and with the flat end portions 0.02 inch thick.

It will be appreciated that this valve construction can be made simply and efficiently and sold at a very low price so as to be used as a throw away valve for a toy balloon. Alternatively the valve can be used to seal specified fluids or gases in the balloon-like structure such as are collected by highway patrolmen giving drunk driver tests.

As pointed out above the material and thicknesses of the structure can be selected so that the device serves as a pressure release valve for a prescribed pressure or as a one way check valve. One such check valve made of PVC No. 60 has been tested for 18 hours on a water hose holding 80 psi without leaking a single drop.

If a balloon is attached to the first end 14 of the device, the combination can act as a noise maker in which case it is desired to have the lip members project from the second end of the main body.

As shown in FIGS. 6A-C a pump can be provided when two flow control assemblies 31 and 32 are similarly oriented and sealed at their periphery within a common elongated passage 33. When the wall of the passage between the two is squeezed (as shown in FIG. 6B) the left hand valve opens and the right hand valve remains sealed closed due to the movement of the lip members. Then, as shown in FIG. 6C, when the pressure is removed, the left hand assembly returns to its normal sealed condition and the right hand member which was acting as a check valve opens to admit air for the next pumping stroke.

It will also be appreciated that the structure not only serves as a control for fluid passing therethrough but as a gripping member 41 for articles such as a fibrous member 42 porous to fluid inserted through the opening as shown in FIG. 7.

What is claimed is:

1. A flow control assembly comprising:

- a hollow cylindrical main body defining a flow passage therewithin and
- a pair of lip members extending inwardly and longitudinally of said main body to a terminal end for controlling flow through such passage, each lip member having
- a peripheral portion connected to the inner surface of said main body member around substantially 180° of the inner surface of said main body and joined to the other lip member forming a complete seal around said main body and
- a central body portion extending from said peripheral portion longitudinally of said main body to the lip member terminal end and defining a slit opening there with the other lip member,
- each lip member curved inwardly toward the axis of said main body between said peripheral portion and said slit opening with the curve of greater radius than the radius of the main body,
- at least part of the lip member central body portions projecting longitudinally within said main body to said terminal end free from said main body member,

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said lip members joined together except for a slit like, normally closed opening on a line intersecting the axis of said main body in a plane normal to said axis,

said lip member central portion having a thickness greater than the thickness of the adjacent peripheral and terminal end portions,

whereby fluid pressure against the concave side of said lip members presses said lip members sealing said slit closed and pressure in the opposite direction opens said slit.

2. An integral one piece flow control assembly of plastic at least partially flexible comprising:

a hollow cylindrical main body defining a flow passage therewithin and

a pair of lip members extending inwardly and longitudinally of said main body to a terminal end for controlling flow through such passage,

each lip member having

a peripheral portion connected to the inner surface of

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said main body member around substantially 180° of the inner surface of said main body and joined to the other lip member forming a complete seal around said main body,

a central body portion extending from said peripheral portion longitudinally of said main body and,

a flat end portion extending to the lip member terminal end from said central body portion where said peripheral portions join,

the central body portion curved inwardly toward the axis of said main body, and having a radius greater than the radius of said main body,

said flat end portions of lesser width than the diameter of said main body and joined to one another along their sides except for a slit like, normally closed opening at the terminal end,

each lip central body portion having a thickness greater than the thickness of the adjacent peripheral end flat end portions.

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