April 27, 1965 J. PETRONELLO 3,180,539

FLUID DISPENSING ARRANGEMENT

Filed April 26, 1962

Fig. 1

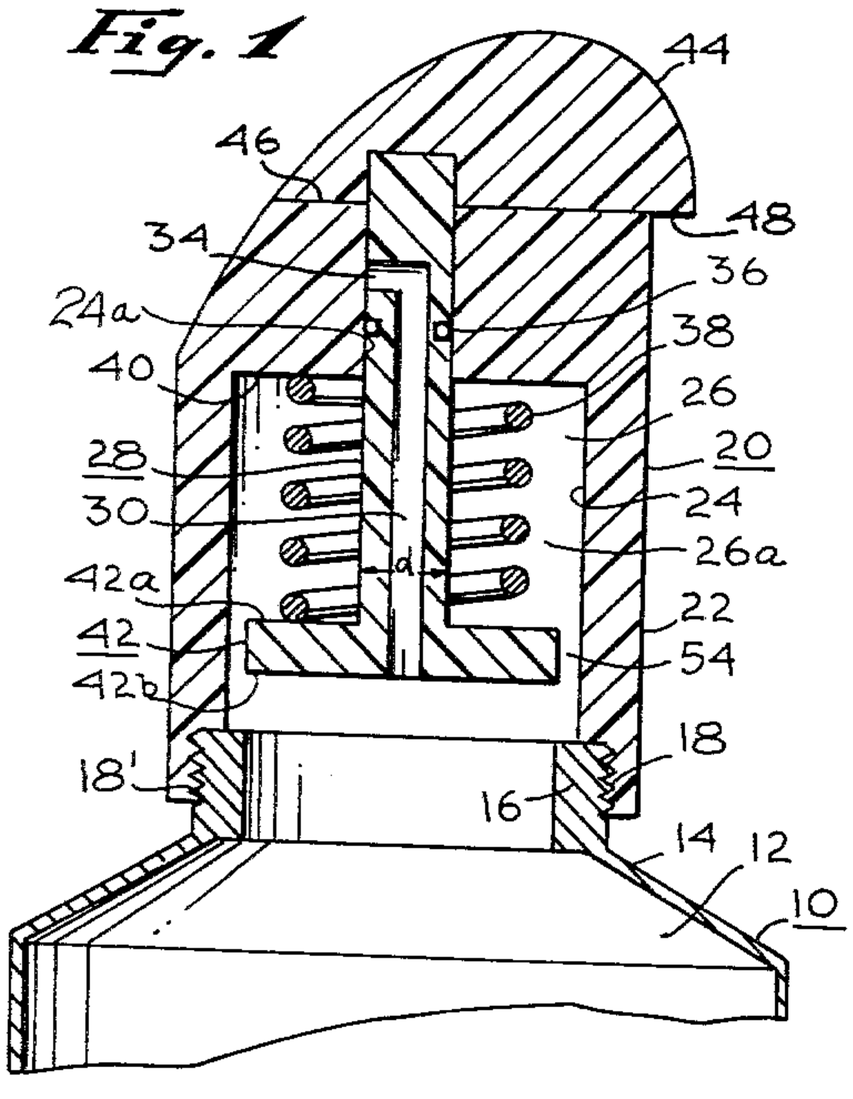



Fig. 2

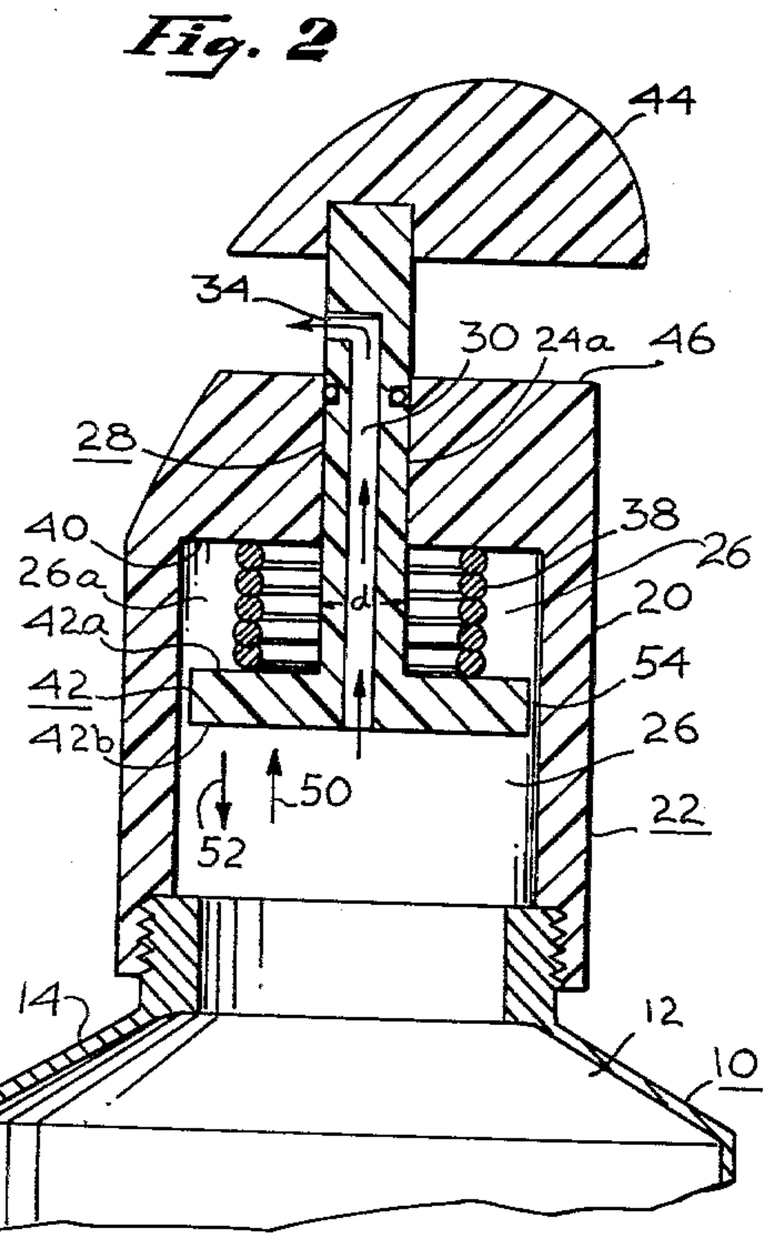



Fig. 3

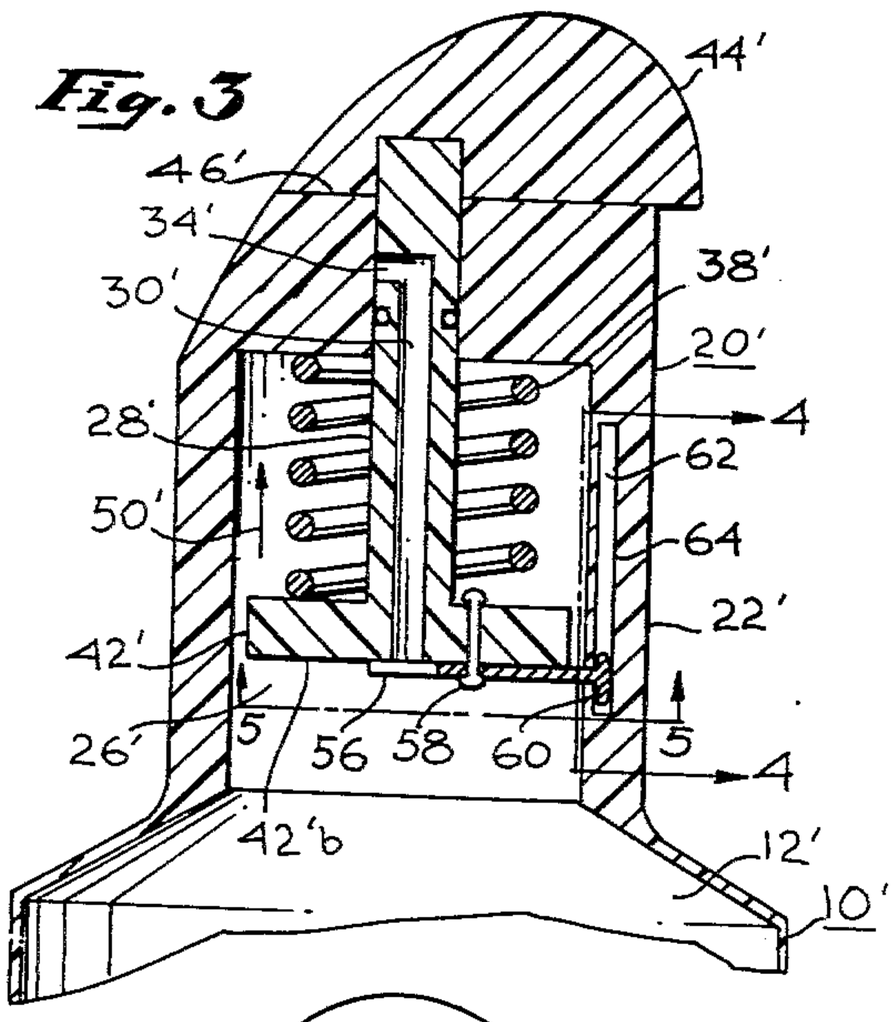



Fig. 4

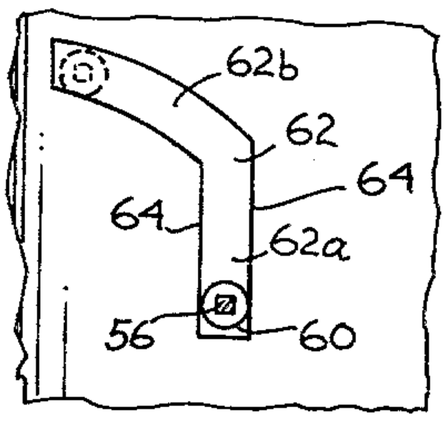
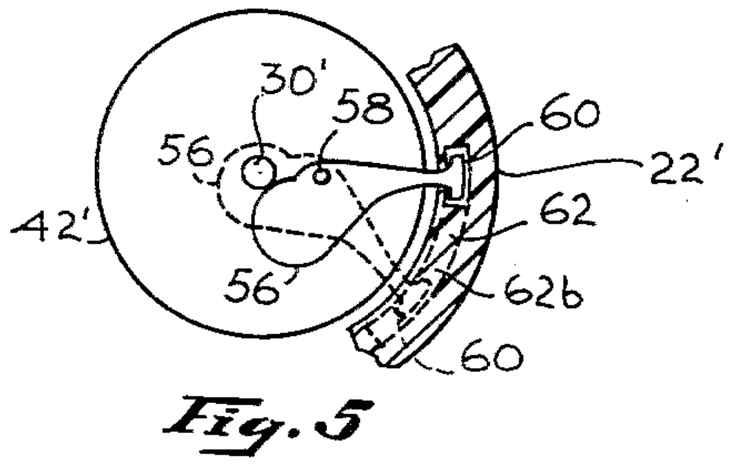



Fig. 5

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# FLUID DISPENSING ARRANGEMENT

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This invention relates to the fluid dispensing art and, more particularly, to an improved closure arrangement for dispensing viscous fluids from collapsible containers.

Many fluids in common use, particularly viscous fluids such as toothpaste, are presently dispensed from collapsible tubes through an orifice of reduced area coupled to the tube. The structure forming the orifice is generally provided with an external thread upon which a cap is installed when the tube is not in use. The removal and replacing of the cap is often difficult for small children who have not yet developed the manual dexterity to satisfactorily perform these operations. Further, dropping or losing of the cap is not only annoying, but often may result in an unsanitary condition to the contents of the tube. Consequently, manufacturers of viscous fluids so dispensed have long sought a simple and economical closure for their tubes forming a permanent part thereof to thus eliminate the inherent problems associated with a removable cap.

In addition to being economical in cost, the closure required must also be sanitary and aesthetically pleasing in order to be acceptable to a large market potential. As far as applicant is aware, no prior device has satisfactorily filled these needs.

Accordingly, it is an object of applicant's invention to provide an improved closure for fluid dispensing systems.

It is another object of applicant's invention to provide an improved closure arrangement for fluid dispensing systems that is economical to manufacture and aesthetically pleasing.

It is yet another object of this invention to provide an improved closure arrangement that may be readily adapted to many existing fluid dispensing systems.

The above and other objects are achieved according to one embodiment of this invention by providing, in an improved closure, a body member having an internal cavity therethrough. Internal threads may be included at one end of the body member to allow insertion on a fluid filled tube. Alternatively, the body member may be formed as part of the tube structure itself. A shaft member is slidably mounted in the internal cavity of the body member and the shaft member has walls defining a passageway communicating at its lower end with the fluid in the tube and terminating at the upper end in an ejector port. The shaft member is yieldingly restrained in the cavity of the body member by a spring means abutting against a shoulder on the body member at its upper end and against a shoulder on the shaft member at its lower end. The spring member maintains the shaft member in a first position for the condition existing when no pressure is exerted on the tube. In this first position, the ejector port is restrained to remain within the cavity. When pressure is exerted on the tube, as by squeezing, the fluid in the tube presses against the lower end of the shaft member. A first part of the fluid exerts a force thereon, forcing the shaft member against the spring into a second position in which the ejector port is exterior the cavity. A second part of the fluid is forced into the lower end of the passageway, travels the length thereof, and then is forced out the ejector port. The fluid emerging from the ejector port may then be utilized as desired.

When pressure on the tube is released, the spring member forces the shaft member back to the first position and the ejector port is sanitarily located inside the cavity.

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The above and other embodiments of this invention are more fully disclosed in the following detailed description with reference to the accompanying drawing wherein similar reference characters refer to similar elements and in which:

FIGURES 1 and 2 illustrate one embodiment of applicant's invention; and

FIGURES 3, 4, and 5 illustrate another embodiment of applicant's invention.

Referring now to FIGURE 1, there is shown the structure associated with one embodiment of applicant's invention. For convenience of description, this embodiment of applicant's invention is shown as utilized on a tube of toothpaste. However, it will be appreciated that it may be utilized on any pressure operated fluid dispensing arrangement such as squeeze bottles, aerosol dispensers, and the like. As shown on FIGURE 1, a tube 10 filled with fluid 12 has generally thin, collapsible walls 14 and an orifice structure 16 provided with external screw threads 18 upon which a cap (not shown) is usually installed. Applicant's closure, generally designated 20, is shown on FIGURE 1 in a first or closed position and is coupled to the tube 10. The closure 20 comprises a body member 22 having walls 24 defining a cavity 26. Internal screw threads 18' are provided on the body member 22, to match the screw threads 18 of the tube 10, upon which the closure 20 is mounted. If desired, the body member 22 may be formed as a part of the structure of tube 10 during fabrication thereof to provide a more unitary construction.

A shaft means 28 is contained within the cavity 26 and has walls defining a passageway 30 therethrough terminating in an ejector port 34. The shaft means 28 is slidably mounted in the channel formed by wall portions 24*a* of walls 24 of the body member 22 and the ejector port 34 is positioned at an angle to the passageway 30 so that it faces the wall portions 24*a*. Depending upon the viscosity of the fluid 12, a sealing means such as an O-ring seal 36 may be provided on the shaft means 28 in regions adjacent the wall portions 24*a*. However, applicant has found that a seal is generally not required when the fluid 12 is a viscous fluid such as toothpaste.

A spring means 38 yieldingly restrains movement of the shaft means 28 through the channel formed by wall portions 24*a* by bearing at its upper end against a shoulder 40 of body member 22 and at its lower end against the upper surface 42*a* of a shoulder 42 coupled to shaft means 28. The spring constant of spring means 38 is selected from considerations of the viscosity of the fluid 12, the friction between the shaft means 28 and wall portions 24*a*, and the desired flow rate of fluid 12 desired for a given pressure exerted thereon.

To provide a more aesthetic appearance and also to increase the sanitary protection, the preferred embodiment of applicant's invention also comprises cover means 44 coupled to the shaft means 28. The cover means 44 fits flush against the upper surface 46 of body member 22 when in the closed position, as shown on FIGURE 1. A lip means 48 which projects beyond the edge of the body member 22 may be included on the cover means 44 to assist in moving the shaft means 28 manually if, for any reason, its normal pressure operated movement is prevented.

When forces are exerted on the collapsible wall portions 14 of tube 10, as by squeezing them together, the fluid 12 is subjected to pressure and is forced through the orifice structure 16 of the tube 10 into the cavity 26 and bears against a bottom surface 42*b* of shoulder means 42. This forces the closure 20 into a second or open position which is shown on FIGURE 2.

As shown on FIGURE 2, as the fluid 12 is forced

against the bottom surface 42*b* of shoulder means **42**, the shaft means **28** moves in the direction indicated by the arrow **50** with the spring means **38** yieldingly resisting this movement. The shaft means **28** continues this movement and the ejector port **34** is moved beyond the upper surface **46** of body member **22**. Simultaneously, a part of the fluid **12** is forced through the passageway **30** and out the ejector port **34** where it may be utilized as desired. Flow of the fluid **12** out of the ejector port **34** is maintained as long as pressure is exerted on the fluid **12** in the tube **10**. When this pressure is terminated, flow of the fluid **12** is ended and spring means **38** forces the shaft means **28** back in the direction indicated by arrow **52** to the first or closed position illustrated in FIGURE 1. The cover means **44** then reseats on surface **46** to close off entrance to the cavity **26**.

After the initial operation of the closure **20**, some of the fluid **12** will be retained in the portion **26***a* of cavity **26** between the upper surface **42***a* of shoulder **42** and shoulder **40** of body member **22**. The fluid **12** thus contained entered the portion **26***a* through the space **54** between the walls **24** and shoulder **42**. Since the area of the bottom surface **42***b* of shoulder **42** is greater than the area of the upper surface **42***a*, the total force exerted by the fluid **12** in the direction shown by arrow **50** on shoulder **42** is greater than the force exerted by the fluid **12** in the direction shown by arrow **52** on shoulder **42**. Consequently, the fluid **12** in the cavity portion **26***a* is displaced therefrom during motion of the shaft means **28** in the direction shown by arrow **50** through the space **54**. A similar displacement of fluid **12** occurs during the return of shaft means **28** by the spring means **38** to the first position.

The difference in area between the bottom surface **42***b* and the upper surface **42***a* of the shoulder **42** may be preselected by choosing a desired value of the dimension *d* of shaft means **28**.

In the dispensing of many fluids from collapsible tubes, it is often desirable to dispense only a preselected amount of fluid each time and provide a positive termination of fluid dispensing even though pressure is maintained upon the fluid in the tube. In another embodiment of applicant's invention, illustrated in FIGURE 3, an automatic termination feature is provided. As shown thereon, a body member **22′** of a closure **20′** is, in this embodiment, formed as a unitary part of a collapsible, fluid filled tube **10′**, which, for example, may be a toothpaste filled tube. A shaft means **28′** is slidably mounted in the body member **22′** and functions in a manner analogous to the shaft means **28** described above and illustrated in FIGURES 1 and 2.

A valve means **56** is pivotally coupled to shoulder **42′** of shaft means **28′** by pivot pin means **58**. A runner **60** is coupled to valve means **56** and is slidably mounted in track **62** formed by wall portions **64** of body member **22′**. FIGURE 4 illustrates the shape of the track **62** in body member **22′**. A first portion **62***a* is substantially straight to provide only a linear movement of valve **56** from the first position, shown in solid lines, as shaft means **28′** moves in the direction indicated by arrow **50′** on FIGURE 3. However, as runner **60** enters a second, arcuate portion **62***b* of track **62**, it engages the wall portions **64** which force the runner **60** to follow the path of arcuate portion **62***b*. This causes a pivotal movement of the valve **56** with respect to the shaft means **28′**, in addition to linear movement with shaft means **28′**.

The two positions of the valve **56** are illustrated in FIGURE 5. In the first position, shown in solid lines, the valve **56** is clear of the entrance to passage **30′**. When the valve **56** is in the second position, it substantially covers the entrance to passage **30′**.

Operation of this embodiment may be better understood by reference to FIGURES 3, 4 and 5. When pressure is exerted on the tube means **10′**, the fluid **12′** contained therein is forced into the cavity **26′** and bears against a bottom surface **42′***a* of shoulder **42′**. Part of the fluid **12′**



enters the passage **30′** and is forced therethrough. Simultaneously, the force exerted on the shoulder **42′** by the fluid **12′** causes the shaft means **28′** to move against spring means **38′** from the first position shown on FIGURE 3 in the direction of the arrow **50′**. As this movement is continued, the ejector port **34′** is forced beyond the upper surface **46′** of body member **22′** and fluid **12′** is dispensed from the ejector port **34′**. However, as movement of the shaft means **28′** is continued, the runner **60** enters the arcuate portion **62***b* of track **62**. This causes rotational movement of the valve **56** on pivot pin means **58** and the valve **56** is forced into the second position. In this position, shown by dashed lines on FIGURES 4 and 5, the valve **56** substantially covers the entrance to passage **30′** and terminates the entrance of fluid **12′** therein. This causes termination of dispensing of fluid **12′** from ejector port **34′**.

The closure **20′** will remain in this condition until pressure on tube **10′** is released and the spring means **38′** returns the shaft means **28′** and valve **56** to the first position. Thus, only a predetermined amount of fluid **12** is dispensed from closure **20′** from the time pressure is applied to tube **10′** until the shaft means **28′** and valve **56** move from the first to the second position. The exact amount of fluid dispensed may be predetermined by properly selecting the size of passage **30′**, the length of shaft means **28′**, and the shape of track **62** for a particularly positioned valve **56**.

Those skilled in the art will find many variations and adaptations of applicant's invention. Therefore, the foregoing description of the various embodiments of applicant's invention together with the accompanying drawing are intended to be illustrative and not limiting and the appended claims are intended to cover all variations and adaptations within the true scope and spirit of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In combination:
a body member having internal wall portions defining an internal cavity;
a shaft member contained within said cavity and comprising a first portion slidably engaging first preselected areas of said wall portions, a shoulder portion coupled to said first portion, and said shoulder portion spaced a preselected distance from second preselected areas of said internal wall portions of said body member to define a gap therebetween, and walls defining an internal passageway through said first portion and said shoulder portion;
a spring means between said body member and said shoulder portion of said shaft member for yieldingly restraining motion of said shaft member in said internal cavity; and
a cover means coupled to said shaft member for engaging preselected external wall portions of said body member.

2. In combination:
a body member having first internal walls defining an internal cavity, second internal walls defining an elongated channel communicating at a first end thereof with said internal cavity and at a second end with regions external said body member, and external wall portions adjacent said second end of said channel;
a shaft member contained within said internal cavity having a first portion mounted for reciprocating movement in said channel, a shoulder portion spaced a preselected distance from said first internal walls of said body member to define a gap therebetween, and wall portions defining a passageway having a first end in said shoulder portion communicating with said internal cavity and a second end in said first portion communicating with regions external said shaft member;
a spring means mounted between said shoulder portion

of said shaft member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel; and

a cover means coupled to said shaft member and adapted to engage said external wall portions of said body member.

3. In combination:

a body member having first internal walls defining an internal cavity, second internal walls defining an elongated channel communicating at a first end thereof with said internal cavity and at a second end with regions external said body member;

a shaft member contained within said internal cavity having a first portion mounted for reciprocating movement in said channel, a shoulder portion spaced a preselected distance from said first internal walls of said body member to define a gap therebetween, and wall portions defining a passageway having a first end in said shoulder portion communicating with said internal cavity and a second end in said first portion communicating with regions external said shaft member; and

a spring means mounted between said shoulder portion of said shaft member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel.

4. An improved closure for fluid dispensing systems comprising, in combination:

a body member having first wall portions defining a fluid receiving cavity, second wall portions defining a channel communicating at a first end thereof with said cavity and at a second end with regions external said body member, and third wall portions adjacent said second end of said channel;

a shaft member having a first cross sectional area mounted for reciprocating movement in said channel and extending a predetermined distance into said cavity and providing a substantially close fit with said second wall portions of said body member and having walls defining a fluid transmitting passageway therethrough, a first end of said passageway communicating with said cavity and a second end adapted to communicate with regions external said shaft member;

a shoulder member spaced from said first wall portions of said body member and coupled to said shaft member adjacent said first end of said passageway and said shoulder member having an aperture therethrough communicating with said first end of said passageway whereby fluid in said cavity is transmitted through said aperture to said passageway, and said shoulder member spaced a preselected distance from said first end of said channel and having a second cross sectional area greater than said first cross sectional area of said shaft member; and

spring means intermediate said shoulder member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel.

5. An improved closure for fluid dispensing systems comprising, in combination:

a body member having first wall portions defining a fluid receiving cavity, second wall portions defining a channel communicating at a first end thereof with said cavity and at a second end with regions external said body member, and third wall portions adjacent said second end of said channel;

a shaft member having a first cross sectional area mounted for reciprocating movement in said channel extending a predetermined distance into said cavity and providing a substantially close fit with said second wall portions of said body member and having walls defining a fluid transmitting passageway therethrough, a first end of said passageway communicating with said cavity and a second end adapted to communicate with regions external said shaft member;



a shoulder member coupled to said shaft member adjacent said first end of said passageway a preselected distance from said first end of said channel and having a second cross sectional area greater than said first cross sectional area of said shaft member and having walls defining an aperture therethrough communicating with said first end of said passageway;

spring means intermediate said shoulder member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel;

track means coupled to said first wall portions of said body member having a straight portion substantially parallel to said shaft member and an arcuate portion;

valve means pivotally coupled to said shoulder member; and

runner means coupled to said valve means and slidably mounted in said track means and said valve means positioned to be clear of said aperture for the condition of said runner in said straight portion of said track means and to substantially cover said aperture for the condition of said runner in said arcuate portion of said track means.

6. In combination:

a body member having first wall portions defining a fluid receiving cavity, second wall portions defining a channel communicating at a first end thereof with said cavity and at a second end with regions external said body member, and third wall portions adjacent said second end of said channel;

a shaft member having a first cross sectional area mounted for reciprocating movement in said channel and extending a predetermined distance into said cavity and having wall portions defining a fluid transmitting passageway therethrough, a first end of said passageway communicating with said cavity and a second end adapted to communicate with regions external said shaft member;

a shoulder member coupled to said shaft member adjacent said first end of said passageway and said shoulder member having an aperture therethrough communicating with said first end of said passageway whereby fluid in said cavity is transmitted through said aperture to said passageway, and said shoulder member spaced a preselected distance from said first end of said channel and having a second cross sectional area greater than said first cross sectional area of said shaft member;

spring means intermediate said shoulder member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel; and

said shaft member adapted to move for the condition of fluid pressure exerted on said shoulder means from a first position to a second position, said second end of said fluid transmitting passageway contained within said channel at said first position and in regions external said body member at said second position.

7. In combination:

a body member having first wall portions defining a fluid receiving cavity, second wall portions defining a channel communicating at a first end thereof with said cavity and at a second end with regions external said body member, and third wall portions adjacent said second end of said channel;

a shaft member having a first cross sectional area mounted for reciprocating movement in said channel and extending a predetermined distance into said cavity and having wall portions defining a fluid transmitting passageway therethrough, a first end of said passageway communicating with said cavity and a

second end adapted to communicate with regions external said shaft member;

a shoulder member coupled to said shaft member adjacent said first end of said passageway a preselected distance from said first end of said channel and having a second cross sectional area greater than said first cross sectional area of said shaft member and having walls defining an aperture therethrough communicating with said first end of said passageway;

spring means intermediate said shoulder member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel;

said shaft member adapted to move for the condition of fluid pressure exerted on said shoulder means from a first position to a second position, said second end of said fluid transmitting passageway contained within said channel at said first position and in regions external said body member at said second position;

valve means pivotally coupled to said shoulder member and having a first position clear of said aperture and a second position substantially blocking said aperture; and

means coupled to said valve means and slidingly engaging preselected portions of said first wall portions of said body member for selectively moving said valve means from said first position to said second position with reciprocating motion of said shaft member in said channel.

8. An improved closure for fluid dispensing systems comprising, in combination:

a body member having first wall portions defining a fluid receiving cavity, second wall portions defining a channel communicating at a first end thereof with said cavity and at a second end with regions external said body member, and third wall portions adjacent said second end of said channel;

a shaft member having a first cross sectional area mounted for reciprocating movement in said channel extending a predetermined distance into said cavity and providing a substantially close fit with said second wall portions of said body member and having walls defining a fluid transmitting passageway therethrough, a first end of said passageway communicating with said cavity and a second end adapted



to communicate with regions external said shaft member;

a shoulder member coupled to said shaft member adjacent said first end of said passageway a preselected distance from said first end of said channel and having a second cross sectional area greater than said first cross sectional area of said shaft member and having walls defining an aperture therethrough communicating with said first end of said passageway;

spring means intermediate said shoulder member and said body member for yieldingly restraining reciprocating movement of said shaft member in said channel;

cover means coupled to said shaft means for energizing said third wall portions of said body member;

fluid seal means intermediate said shaft member and said second wall portions of said body member;

track means coupled to said first wall portions of said body member having a straight portion substantially parallel to said shaft member and an arcuate portion;

valve means pivotally coupled to said shoulder member; and

runner means coupled to said valve means and slidably mounted in said track means and said valve means positioned to be clear of said aperture for the condition of said runner in said straight portion of said track means and to substantially cover said aperture for the condition of said runner in said arcuate portion of said track means.


**References Cited by the Examiner**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 529,221 | 11/94 | Wagner | 222—514 |
| 889,738 | 6/08 | Weber | 222—506 X |
| 1,838,384 | 12/31 | Frohmann | 222—496 |
| 1,961,880 | 6/34 | Hine et al. | 222—514 |
| 2,504,276 | 4/50 | Olsen | 222—514 X |
| 2,596,592 | 5/52 | Parker | 222—92 |
| 2,625,303 | 1/53 | Mays | 222—514 X |
| 2,788,925 | 4/57 | Ward | 222—514 X |

FOREIGN PATENTS

| | | |
|---|---|---|
| 370,398 | 4/32 | Great Britain. |


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