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[54] **DISPOSABLE VALVE CONSTRUCTION AND METHOD OF MAKING SEALS**

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[52] **U.S. Cl.** **137/454.5**, 137/359

[51] **Int. Cl.** **F16k 31/38**

[58] **Field of Search** 137/454.2, 454.4, 454.5, 137/454.6

[56] **References Cited**

UNITED STATES PATENTS

3,451,431	6/1969	Boyer	137/454.5 X
3,229,710	1/1966	Keller	137/454.5
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1,015,289	9/1957	Germany	137/454.5

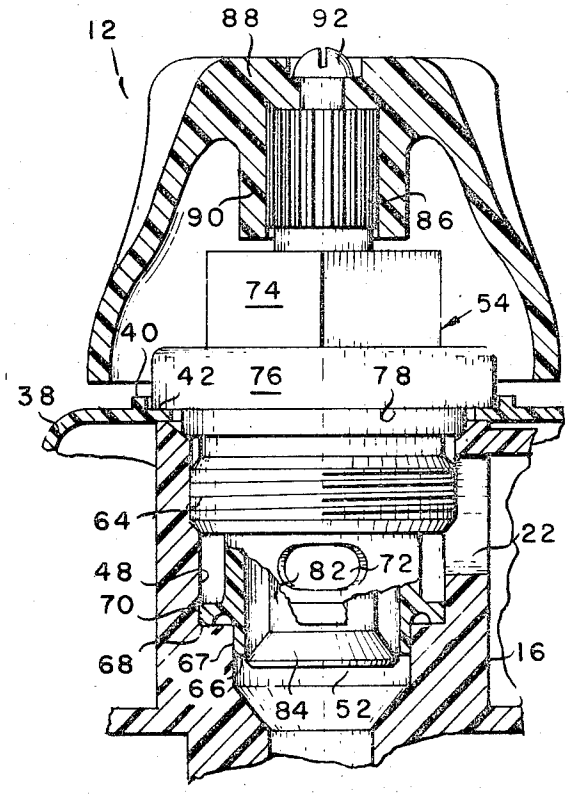
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[57] **ABSTRACT**

A disposable valve construction and method of making seals in which the valve member is made from a flexible material, such as plastic. A valve housing member is provided with a longitudinal bore which communicates with a fluid to be dispensed. The housing member is provided with a countersunk portion to receive therein a hollow valve member. The latter is provided with a lower cylindrical portion, the bottom surface of which functions as a valve seat for a centrally disposed stem member. The outer surface of the lower cylindrical portion provides an interference fit for the bore of the housing member. The hollow valve body member is threaded into the countersunk housing until an interference seal is initially established with the bore of the housing member. The valve body member is threaded further causing flexing of the valve body to occur as an integral annular skirt portion of the valve body engages the shoulder at the bottom of the countersink which serves as a valve seat therefor. Continued threading of the valve body establishes a controlled tension on the valve housing member by an interference in length between the valve member and the housing member between the valve seat and a bottoming out position. While the countersunk portion is threaded to receive the valve body member, the bottom of the countersink is unthreaded and is positioned to support the annular skirt portion of the valve body and prevents radial movement thereof which would cause leaking under heavy pressures.

16 Claims, 6 Drawing Figures



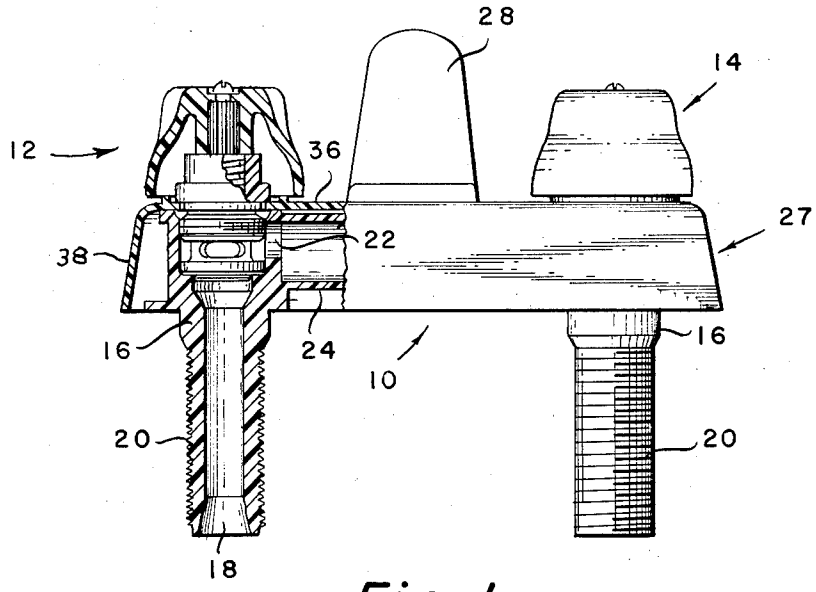


Fig. 1

Fig. 2

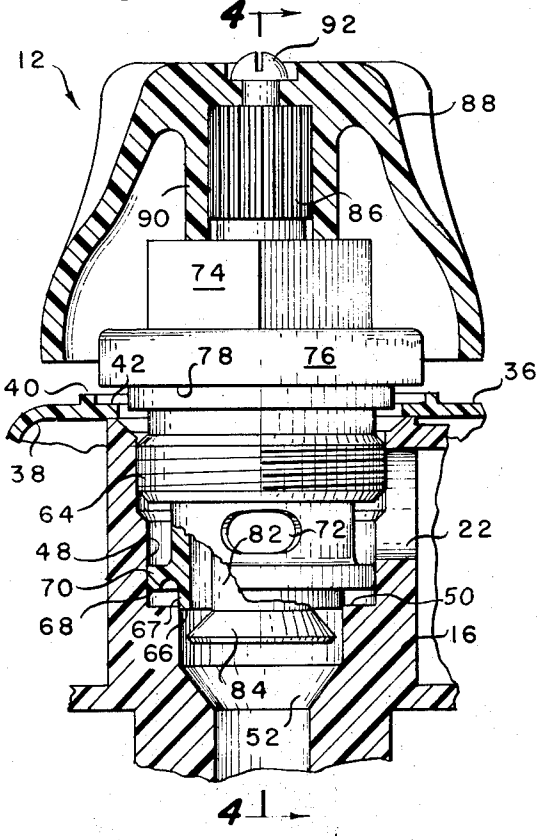
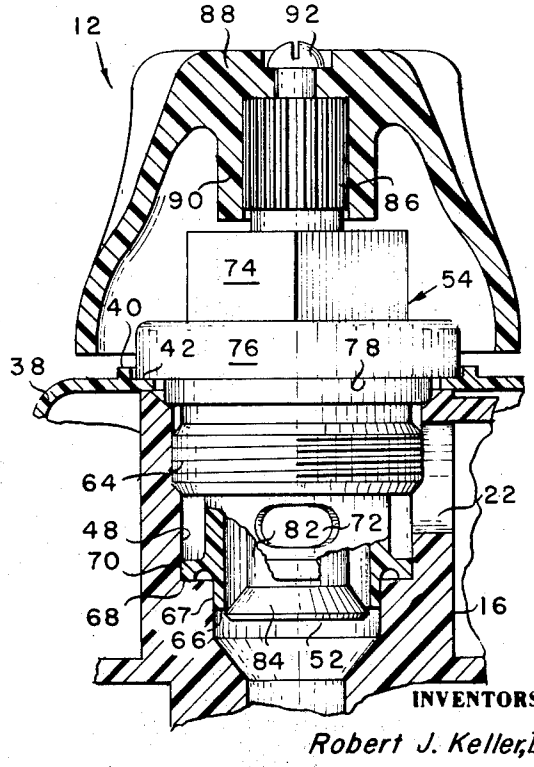


Fig. 3



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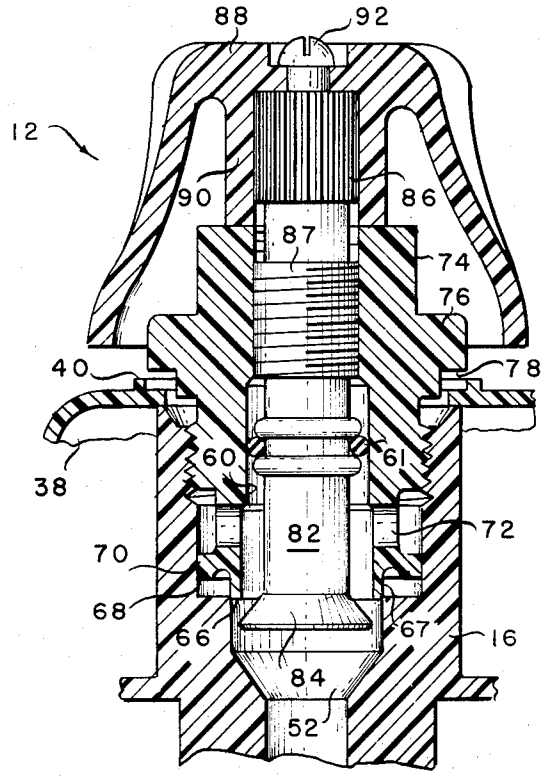
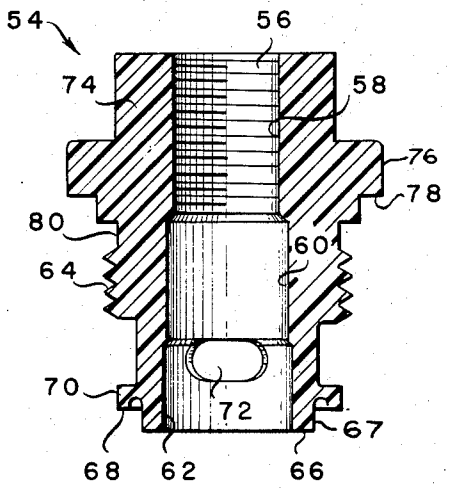


Fig. 4

Fig. 5

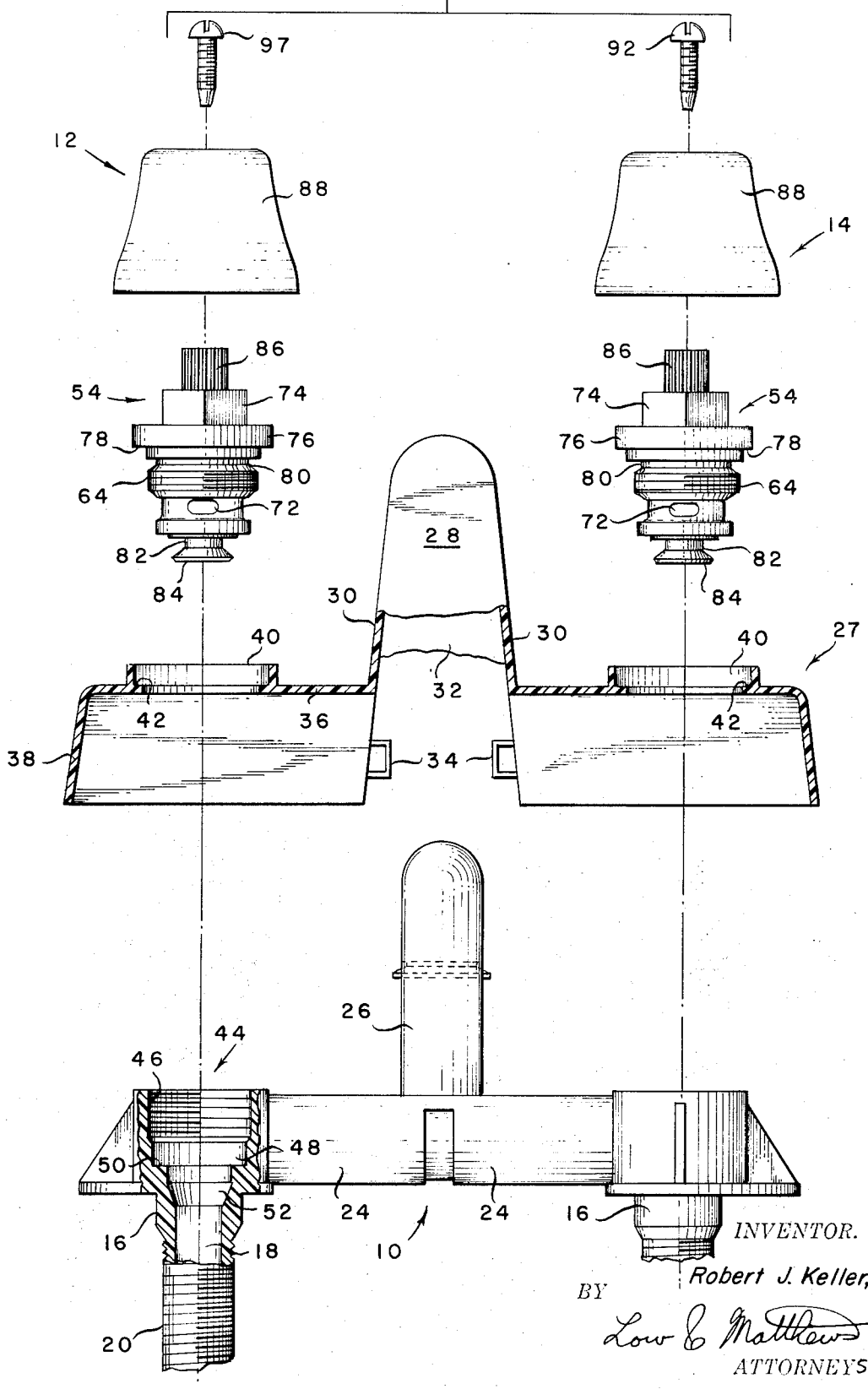


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Fig. 6



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DISPOSABLE VALVE CONSTRUCTION AND METHOD OF MAKING SEALS

This invention relates to a disposable valve construction and method of making same and more particularly to such a valve construction and method which can be made almost exclusively from plastic.

The invention is illustrated for use in connection with mixing faucets such as are disclosed in my U.S. Pat. No. 3,229,710, issued Jan. 18, 1966; 3,241,810, issued Mar. 22, 1966; and 3,448,768, issued June 10, 1969, although the valve per se and the method of effecting a seal are not limited to this usage.

It is particularly desirable to device a disposable valve wherein substantially all of the wear occurs on the part or assembly which is easily removed. This is accomplished in accordance with the present invention whereby it becomes possible to make a permanent installation of the non-disposable elements of the valve assembly.

It is also desirable to effect a double seal in the vicinity of the valve seat. This is accomplished in accordance with the present invention by providing an interference seal between the bore of the main housing member and an external cylindrical surface at the lower end of a hollow valve body member and a second seal between a flanged annular skirt on the hollow valve body member and a valve seat in the main housing member formed at the bottom of a countersink therein. While the seal areas are closely adjacent, they are substantially at right angles to each other.

One difficulty which has heretofore been experienced in mixing faucets in the tendency of the inner O-ring member to be extruded through the lateral ports of the valve member which communicate with a mixing chamber during the assembly of the O-ring member. This tendency for the O-ring to be extruded through these lateral ports frequently cuts the O-ring and results in leaks. The construction of the valve member in accordance with the present invention obviates this tendency to cut or extrude the O-ring during assembly of the valve and ensures that a leak-proof valve is obtained.

Still another feature of the present invention is the use of means to provide support for a flanged annular skirt portion of the hollow valve body member which flexes when it is brought into sealing position. This support is effected in the present invention by so dimensioning the countersunk underbody or main housing member of the valve construction so that it is closely adjacent the flanged annular skirt of the valve body member so as to prevent radial outward movement thereof. In this manner, leaking under heavy pressure is prevented.

The inherent advantages and improvements of the present invtion will become more readily apparent upon considering the following detailed description of the invention and by reference to the drawings in which:

FIG. 1 is a rear elevational view, partially in vertical cross section, illustrating the disposable valve construction of the present invention;

FIG. 2 is a fragmentary elevational view, taken partially in vertical cross section, and drawn to an enlarged scale illustrating one position of the valve assembly of the present invention;

FIG. 3 is a fragmentary elevational view similar to FIG. 2, but showing another position of the valve assembly of the present invention;

FIG. 4 is a fragmentary elevational view taken in vertical cross section along line 4—4 of FIG. 2;

FIG. 5 is an elevational view, taken in vertical cross section, of the valve member of the present invention; and,

FIG. 6 is an exploded rear elevational view, shown partially in vertical cross section, further illustrating the arrangement of the parts in accordance with the present invention.

Referring now to FIG. 1 of the drawings, there is illustrated a mixing faucet unit, indicated generally at **10**, having one valve assembly **12** on the left side thereof and a duplicate valve assembly indicated generally at **14** on the right side thereof. Since each valve assembly **12** and **14** is identical, only one will be described in detail. An underbody or main housing member **16** is shown to have a central bore **18** extending therethrough and provided with an externally threaded portion **20**. The underbody or main housing member **16** is provided with port means **22** consisting of an aperture which communicates with a mixing chamber **24**.

Reference is now made to the remaining figures, and in particular to FIG. **6** for the further details of the main housing member. Thus there is shown a neck portion **26** which is protected within a plastic cover member indicated generally at **27**. The plastic cover member **27** is provided with a top wall **28** and side walls **30** which are preferably all made from plastic. A snap-in plastic bottom closure member is shown partially at **32** in FIG. **6** and for purposes of this invention may be substantially identical to that shown in my U.S. Pat. No. 3,448,768. The snap-in bottom closure member **32** is received in suitable snap-in catches **34** and the plastic cover member **27** is further illustrated to have a top wall **36** and an integral depending skirt **38**.

In order to receive an individual valve member, the plastic cover member **27** is provided with upstanding flanges **40** which are provided with an internal seat **42**. Each underbody member **16** is countersunk as indicated generally at **44** in FIG. **6** and has a threaded upper wall portion **46** and an unthreaded lower wall portion **48** the purpose of which will become more apparent thereinafter. The bottom of countersink **44** comprises a shoulder which constitutes a valve seat **50**. A chamber **52** which permits a stem member **82** to open and close is disposed between valve seat **50** and the lower portion of central bore **18**.

The valve body member itself is shown in isolation in FIG. **5**. Reference to this figure shows that the valve body member designated generally at **54** is hollow by virtue of a certral bore **56** which has an internal threaded portion at **58**. The hollow valve body member is provided with a central bore region **60** for reception therein of an O-ring **61**, shown in assembled position in FIG. **4**. The bore is shown to have a relieved portion **62** in order to prevent extrusion of the O-ring **61** through the port means of the valve body member or cutting of the O-ring **61** during the assembly of the valve.

The valve body member is externally threaded at **64**. One feature of the invention which permits adjustment of the cooperative forces on the sealing elements of the valve is to make the threaded portion **64** of an opposite hand from the internal threading **58**. Thus in one em-

bodiment of the invention the external threads 64 were right-hand threads and the internal threads 58 were left-hand threads.

The hollow valve body member 54 is provided with a lower cylindrical portion, the bottom surface of which at 66 provides an annular valve seat. The lower portion of hollow valve body member 54 has an external surface at 67 which provides a valve sealing surface intended to establish an interference seal with the bore of the main housing or underbody member 16 immediately below valve seat 50. The diameter of external surface 67 is made approximately 0.010 inches greater than the bore of the underbody 16 immediately below valve seat 50 to establish an interference seal. Hollow valve body member 54 is provided with a flanged annular skirt portion 70 integral therewith the lowermost surface of which constitutes a valve sealing surface 68 which is brought into engagement with valve seat 50. The radius illustrated between the flanged annular skirt 70 and the lower cylindrical portion of the hollow valve body member 54 permits flexing of the flanged annular skirt 70. The external surface 67 is permitted to penetrate the bore of underbody 16 below valve seat 50 for approximately 0.075 inches in the fully assembled position of FIG. 3.

The valve body member 54 is shown to have port means 72 and which preferably are in diametrically opposed walls of the valve body member 54. The relieved portion 62 of the central bore of the valve body member 54 is of sufficient length so that O-ring 61 may substantially pass port means 72 before engaging the more restricted bore 60. Therefore, the O-ring 61 will not be extruded through port means 72 nor be cut thereby during the assembly of the disposable valve.

The top 74 of valve body member 54 is preferably hexagonal as is illustrated in FIGS. 2, 3 and 6 whereby the valve body 54 may be turned by a socket head wrench or the like and establish a controlled torque in tension on the main housing or underbody 16 by virtue of a length interference between parts between valve seat 50 and bottoming out seat 42. Beneath the hexagonal top 74 is an abutment means 76 having a shoulder 78 formed on the lower surface thereof. This shoulder 78 provides a final stop for valve 54 and because a controlled torque is applied to the valve body 54 this results in a controlled tension being applied to the main housing or underbody 16. The valve body member 54 is further provided with an annular groove 80 in order to receive an O-ring member (not shown).

A stem member is illustrated at 82 in FIGS. 2, 3, 4, and 6 and, as best seen in FIG. 4, is shown to have a valve disk 84 at the lower end thereof and a handle receiving means, such as a spline 86 at the upper end thereof. The valve disk 84 is brought into sealing engagement with the annular valve seat 66 by longitudinal movement of stem member 82.

A handle 88 is frictionally received on spline 86 of the stem member 82 by engagement of its cylindrical hub 90 therewith and is retained thereon with the aid of a screw 92. The stem member 82 is preferably made of brass and with the further exception of screw 92, all other parts hereof are preferably made of plastic. One plastic material which may be used, for example, is Celanese Plastic Company's "CELCON" which is a copolymer of formaldehyde and is suitable because it has some resiliency. The parts may be made by injection molding.

In the assembly of the valve disclosed herein, the O-ring 61 illustrated in FIG. 4 is placed on stem member 82 and the hollow valve body member 54 is then slipped over the splined end 86 of the stem member and assembled thereto by engagement of the left-handed threads 58 of the valve member with the left-handed threads 87 on stem member 82. A suitable wrench means such as a socket head wrench capable of imparting a controlled torque is used to engage the hexagonal nut like top 74.

The lower cylindrical portion of the hollow valve body 54 enters the bore immediately below the valve seat 50 of countersink 44 and establishes an interference seal therewith by engagement of the valve sealing surface 67. This general position of the valve body member 54 is indicated in FIGS. 2 and 4 although handle 88 will not be in place at tht time so that a wrench may engage nut 74. By continuing to thread the hollow valve body member 54 into the countersunk bore the lowermost surface 68 of the flanged annular skirt 70 engages the valve seat 50 at the bottom of countersink 44. In so doing, the hollow valve body member 54 flexes and the radial movement of annular skirt 70 is restrained by the nearness of the unthreaded lower wall portion 48 of countersink 44. In actual practice, only about .005 inches clearance is permitted between the outer wall of the flanged annular skirt 70 and the unthreaded lower wall 48. Thus additional radial movement of the flanged annular skirt 70 is prevented which would cause leaking under heavy pressures. The hollow valve body member is continued to be threaded into the counterbore 44 until a final bottoming out position is reached when shoulder 78 abuts against seat 42 of the plastic cover member 27. By making the length of the hollow valve body member 54 between the valve sealing surface 68 and shoulder 78 slightly greater than the distance from the bottom of the counterbore, i.e., shoulder 50, to seat 42 of the plastic cover member 27 a controlled tensioning is established in the main housing or underbody member 16 when shoulder 78 bottoms out on seat 42. This amounts to an interference in length which is partially taken up by the resilience of the threads. In actual practice an interference in length of approximately 0.012 inches has been used. When handle 88 is applied and retained by screw 92, the fully assembled and closed position of the valve assembly is reached as is shown in FIG. 3.

It will be observed that valve disk 84 of the stem member 82 is in engagement with the valve seat 66 provided by the bottom surface of the lower cylindrical portion of the hollow valve body member 54. It is also important to note that the valve disk 84 of the stem member 82 provides a substantially conical surface whereby the valve disk has a component of force directed toward the bore of the main valve housing member or underbody 16. When the valve body member 54 is new the lower edge of valve seat 66 forms substantially a right angle with the inner bore of the valve body member. The conical surface of the valve disk 84 compensates for wear of this valve seat as the inner edge takes on a beveled configuration.

Since the plastic cover member 27 does not move vertically, engagement of shoulder 78 therewith constitutes engagement with a fixed reference point. The stem member 82 is then movable between the closed position shown in FIG. 3 to its open position by counterclockwise movementof handle 88 assuming right-

hand threads at 64 and 46, and left-hand threads for the internal threads 58 on valve member 54 and at 87 on stem member 82. In the closed position of the valve disk 84 as shown in FIG. 3, the bottom of hub 90 is separated from the top 74 of the valve member. Thus it is possible when valve disk 84 is open for water to be received into the bore 18 of the underbody or main housing member 16 from a suitable source, not shown, past the valve disk 84 into the relieved bore portion 62 of valve member 54 and out through port means 72 into mixing chamber 24 and then through neck 26 to be dispensed. While the unthreaded lower wall portion 48 is shown to be substantially larger than the height or length of the flanged annular skirt portion 70 i is only necessary for wall portion 48 to be at least as great as the length of this flange in order to provide close support therefor and prevent radial movement of the flange 70.

The bottom of hub 90 by engagement with the upper surface of hexagonal nut-like top 74 of the valve member 54 as shown in FIG. 2 prevents the O-ring 61 from moving out of the restricted bore portion 60 of the valve body member 54. In other words, hub 90 serves to limit the downward movement of stem member 82.

From the foregoing it will be apparent that a disposable valve assembly is provided wherein a controlled tension load is placed upon the main housing or underbody member. An unpredictable load is exerted in compression of the valve body member, but this member is supported.

While presently preferred embodiments of the invention have been illustrated and described, it will be recognized that the invention may be otherwise variously embodied and practiced within the scope of the claims which follow.

What is claimed is:

1. A valve construction which comprises:
   a. a main housing having a threaded countersunk portion with the bottom of the countersink defining a shoulder which constitutes a first valve seat,
      1. said main housing further having a bore extending beneath said valve seat and communicating with a fluid to be dispensed,
   b. a hollow valve body member threadedly received in said threaded countersunk portion of said main housing,
      1. said hollow valve body member having a lower hollow cylindrical portion the bottom surface of which provides a second valve seat,
      2. said hollow cylindrical portion having a cylindrical external surface which provides an interference valve sealing surface when inserted into engagement with said bore of said main housing,
   c. a stem member threadedly received within said hollow valve body member,
      1. said stem member having a valve disk at one end selectively movable into and out of engagement with said second valve seat on said hollow valve body member,
   d. and said hollow valve body member having a flanged annular skirt portion integral therewith, the lowermost surface of which constitutes a second valve sealing surface,
   e. said second valve sealing surface being brought into engagement with said first valve seat by continued insertion of said lower cylindrical portion of said hollow valve body member into said bore of said main housing.

2. A valve construction as defined in claim 1 including means for limiting radial movement of said flanged annular skirt portion of said hollow valve body member.

3. A valve construction as defined in claim 2 wherein said countersunk portion has a cylindrical wall the lowermost portion of which is unthreaded and is positioned closely adjacent said flanged annular skirt portion for limiting radial movement thereof.

4. A valve construction as defined in claim 3 wherein said unthreaded lowermost portion of said cylindrical wall of said countersunk portion is at least as high as the length of said flanged annular skirt portion of said hollow valve body member.

5. A valve construction as defined in claim 1 wherein said hollow valve body member is made from a plastic material.

6. A valve construction as defined in claim 1
   a. wherein said stem member is provided with handle receiving means at one end opposite from the end having said valve disk,
   b. and wherein said hollow valve body member is provided with port means located between said first valve seat and the threaded securement of said hollow valve body member to said stem member to permit fluids which enter said hollow valve body member between said stem member and said first valve seat to exit from said hollow valve body member.

7. A valve construction as defined in claim 6 wherein said hollow valve body member is threaded by threads of one hand to said countersunk portion and by threads of the other hand to said stem member.

8. A valve construction as defined in claim 6 including means for limiting radial movement of said flanged annular skirt portion of said hollow valve body member.

9. A valve construction as defined in claim 8 wherein said countersunk portion has a cylindrical wall the lowermost portion of which is unthreaded and is positioned closely adjacent said flanged annular skirt portion for limiting radial movement thereof.

10. A valve construction as defined in claim 9 wherein said unthreaded lowermost portion of said cylindrical wall of said countersunk portion is at least as high as the length of said flanged annular skirt portion of said hollow valve body member.

11. A valve construction is defined in claim 6 wherein said hollow valve body member is made from a plastic material.

12. A valve construction which comprises:
   a. a plastic main housing having a threaded countersunk portion with the bottom of the countersink defining a shoulder which constitutes a valve seat,
      1. said main housing further having a bore extending beneath said valve seat and communicating with a fluid to be dispensed,
   b. a hollow plastic valve body member threadedly received in said threaded countersunk portion of said main housing,
      1. said hollow plastic valve body member having a lower hollow cylindrical portion the bottom surface of which provides a valve seat for a stem member,

i. said lower hollow cylindrical portion having an external surface molded integrally with said hollow plastic valve body member which provides an interference valve sealing surface in engagement with said bore of said main housing,

2. said hollow valve body member carrying an abutment means engageable with a fixed reference point for limiting the threaded insertion of said hollow valve body member into said main housing member,

3. and said abutment means being spaced a predetermined distance above said shoulder of said main housing to limit the amount of compression of said hollow valve body member and the amount of tension exerted on said main housing member,

c. a stem member threadedly received within said hollow valve body member,

1. said stem member having a valve disk at one end selectively movable into and out of engagement with said valve seat therefor on said hollow valve body member.

13. A valve construction comprising:

a. a plastic main housing having a threaded countersunk portion with the bottom of the countersink defining a shoulder which constitutes a valve seat,

1. said main housing further having a bore extending beneath said valve seat and communicating with a fluid to be dispensed,

b. a hollow plastic valve body member threadedly received in said threaded countersunk portion of said main housing,

1. said hollow plastic valve body member having a lower hollow cylindrical portion the bottom surface of which provides a valve seat for a stem member,

i. said lower hollow cylindrical portion having an external surface which provides an interference valve sealing surface in engagement with said bore of said main housing,

ii. said lower hollow cylindrical portion of said hollow valve body member carrying an outwardly extending annular flange member,

2. said hollow valve body member carrying an abutment means engageable with a fixed reference point for limiting the threaded insertion of said hollow valve body member into said main housing member,

3. said abutment means being spaced a predetermined distance above said shoulder of said main housing to limit the amount of compression of said hollow valve body member and the amount of tension exerted on said main housing member,

4. said outwardly extending annular flange member having a downwardly extending annular skirt portion the lowermost surface of which contacts the shoulder of said main housing member prior to engagement of said abutment means with said fixed reference point,

c. and a stem member threadedly received within said hollow valve body member,

1. said stem member having a valve disk at one end selectively movable into and out of engagement with said valve seat therefor on said hollow valve body member.

14. A valve construction as defined in claim **13**, wherein said outwardly extending annular flange has a weakened portion which permits flexing of said annular flange thereby permitting the further insertion of said hollow valve body member into said main housing member until said abutment means contacts said fixed reference point.

15. A valve construction as defined in claim **14**, including means for limiting radial movement of said flanged annular skirt portion of said hollow valve body member.

16. A valve construction which comprises:

a. a main housing having a threaded countersunk portion with the bottom of the countersink defining a shoulder which constitutes a valve seat and the top thereof constituting an open mouth,

1. said main housing further having a bore extending beneath said valve seat and communicating with a fluid to be dispensed,

b. a hollow valve body member threadedly received in said threaded countersunk portion of said main housing,

1. said hollow valve body member having a lower hollow cylindrical portion the bottom surface of which provides a valve seat for a stem member,

i. said lower cylindrical portion having a cylindrical external surface which provides an interference valve sealing surface when inserted in engagement with said bore of said main housing,

2. said hollow valve body member having an annular groove to receive an annular sealing member adjacent the open mouth of said countersink in said main housing member,

3. said hollow valve body member having a flanged annular skirt portion integral therewith, the lowermost surface of which constitutes a second valve sealing surface,

i. said second valve sealing surface being brought into sealing engagement with said shoulder of said main housing by continued insertion of said lower cylindrical portion of said hollow valve body member into the bore of said main housing member during which time said annular sealing member adjacent the mouth of said countersink is being compressed within said annular groove of said hollow valve body member,

c. a stem member threadedly received within said hollow valve body member,

1. said stem member having a valve disk at one end selectively movable into and outer of engagement with said valve seat therefor on said hollow valve body member.

* * * * *