May 25, 1965 F. H. MUELLER ETAL 3,185,171

VALVING STRUCTURE FOR FIRE HYDRANT

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FIG. 1.

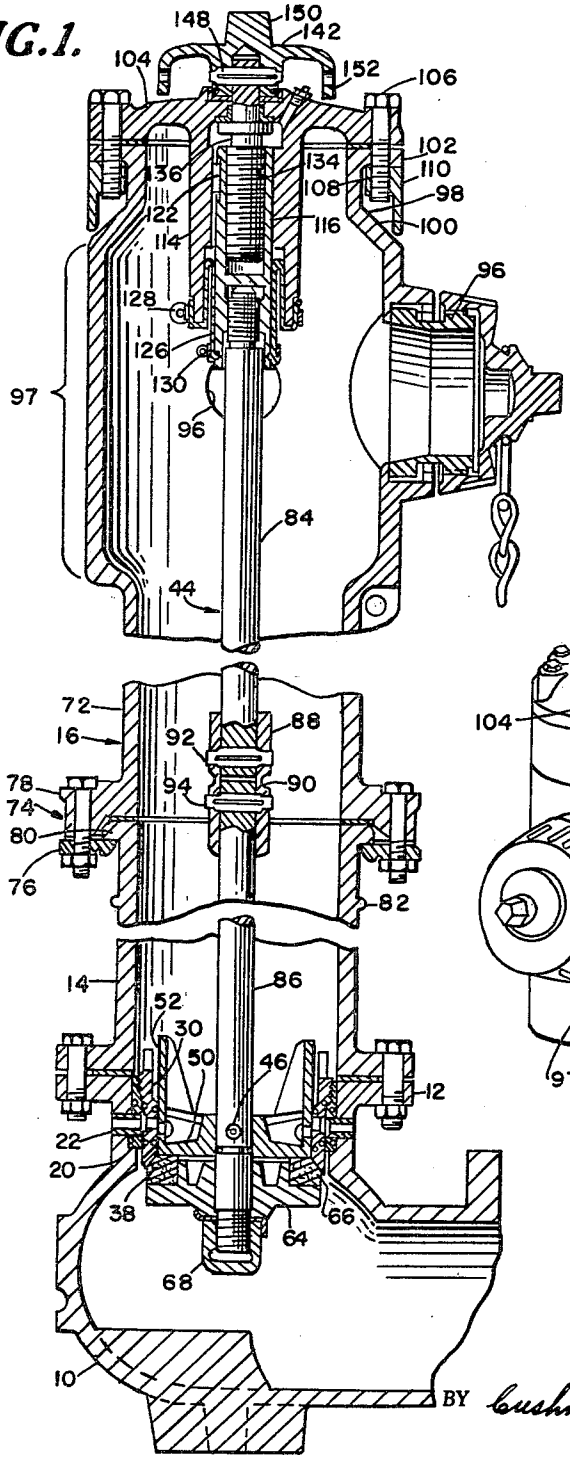
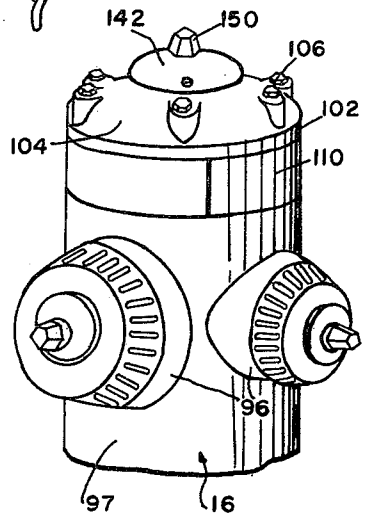


FIG. 2.



INVENTOR
FRANK H. MUELLER
JOHN J. SMITH

BY Cushman, Darby & Cushman
ATTORNEYS

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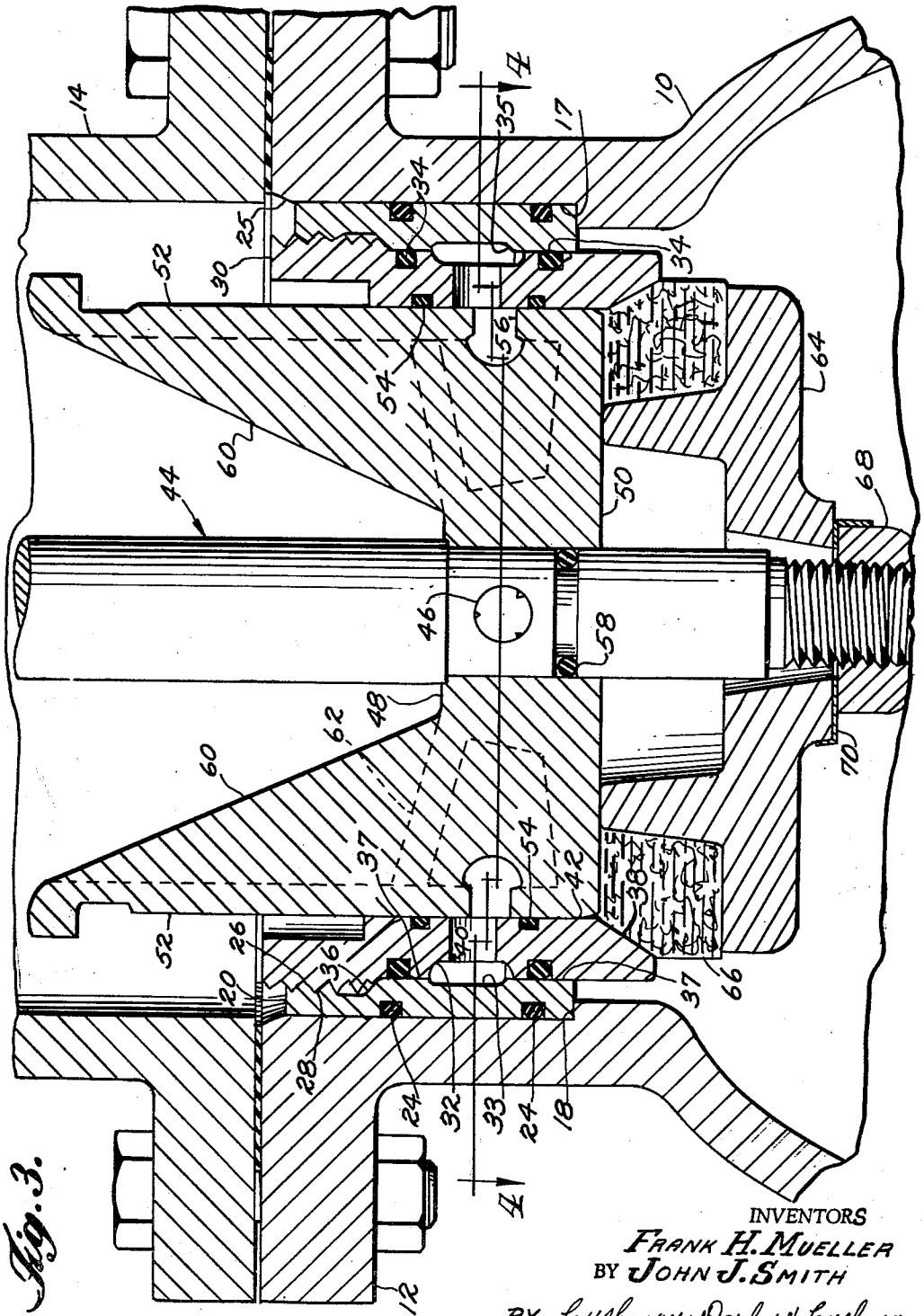


Fig. 3.

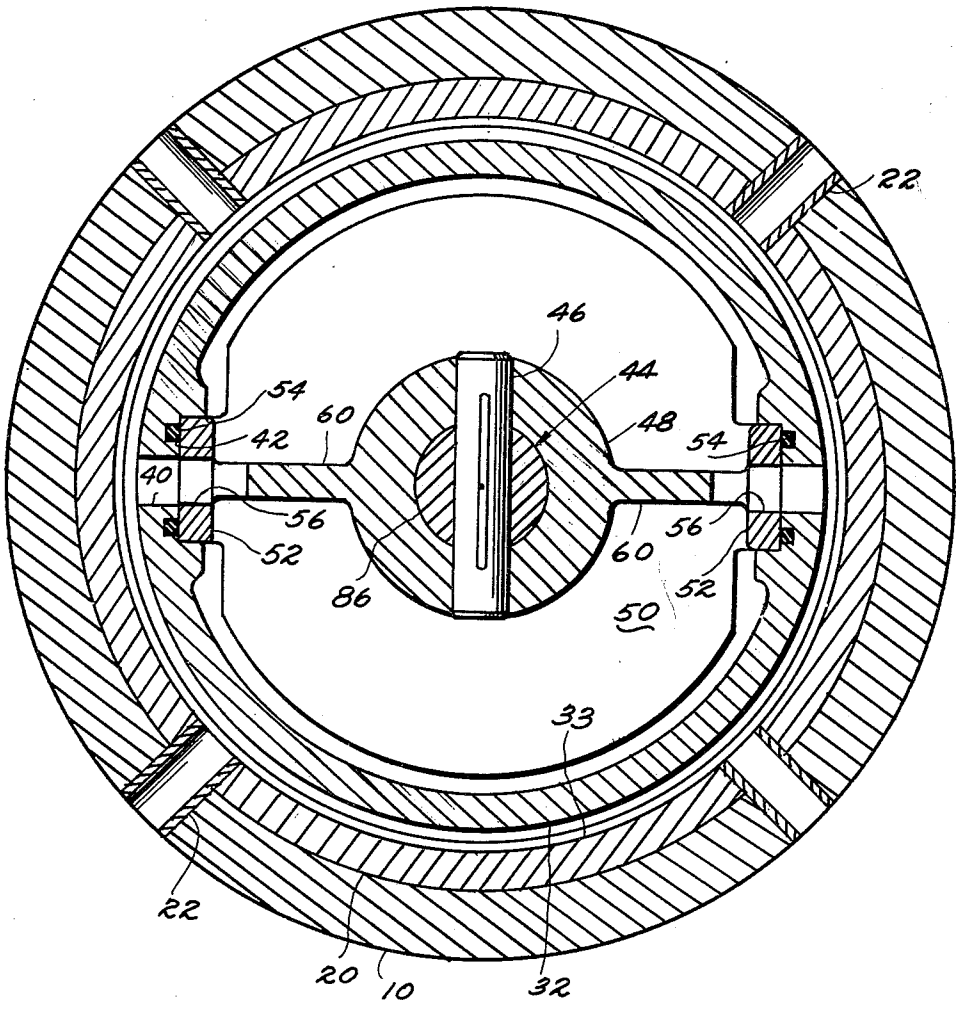
INVENTORS
FRANK H. MUELLER
BY JOHN J. SMITH
BY Cushman, Darby & Cushman
ATTORNEYS

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Fig. 4.



INVENTORS
FRANK H. MUELLER
BY JOHN J. SMITH
BY Cushman, Darby & Cushman
ATTORNEYS

United States Patent Office 3,185,171 Patented May 25, 1965

3,185,171

VALVING STRUCTURE FOR FIRE HYDRANT

Frank H. Mueller and John J. Smith, Decatur, Ill., assignors to Mueller Co., Decatur, Ill., a corporation of Illinois

Filed Dec. 19, 1961, Ser. No. 161,339
8 Claims. (Cl. 137—283)

This invention relates to improvements in fire hydrants. More particularly, this invention relates to improvements in fire hydrants which will render the same not only cheaper to manufacture, but also easier to maintain and repair. Moreover, the improvements reduce the maintenance requirements for a hydrant and enable the same to be operated or put in service for extended periods of time without any attention. This application is a continuation-in-part of our copending application Serial No. 45,387, filed July 26, 1960, since abandoned, which was a division of our copending application, Serial No. 856,981, filed December 3, 1959 now Patent No. 3,104,554.

Fire hydrants conventionally have a valve seat ring threaded into the mouth of the hydrant shoe to provide a downwardly facing valve seat. The threaded engagement makes it possible to remove the seat ring, for repair or replacement, without digging up the hydrant. The formation of threads within the mouth of a hydrant shoe is a relatively costly machining operation, however, because the shoe is a large, heavy and cumbersome structure.

Consequently, it is an object of this invention to provide a valve seat ring removably engaged within the mouth of the hydrant shoe, but wherein the shoe is not provided with interior threads.

Fire hydrants of the type with which this invention is concerned also normally are provided with drain valve ports which extend through the wall of the seat ring into communication with drain tubes or ports in the side wall of the shoe. Slide valve elements on the hydrant valve stem cooperate with the inner ends of the drain valve ports to open such ports when the main hydrant valve is closed in order to drain the barrel, and to close such ports when the main hydrant valve is open. There is a problem, however, in providing an effective satisfactory seal between the inner ends of the drain valve ports and the slide valve elements.

Accordingly, it is another object of this invention to provide an improved seal between the seat ring drain valve ports and the slide valve elements carried by the stem of a fire hydrant.

It is a further object of this invention to provide an improved seat ring assembly for a fire hydrant which facilitates assembly and also disassembly of the seat ring itself for repair or replacement.

Other objects and advantages of the invention will become apparent from the following description and accompanying drawings in which:

FIGURE 1 is a vertical sectional view of a fire hydrant embodying this invention.

FIGURE 2 is a perspective view of the upper portion of the hydrant shown in FIGURE 1, and taken from the upper right-hand side of such figure.

FIGURE 3 is an enlarged fragmentary view of a lower portion of the hydrant shown in FIGURE 1.

FIGURE 4 is a sectional view taken substantially on line 4—4 of FIGURE 3.

Referring now to the drawings there is shown a hydrant shoe 10 adapted to be connected to a water main (not shown) and having an upwardly opening mouth surrounded by a peripheral flange 12 to which is bolted the lower end of a lower section 14 of a two-part barrel 16. The shoe 10 normally is formed of cast iron and its mouth is provided with smooth-walled counterbore 17 which forms an upwardly facing shoulder 18 against which is seated a brass bushing 20. The bushing 20 is retained in place by four uniformly circumferentially spaced stainless steel drain tubes 22 force-fitted through radially aligned apertures in the bushing and in the shoe 10. The outer surface of the bushing 20 is provided with a pair of spaced circumferential grooves, one above and one below the drain tubes 22, having O-rings 24 disposed therein and engaged with the opposed smooth surface of the counterbore 17 in the mouth of the shoe 10.

The upper end or rim of the counterbore 17 is provided with a smooth bevel or chamfer 25 of appreciable extent to facilitate assembly of the bushing 20 together with the O-rings 24, in the counterbore 17 without damaging the O-rings. The radial section diameter of the O-rings 24 when relaxed is, as is well known in the art, greater than the depth of their corresponding grooves so that the rings initially protrude slightly therefrom and are subject to damage if forced past a sharp corner or edge.

Interior threads 26 in the upper end of the bushing 20 are engaged by complementary exterior threads 28 on the upper end of a valve seat ring 30 which has an exterior circumferential drain groove 32 registering with an interior circumferential drain groove 33 in the bushing 20.

The inner ends of the drain tubes 22 are substantially flush with the bottom of the groove 33, as shown in FIGURE 4, and the lower side wall or edge of the groove 33 is inclined or chamfered, as at 35, for reasons later explained. Additionally, the bushing 20 is interiorly reduced below its threads 26 to provide smooth-walled portions 37 above and below the groove 33 which are of smaller interior diameter than the next diameter of the threads 26.

The seat ring 30 is provided with a pair of spaced exterior circumferential grooves, one above and one below the drain groove 32, having O-rings 34 therein in sealing engagement with the smooth inner surface 37 of the bushing 20 below its threads 26. The enlargement of the next diameter of the threads 26, as compared to the diameter of the smooth-walled portions 37 engaged by the O-rings 34, and the chamfer 35 on the lower wall of the groove 33, again facilitates assembly of the seat ring 30 in the bushing 20 without damaging the O-rings 34. Moreover, the aforesaid enlargement of the threads 26 forms an annular inclined shoulder 36 therebelow engageable by the seat ring threads 28 to limit the extent of insertion of the seat ring 30 in the bushing 20. Such inclined shoulder 36 additionally prevents damage to the O-rings 34 during assembly of the seat ring 30 in the bushing 20. The lower end of the seat ring 30 is provided with a downwardly flaring frusto-conical hydrant main valve seat 38. A pair of diametrically disposed drain valve ports 40 in the ring 30 communicate, at their outer ends, with the drain groove 32. At its inner end, each drain

port 40 opens into the flat bottom of a longitudinal interior groove 42 in the ring 30, such groove being substantially rectangular in cross-section, as shown best in FIGURE 6.

A reciprocating valve stem 44 extends within the barrel 16 and secured on the lower end of such stem, as by a transverse pin 46, is a hub portion 48 of an upper valve plate 50. At the periphery of the plate 50 is a pair of diametrically disposed, upstanding, rib-like drain valve elements 52. The elements 52 constitute slide valves that are fitted in and complementary to the longitudinal seat ring grooves 42. These elements 52, in the open position of the hydrant main valve, as later explained, are adapted to close the inner ends of the drain valve ports 40. In the flat bottom of each longitudinal groove 42 in the seat ring is an annular or circular groove surrounding the inner end of each drain valve port 40 and having an O-ring 54 therein sealingly engaged with the opposed face of the corresponding drain valve element 52. Each element 52 is provided, at its lower end, but above the plate 50, with a drain valve port 56 which registers with the corresponding drain valve port 40 in the seat ring 30 in the closed position of the hydrant main valve. Preferably, the valve stem 44 is provided below the pin 46 with a circumferential groove within which is disposed an O-ring 58 in sealing engagement with the hub portion 48 of the upper valve plate 50. Preferably, the elements 52 are re-enforced by inner longitudinal stiffening ribs 60 having side re-enforcing flanges 62.

Clamped between the upper valve plate 50 and a lower valve plate 64 is a one-piece annular rubber-like valve washer 66 which has an inclined edge adapted to seat against the valve seat 38 at the lower end of the seat ring 30. The lower valve plate 64 is retained on the valve stem 44 by a cap nut 68 threaded onto the lower end of the stem. Preferably, a lock washer 70 having bendable outer flanges is interposed between the nut 68 and the lower valve plate 64.

The hydrant barrel 16 also has an upper section 72 that is secured to the lower section 14 by a frangible connection 74 described more in detail in the copending application of Mueller et al., Serial No. 848,319, since abandoned. In this connection, it is sufficient for the purposes here to point out that the barrel sections 14 and 72 are secured together by a clamp ring 76 bolted to a flange 78 on the lower end of the upper barrel section 72 and having an inner frangible portion which underlies a circumferential flange 80 on the upper end of the lower barrel section 14. The hydrant normally is buried up to a ground line mark 82 (FIGURE 1) on the lower barrel section 14. From this construction it will be seen that when the upper barrel section 72 is subjected to a severe blow, as by being hit by a motor vehicle, the inner portion of the ring 76 fractures off and permits the upper barrel section to be knocked over without damage to either section.

The valve stem 44 likewise must be provided with upper and lower parts 84 and 86, respectively, coupled together by a frangible or otherwise readily disengageable connection to permit ready separation of such stem parts without damage to the valve or operating parts engaged by the lower and upper ends of the stem 16. For this purpose the upper and lower stem parts 84 and 86 have their plane of separation disposed above the upper edge of the lower barrel section 14 and are secured together by a coupling sleeve 88 provided intermediate its ends with a circumferential weakening groove 90. This groove 90 is disposed at the plane of separation between the opposed ends of the upper and lower stem parts 84 and 86. The sleeve 88 is secured to the stem parts 84 and 86 by force-fitted pins 92 and 94, respectively, which extend diametrically through the sleeve and through transverse bores in the stem parts.

From the foregoing construction, it will be seen that when the upper barrel section 72 is impacted sufficiently

to break its frangible connection 74 with the lower barrel section 14, the upper stem part 84 will be subjected to a bending moment, relative to the lower stem part 86, sufficient to fracture the stem coupling sleeve 88 about its weakening circumferential groove 90 to thereby permit uncoupling or separation of the stem parts. Because the lower sleeve-retaining pin 94 is disposed above the upper end of the lower barrel section 14, such pin is readily accessible for being knocked out by an appropriate tool (not shown) so that the two stem parts 84 and 86 can be recoupled, by a new coupling sleeve and a pair of new pins, before the barrel sections 14 and 72 are resecured together by a new clamp ring. It will be seen that if the opposed or adjacent ends of the two stem parts 84 and 86, and the coupling sleeve 88, were so positioned that the pin 94 connecting the sleeve to the lower stem part was within the uper portion of the lower barrel section 14, i.e., below its upper end, the operation of knocking out the pin 94 to remove the lower half of a fractured sleeve, would be extremely difficult, because of the tight quarters within which a knockout tool could be manipulated.

In this same connection it will be noted that the hydrant main valve seat elements and drain valve seat elements, i.e., bushing 20, seat ring 30, and tubes 22 are fastened solely to the hydrant shoe 10, so that even if the lower portion of the lower barrel section 14 should be broken, no breakage will occur.

The upper portion of the hydrant barrel 16 preferably is interiorly and exteriorly enlarged throughout a longitudinal zone or section 97 (FIGURE 1) wherein the usual hydrant nozzles 96 are located, for reasons described in greater detail in the copending application of James H. Skomp, Serial No. 854,416, now Patent No. 3,076,474. For purposes here, it is sufficient to point out that such enlargement facilitates variations in the number, spacing, and location of the nozzles 96 during the manufacture of the upper barrel section 72.

Adjacent its upper end, the upper barrel section 72 is interiorly and exteriorly reduced to define an exterior circumferential groove or recess 98 having a downwardly and outwardly inclined lower wall 100 and an upper wall that is defined by a circumferential flange 102, the outer periphery of which lies in a cylinder constituting an extension of the outer surface of the enlarged portion 97 of the upper barrel section. A top plate 104 preferably of iron, closes the upper end of the barrel 16 and is secured thereto by a plurality of circumferentially spaced bolts 106 extending downwardly through registering bolt holes in the top plate and in the barrel flange 102. The bolts 106 are engaged within threaded apertures in inwardly extending lugs 108 on a band-like segmental ring 110 that smoothly covers the circumferential groove 98 in the upper barrel section 72. The ring 110, which is generally rectangular in radial section and of greater height than width, preferably constitutes a smooth extension of the outer surface of the enlarged portion 97 of the upper barrel section 72. The ring also is formed in two or more segments to enable attachment and detachment from the bolts 106.

Hydrant top plates frequently are secured to a hydrant barrel by cap screws engaged within tapped recesses or sockets in the upper end of the barrel. Occasionally such screws become so frozen in their engagement with the barrel that a screw is twisted in two by attempts to remove or unscrew the same. In such an event, the broken-off portion of the screw must be drilled out from its tapped socket in the barrel, sometimes necessitating retapping such socket to a larger diameter, or the entire barrel must be replaced. All of the foregoing operations necessarily are time-consuming and expensive and usually take a hydrant out of service for an extended period of time, obviously a most undesirable result. By means of this invention, however, if one of the bolts 106 should be broken off, removal of the corresponding segment of

the ring 110 becomes a very simple matter. The broken-off part of the bolt can then be either drilled out of the ring segment, or the latter replaced at relatively small expense. It also will be seen that because the ring 110 covers the groove 98 not only is the latter kept free of dirt and debris, but also the appearance of the hydrant is improved.

Centrally depending from the inner side of the top plate 104 is a tubular portion or sleeve 114 which serves as a guide for snugly receiving an upper portion of the reciprocating valve stem 44. This upper portion of the stem preferably is formed by an elongated extension in the form of an elongated brass cap nut 116 having a threaded socket in its lower end engaged with the threaded upper end of the upper valve stem part 84. Rotation of the nut 116 relative to the top plate 104 is prevented by means of a longitudinal keyway in the interior guiding portion of the sleeve 114, and a key 122 in such keyway which is engaged in an opposed longitudinal keyway in the outer surface of the nut. A seal is provided between the valve stem 44 and the top plate 104 by means of a section of tubing 126, preferably made of Buna–N synthetic rubber. One end of the tubing 126 is fitted over the lower end of the sleeve 114 and secured thereto by a clamp 128, preferably of stainless steel, and the other end of the tubing is similarly secured by a stainless steel clamp 130 to the valve stem, i.e., to the lower end of the extension or nut 116. Intermediate its ends, the tubing 126 is folded back on itself within an annular recess between the extension 116 and an interiorly enlarged portion of the lower end of the sleeve 114. A tubular seal of this nature conventionally is known as a rolling diaphragm, which is very inexpensive to manufacture and to install. Likewise, the clamps 128 and 130 are relatively inexpensive and easy to install.

The extension or cap nut 116 is provided with an elongated interiorly threaded socket 134 in its upper end and received therein is the exteriorly threaded lower end of an operating shaft or screw 136. An integral flange on the screw 136 bears against the underside of the plate 104, while a reduced cylindrical portion of the screw rotatably extends through a bushed bearing aperture in the plate. A weather cap 142 has a central depending hub surrounding a socket 146 which snugly receives the outer end of the screw 136. The cap 142 is secured to the screw 136 by a pin 148 that extends through both sides of the hub and through the screw. The cap is provided with an upstanding central noncircular wrench-engageable projection 150 for turning the screw 136 to reciprocate the valve stem for opening and closing the hydrant main valve. Preferably, the cap also is provided with a peripheral skirt 152 that depends into close adjacency with the upper side of the top plate 104. Apertures in this skirt 152 register with the ends of the pin 148 to permit assembly of the parts.

The construction described provides a completely sealed assembly, which includes the top plate 104 of the hydrant and the valve stem operating mechanism, that can be removed as a unit from the barrel 16 without disassembly of the operating mechanism. Thus, by unscrewing and removing the bolts 106, the top plate 104 can be rotated to unscrew the stem extension 116 from the remainder of the valve stem 44. Thereupon, the top plate, together with the stem operating mechanism can be removed from the hydrant barrel 116 without disturbing in the least the seal effected by the diaphragm 126. Thereafter an appropriate wrench (not shown) can be applied to the upper end of the upper stem part 84 to rotate the entire stem 44. Such rotation, because the stem 44 is secured to the plate 50 by the pin 46 and the slide valves 52 fit in the seat ring grooves 42, will unscrew the seat ring 30 from the bushing 20. The stem 44 can then be pulled up out of the barrel 16 and will carry the seat ring 30 with it, so that the ring can be repaired or replaced with another.

It thus will be seen that the objects of this invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiment has been shown and described only for the purpose of illustrating the principles of this invention and is subject to extensive change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

We claim:

1. In a fire hydrant the combination comprising: a hydrant shoe having an upwardly-opening mouth provided with a smooth interior surface; a bushing lining said mouth and having a smooth exterior surface opposed to said interior surface; drain tubes snugly fitting pairs of aligned radial apertures in said shoe and bushing for retaining the latter in the former; means defining circumferential grooves between the opposed surfaces of said shoe and said bushing, one above and one below said drain tubes; a resilient pressure-deformable sealing ring in each of said grooves and engaged with the bottom thereof and with the corresponding one of said opposed surfaces to form a seal between said bushing and shoe; a valve seat ring threadedly engaged within said bushing and having on its inner end a downwardly facing valve seat, said ring also having a radial drain valve port; means defining a circumferential groove between the opposed surfaces of said bushing and ring and providing communication between said port and said tubes; a reciprocating valve stem carrying a valve washer for seating and unseating cooperation with said seat; slide valve means carried by said stem for cooperation with the inner end of said port to open the latter when said washer is seated on said seat and close said port when said washer is unseated; and noncircular interfitting means carried by said stem and ring for restraining relative rotation therebetween.

2. The structure defined in claim 1 including a pair of circumferential resilient pressure-deformable sealing means between the opposed surfaces of the bushing and the ring, one above and one below the groove.

3. The structure defined in claim 1 including a plane inner surface portion on the ring about the port; means defining a circular groove in said surface surrounding said port; and an O-ring in said groove for sealing engagement with the slide valve means.

4. The structure defined in claim 1 in which the interfitting means includes a rib formed by the slide valve means fitting in a longitudinal inner groove in the ring.

5. The structure defined in claim 1 in which the resilient pressure-deformable sealing rings are carried in exterior circumferential grooves in the bushing and engaged with the opposed surface of the shoe, the rim of the mouth of said shoe having a chamfered edge to facilitate assembly of said bushing in said shoe without damaging said sealing rings.

6. In a fire hydrant the combination comprising: a hydrant shoe having an upwardly opening mouth; a bushing lining and secured within said mouth and having upper interior threads, a lower smooth-walled interior cylindrical portion of a diameter less than the crest diameter of said threads, a downwardly and inwardly inclined upwardly-facing annular shoulder at the upper end of said smooth-walled portion, and an interior circumferential drain groove provided with a chamfered lower edge; drain tubes snugly fitting pairs of aligned radial apertures in said shoe and bushing, the inner ends of said tubes not projecting appreciably beyond the bottom of said drain groove; a valve seat ring threadedly engaged with said bushing threads and having a radial drain valve port registering with said drain groove, a downwardly-facing valve seat on its inner end, and a pair of resilient pressure-deformable sealing rings carried in exterior circumferential grooves, and engaged with the opposed smooth-walled portion of said bushing, one above and one below said

drain groove; a reciprocating valve stem carrying a valve washer for seating and unseating cooperation with said seat; and slide valve means carried by said stem for cooperation with the inner end of said port to open the latter when said washer is seated and close said port when said washer is unseated.

7. The structure defined in claim 6 wherein the slide valve means includes rib-like means fitting in a longitudinal inner groove in the seat ring and fixed against rotation to the stem, whereby rotation of the latter can screw and unscrew the seat ring into or out of the bushing.

8. The structure defined in claim 6 including a plane inner surface on the seat ring about the port, means defining a circular groove in said surface surrounding said port; and an O-ring in said groove sealingly engaged with the slide valve means.

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ISADOR WEILL, *Primary Examiner.*