United States Patent

[11] 3,532,123

[72] Inventor **Robert C. Anthony**
North Oaks, St. Paul, Minnesota

[21] Appl. No. **762,019**
[22] Filed **Sept. 24, 1968**
[45] Patented **Oct. 6, 1970**
[73] Assignee **Union Brass and Metal**
a corporation of Minnesota

[54] **FLUID METERING AND MIXING DEVICE**
10 Claims, 17 Drawing Figs.

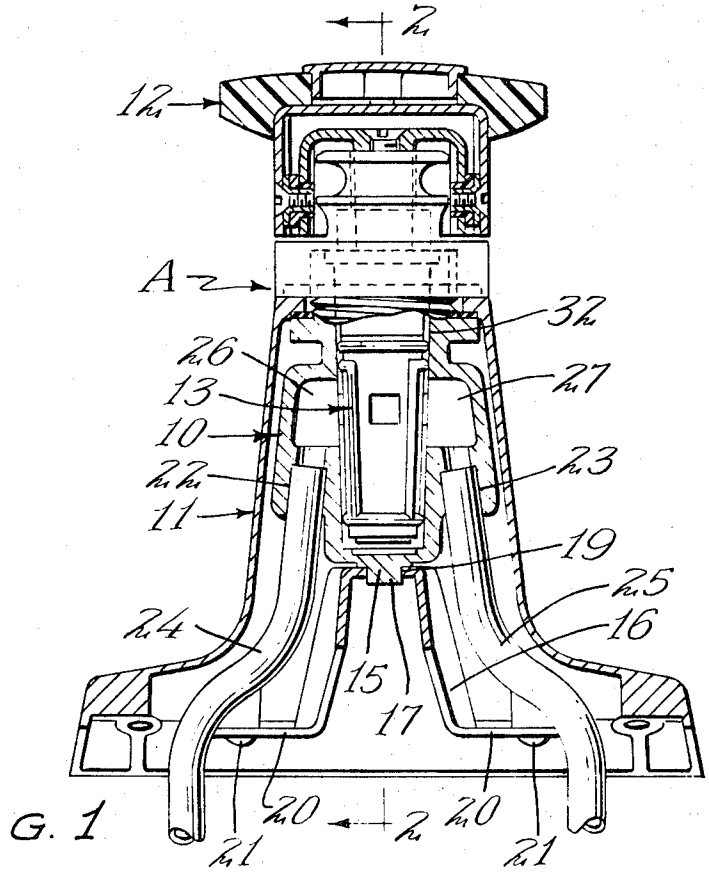
[52] **U.S. Cl.** **137/636.2,** 251/172, 137/454.6, 137/636.3
[51] **Int. Cl.** **F16k 11/10**
[50] **Field of Search** 137/636.4, 636.3, 636.2, 636.1, 636, 602, 607, 609, 454.6; 251/309

[56] **References Cited**
UNITED STATES PATENTS

3,333,812	8/1967	Mueller	251/309X
3,342,214	9/1967	Panerai	137/636.4
3,351,095	11/1967	Harvey	137/636.4X
3,387,631	6/1968	Pecis	137/630.15X
3,456,677	7/1969	Mongerson	137/636.4X

Primary Examiner—Clarence R. Gordon
Attorney—Robert M. Dunning

ABSTRACT: A fluid metering and mixing device is operated by pivotal movement of a single handle. The handle is connected to a valve plunger which is slidably and rotatably supported in a sleeve. The sleeve separates the valve plunger from the housing which includes hot and cold inlet chambers. The sleeve is coated inside and with a resilient covering material which seals both against the housing and the valve plunger. The arrangement is such that the effectiveness of the seal increases as the inlet water pressure increases.



G. 1

Patented Oct. 6, 1970 3,532,123

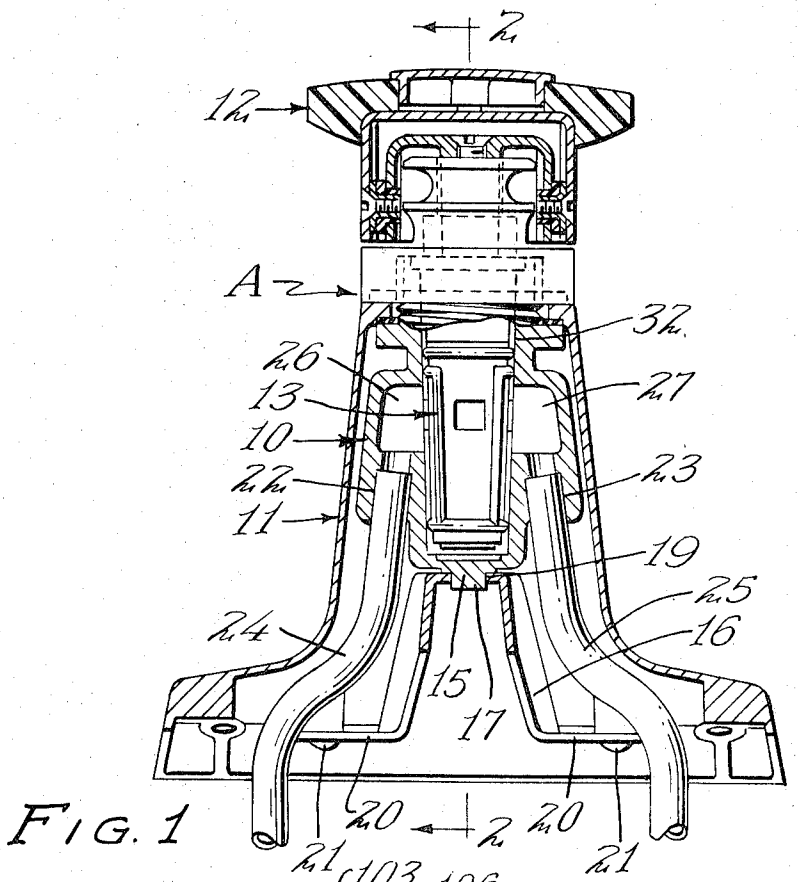


FIG. 1

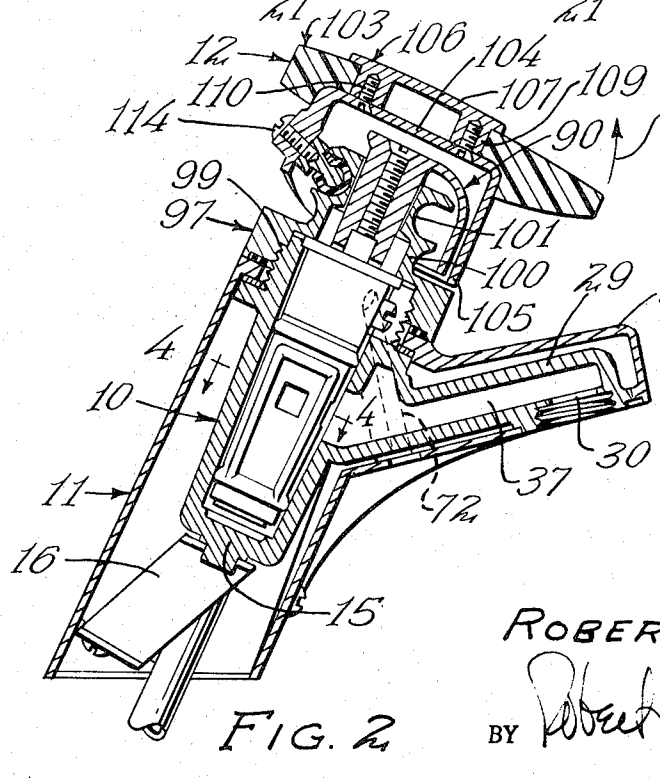


FIG. 2

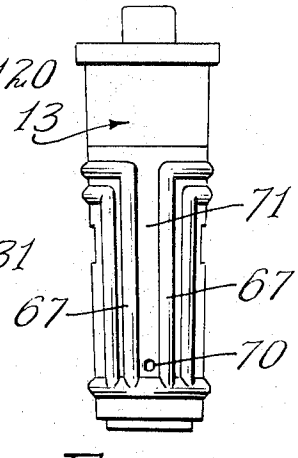


FIG. 3

INVENTOR
ROBERT C. ANTHONY
BY Robert M. Dunning
ATTORNEY

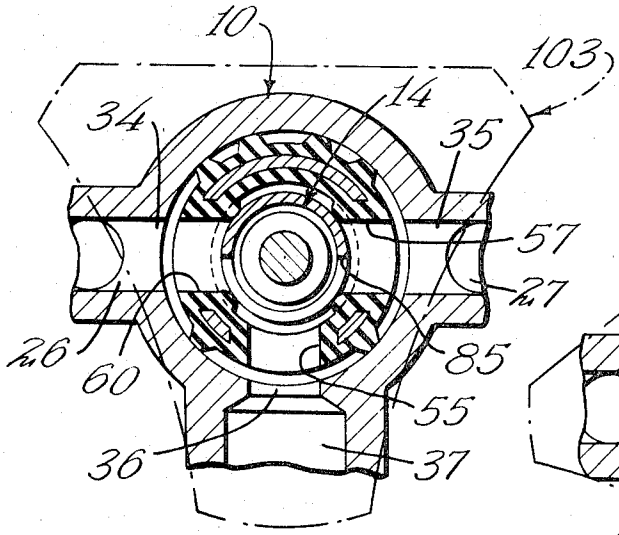


FIG. 4

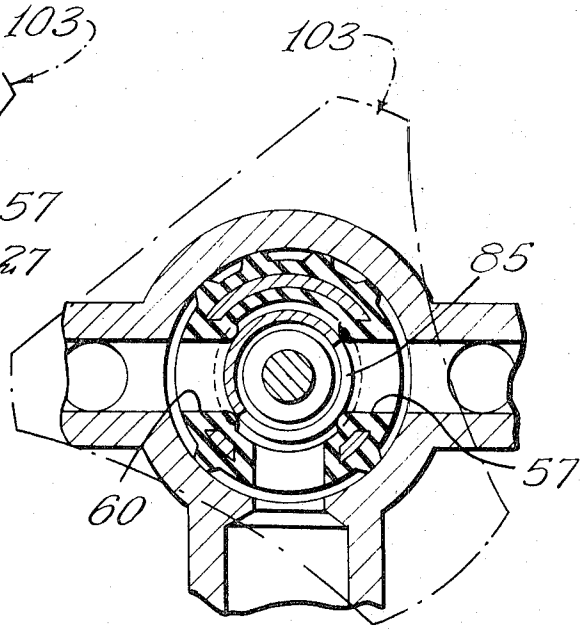


FIG. 5

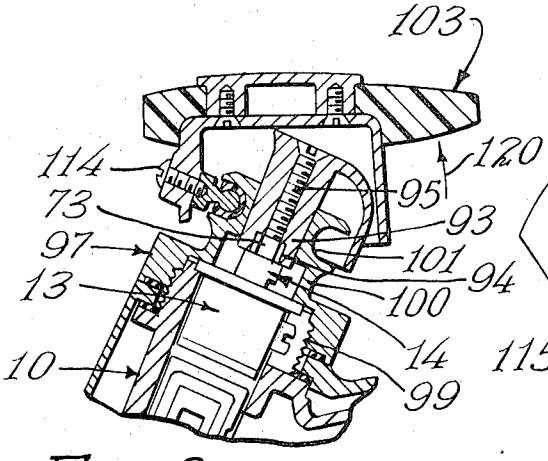


FIG. 6

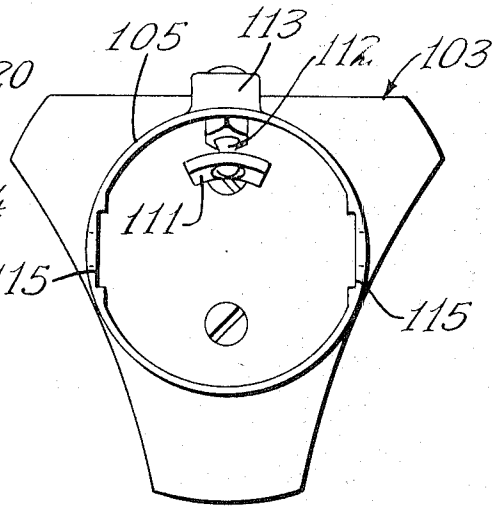


FIG. 7

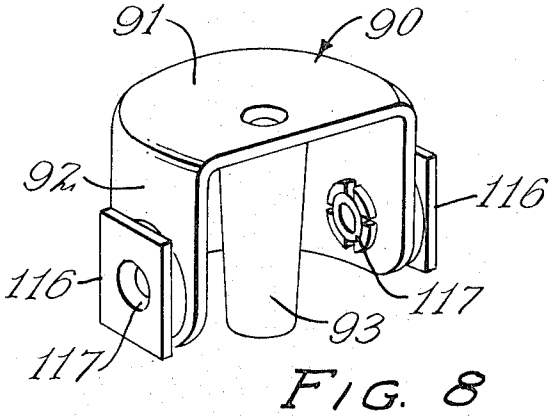


FIG. 8

INVENTOR
ROBERT C. ANTHONY
BY Robert M. Dunning
ATTORNEY

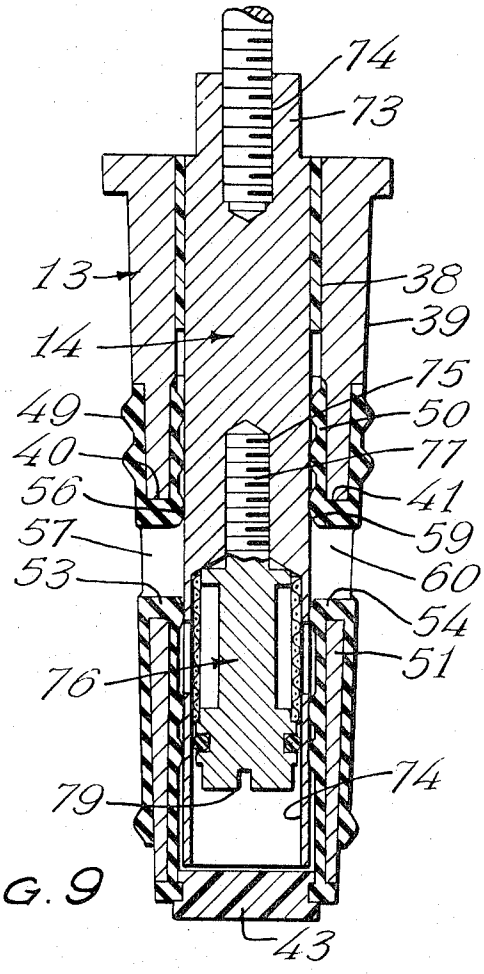


FIG. 9

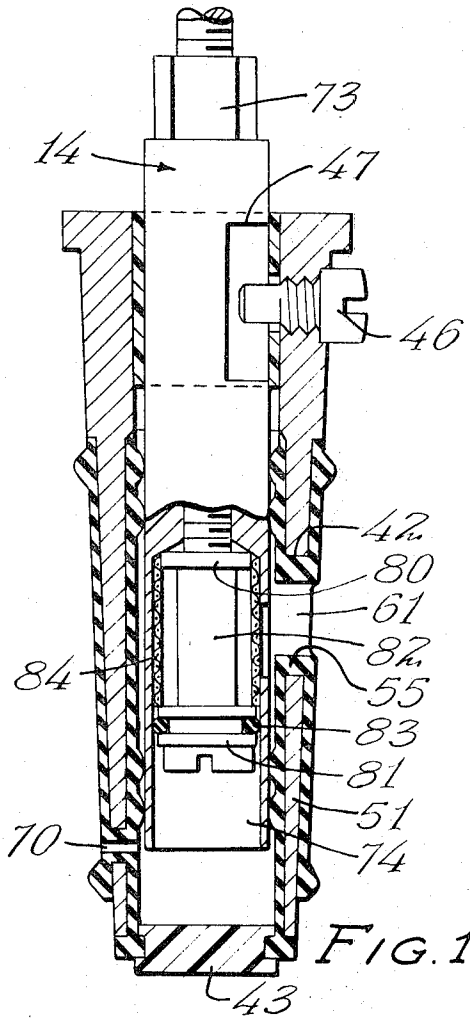


FIG. 10

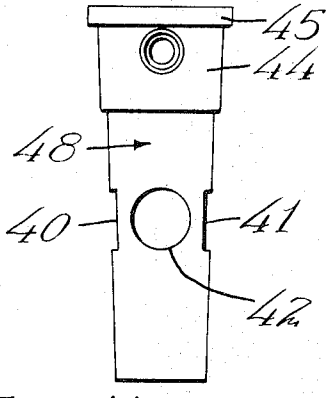


FIG. 11

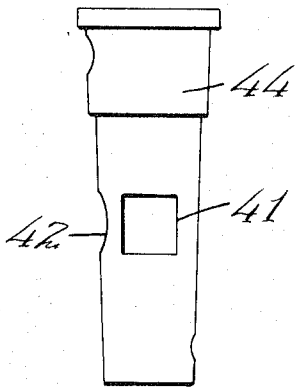


FIG. 12

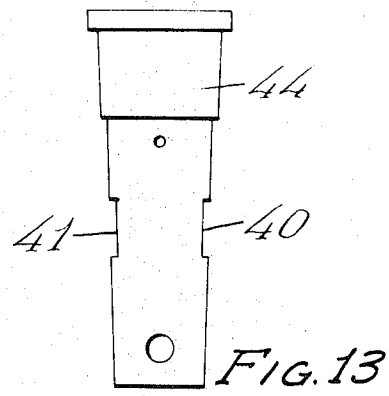


FIG. 13

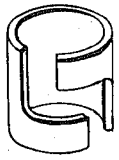


FIG. 14

INVENTOR
ROBERT C. ANTHONY
BY Robert M. Dunning
ATTORNEY

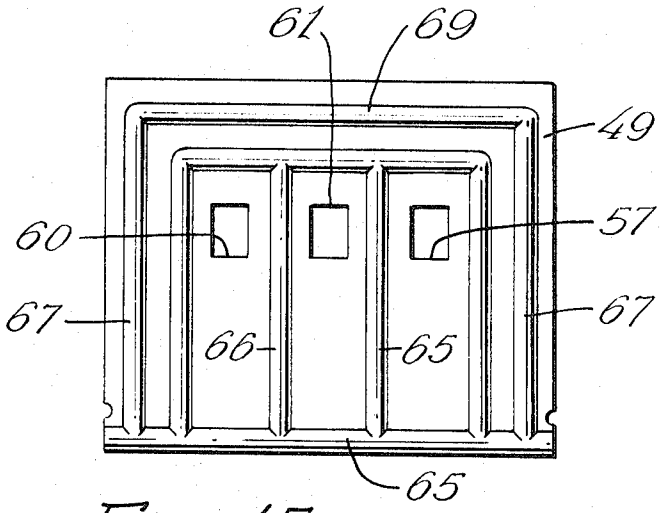


FIG. 15

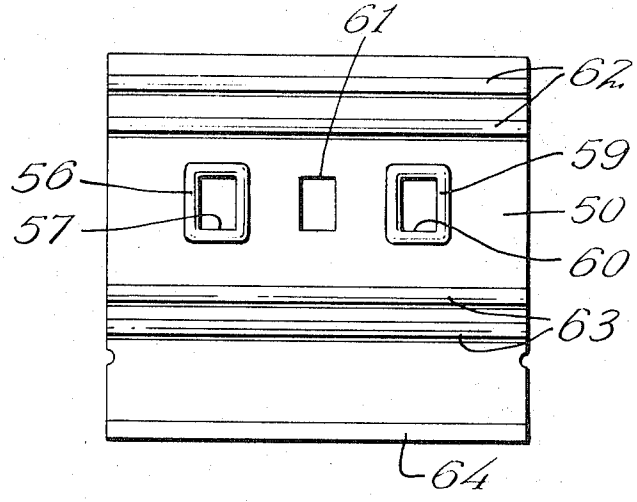


FIG. 16

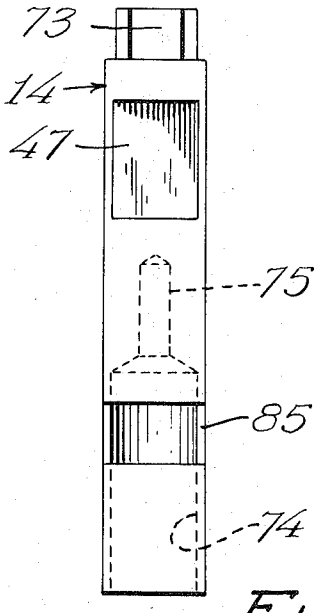


FIG. 17

INVENTOR
ROBERT C. ANTHONY
BY Robert M. Dunning
ATTORNEY

FLUID METERING AND MIXING DEVICE

This invention relates to an improvement in fluid metering and mixing device normally used to supply potable water at a desired temperature and volume to a plumbing fixture or other vessel. The fact that this is accomplished by the movement of a single member is incidental, but is essential to the invention.

As normally installed, the present device is connected to two separate water supply lines or pipes, one line having cold water available and the second having hot water available. These two lines deliver water at approximately the same pressure and in sufficient volume for the use intended. Since the water pressure will vary greatly from installation to installation, one of the objects of this invention is to provide a device which is so designed and constructed that the force necessary to seal off the supplied fluid will vary directly as the supply pressure of the fluid varies. The sealing pressure is provided by the pressure of the supplied fluid.

A further feature of the present invention is to provide a device whose design and construction will fully compensate for the wear of the moving part during the expected life of the device.

Another object of the present invention lies in the provision of a device whose design and construction enables the operator to seal off the hot water supply route when only cold water is to be drawn off, and to completely seal off the cold water supply route when only hot water is to be drawn off.

Still another object of this invention is to provide a device so designed and constructed that the adhering of foreign particles to the moving part interfaces.

Another object of this invention is to provide a device so designed and constructed as to allow the replacement of a compact assembly with common tools, minimal physical efforts, and with no danger of leakage or damage to the mating parts. As a result, the points of wear and deterioration may be entirely renewed in a simple manner.

An object of the present invention resides in the provision of a mixing valve including an outer housing having a tapered socket therein which is designed to accommodate a sleeve having a mating tapered outer surface and a cylindrical inner surface. A valve plunger is slidably and rotatably supported in the cylindrical socket, and means are provided for moving the plunger axially and rotatably. Axial movement of the plunger acts to turn the water supply on and off, as well as to vary the amount of water dispensed. Rotation of the plunger acts to communicate hot water, cold water, or a mixture of hot and cold water to the outlet tap.

A feature of the present invention resides in the construction of the sleeve which fits in the tapered socket of the housing and which contains the valve plunger. A portion of the length of the sleeve is coated both inside and out with a surface of rubber-like material vulcanized to the sleeve. This resilient material is contoured on its inner and outer surfaces to seal tightly against the adjoining parts. The outer surface of the sleeve is provided with external ribs encircling the hot water port, the cold water port, and the discharge port so as to form a continuous seal against the housing and to prevent the leakage of water about the sleeve and within the housing. The inner surface of the sleeve is provided with internal ribs encircling the hot and cold water ports and sealing against the valve plunger. Circular internal integral ribs which act in a manner similar to "O-rings" are also provided above and below the port area to prevent the flow of water longitudinally of the plunger. Due to the durable nature of the vulcanized rubber-like material, the material coating the sleeve is extremely resiliant to wear.

It is also an object of the present invention to provide a sleeve of the type described which includes a supporting body of brass or similar noncorrosive metal with hot and cold water ports and outlet ports which are of somewhat larger dimensions than are required to accommodate the flow of fluid. The coating of rubber-like material not only extends over the inner and outer surfaces of the sleeve, but also continues integrally through the ports. As a result of this arrangement, the resilient material forms the walls of the ports and is not rigidly supported by the metal sleeve in this area. As a result, the water pressure of the hot and cold water lines have a tendency to press the resilient material inwardly against the surface of the valve plunger, thereby increasing the effectiveness of the seal about the inlet ports. As the pressure of fluid in the inlet and outlet ports increases, the effectiveness of the seal correspondingly increases.

An added feature of the present invention resides in the provision of a valve of the type described having a valve plunger provided with a smooth outer surface which is preferably plated to discourage the collection of deposit from the hard water supply on the interfaces between the plunger and the sleeve. The structure also tends to eliminate any such material collected due to the longitudinal movement and rotary movement of the valve stem relative to the sleeve.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification.

FIG. 1 is a sectional view through the fluid measuring and mixing device, showing the general arrangement of the parts.

FIG. 2 is a sectional view through the device, the position of the section being indicated by the line 2–2 of FIG. 1.

FIG. 3 is a plan view of the sleeve which forms an important part of the device.

FIG. 4 is a cross-sectional view generally on the line 4–4 of FIG. 2, but showing the operating handle in broken line.

FIG. 5 is a view similar to FIG. 4, but showing the valve plunger in a different rotative position.

FIG. 6 is a sectional view similar to FIG. 2 but indicating the handle in a different operative position.

FIG. 7 is a bottom plan view of the handle section removed from the remainder of the device.

FIG. 8 is a portion of the valve plunger operating mechanism designed to control the movement of the valve plunger.

FIG. 9 is an enlarged sectional view of the portion of the device which is adapted to be replaced as a unit in the event it becomes necessary, the view including the valve sleeve and the valve plunger.

FIG. 10 is a view similar to FIG. 9, but showing the valve in open position.

FIG. 11 is an elevational view of the supporting portion of the valve sleeve before the resilient covering is vulcanized thereto.

FIG. 12 is a view taken at right angles to FIG. 11.

FIG. 13 is a view showing the opposite side of the sleeve from that indicated in FIG. 11.

FIG. 14 is a perspective view of the bearing washer used between the sleeve and the valve plunger.

FIG. 15 is a diagrammatic view of the outer surface of the resilient covering projected on a single plane.

FIG. 16 is a diagrammatic view of the inner surface of the inner surface of the resilient covering projected on a common plane.

FIG. 17 is an elevational view of the valve plunger.

In general, the fluid measuring and mixing device which is indicated in general by the letter A includes a cast housing or body portion 10 which is enclosed within a suitable outer decorative enclosure 11 and which is operated by an operating handle 12. A sleeve 13 is sealed within the housing 10, and a valve plunger 14 is rotatably and slidably supported within the sleeve 13 for actuation by the handle 12.

More specifically, with reference to FIGS. 1 and 2 of the drawings, the housing 10 has a closed lower end 15 which is held in alignment with the outer enclosure or shroud 11 by a bracket 16. The closed lower end of the housing is provided with a cylindrical boss or projection 17 which fits through an aperture 19 in the base portion of an inverted U-shaped bracket 16, the bracket being provided with opposed laterally extending ends 20 secured to the outer enclosure 11 by bolts

21 or other suitable means. The housing 10 is provided with a pair of diametrically opposed sockets 22 and 23 which are designed to accommodate the ends of a hot water pipe 24 and a cold water pipe 25. The pipes 24 and 25 communicate with inlet ports or chambers 26 and 27 through which the water may flow when the valve plunger is in its proper location.

As indicated in FIG. 2 of the drawings, the housing 10 includes an angularly extending outlet duct 29 which terminates in an outlet 30 through which the liquid from the mixing device may be dispensed. The outlet portion 29 of the housing is enclosed within an angularly projecting portion 31 of the outer enclosure or shroud 11. The housing 10 also provides an axial tapered socket 32 which accommodates the sleeve 13. In operation, the sleeve 13 remains in a fixed position in the socket 32, and normally the sleeve is only removed when it becomes necessary to replace the working parts of the device after its normal period of use.

As is perhaps best illustrated in FIGS. 4 and 5 of the drawings, the housing 10 has a hot water inlet passage 34, and a cold water inlet passage 35 which extend transversely through the wall of the socket 32. The housing 10 also includes a discharge port 36 which forms communication with the passage 37 leading through the outlet spout 29 to the discharge opening 30. The passages 34, 35, and 36 are normally arranged 90° apart.

The sleeve 13 is constructed as is best illustrated in FIG. 3 and FIGS. 9 through 13 of the drawings. Basically, the metal supporting portion of the sleeve 13 is provided with a cylindrical inner surface 38, and a tapered outer surface 39 designed to fit within the tapered socket 32 of the housing 10. The sleeve 13 includes a hot water inlet port 40, a cold water inlet port 41, and an outlet port 42. As indicated in FIGS. 9 and 10, the lower end of the sleeve is normally closed by a closure cap 43 of plastic or other suitable material. The metal supporting portion 48 of the sleeve 15 is provided with a slightly larger diameter tapered section 44, and the sleeve is provided at its upper end with a peripheral flange 45. A set screw 46 extends through the sleeve adjoining the upper end thereof, and extends into an arcuate notch 47 in the valve plunger 14. The rotation of the valve plunger 14 is limited by the engagement of the inner end of the said screw 46 with the ends of the arcuate notch 47.

As shown in the drawings, a layer of rubber-like resilient material 49 is provided on the outer surface of the sleeve 13, and an integral inner layer 50 is provided on the inner surface of the sleeve 13. The outer and inner coatings are integral, and are vulcanized to the surface of the supporting portion of the sleeve member 48. As may be seen in FIGS. 9, and 10 of the drawings, the hot and cold water inlets 40 and 41, of the metal supporting member 48 as well as the outlet 42, are of somewhat larger size than is required to accommodate the flow of fluid. When the inner and outer coatings of rubber-like material are vulcanized to the supporting sleeve portions 51, tubular resilient walls extend through the openings to connect the outer coating 49 with the inner coating 50. For example, rectangular sleeve like connecting portions 53 and 54 (See FIG. 9) extend through the hot and cold water ports 40 and 41, to form a resilient connection between the inner and outer coatings. As may be seen in FIG. 10 of the drawings, a similar cylindrical sleeve 55 connects the inner and outer coatings and extends through the outlet opening 42 of the supporting sleeve portion 51.

As is diagramatically illustrated in FIGS. 16 and 9, a rectangular inwardly projection rib 56 encircles the aperture 57 extending through the rectangular sleeve 53, within the aperture 40 and engages the outer surface of the valve plunger 14. Similarily, a rectangular inwardly projecting rib 59 encircles the aperture 60 extending through the inlet port 41. The inwardly projecting ribs 56 and 59 act somewhat in the manner of "O-rings" about the apertures and are designed to seal against the valve plunger 14. It is important to note that the inwardly projecting ribs 56 and 59 are inwardly of the apertures 40 and 41 through the supporting portions 51 of the sleeve. As a result, it is evident that fluid pressure in the inlet ports 26 and 27 of the housing 10 may tend to force these ribs more tightly against the valve plunger 14 than would otherwise be possible.

As is also indicated in FIG. 16 in the drawings, an outlet aperture 61 also extends through the sleeve 55 within the outlet opening 42 connecting the inner and outer layers. As indicated in FIGS. 15 and 16, the outlet opening 61 is between the inlet openings 57 and 60. In actual practice, the inlet openings 57 and 60 are diametrically opposed while the outlet opening 61 is at 90° between them.

As is also indicated in FIG. 16, the inner coating 50 is provided with two spaced sealing ribs 62 above the inlet and outlet openings, and a similar pair of ribs 63 beneath the inlet and outlet openings. An arcuately extending sealing rib 64 also extends inwardly at the bottom of the inner coating 50. The diagramatic views 15 and 16 are merely for showing the layout of the various sealing members, these FIGS. showing the substantially cylindrical coating in flat form.

The arrangement of sealing ribs on the outer coating 49 is indicated in FIG. 15 of the drawings. As will be noted, an annular rib 65 extends entirely about the surface to form a seal between the lower end of the sleeve and the housing socket. A vertically elongated rectangular sealing elements 65 and 66 encircle the inlet openings 57 and 60, the lower wall of the rectangular sealing rib being formed by the annular rib 65. A second seal encloses the rectangular sealing ribs 65 and 66 and includes a pair of outwardly projecting generally vertical ribs 67 blending into the annular rib 65 at their lower ends and connected at their upper ends by an outwardly projecting arcuate rib 69. Between the closely spaced vertical ribs 67 (See FIG. 3) an aperture 70 extends through the wall of the sleeve to communicate with the lower end of the socket within the sleeve or beneath the valve plunger 14. This arrangement is provided to prevent the entrapment of fluid beneath the valve plunger which would tend to interfere with longitudinal movement thereof.

As may be seen from FIG. 3, the space between the vertical ribs provides a channel 71 which leads to the upper end of the sleeve above the sealing area of the coating. As indicated in FIG. 2 of the drawings, a drain passage 72 is provided through the valve housing to below the outlet passage 37 to permit any water finding its way past the seals to escape to atmosphere.

The valve plunger 14 is constructed as is best illustrated in FIGS. 9, 10, and 17 of the drawings. The valve plunger comprises an elongated cylindrical rod having an upwardly extending multisided boss 73 at its upper end which is provided with an axial inwardly threaded socket 74 designed to accommodate a fastening means which will be described. The lower end of the rod 14 includes an elongated axial socket 74 which terminates in an axial threaded socket 75 of somewhat smaller internal diameter. A plug 76 is provided with an axial externally threaded shank 77 which threads into the socket 75, a screwdriver or similar tool. The plug 76 is spool shaped in form including an upper flange 80 and a lower flange 81 which are separated by a reduced diameter portion 82. A sealing ring 83 encircles a groove in the flange 81 and forms a seal with the inner surface of the axial socket 74. A cylindrical screen 84 is supported by the flanges 80 and 81, the screen 84 being designed to remove foreign particles from the water. As indicated in FIG. 17 of the drawings, the valve plunger 14 is provided with a substantially semicircular notch 85 therein which communicated with the socket 74 through the screen 84.

The flow of liquids through the mixing device is controlled by axial movement of the valve plunger 14 within the sleeve 13. When the plunger is in the position indicated in FIG. 9 of the drawings, both the hot and cold water inlets are closed off by engagement by the sealing rings 56 and 59 against the surface of the plunger. The plunger is preferably provided with a highly polished chromium plated surface in order to reduce the tendency for foreign material to adhere thereto. It will be noted that when in closed position, water under pressure may fill the rectangular areas within the rectangular sealing rings

65 and 66, externally of the sleeve 13. This pressure acts through the sleeves 53 and 54 to urge the smaller dimensioned sealing rings 56 and 59 against the surface of the plunger. The greater the pressure at the valve inlets, the greater will be the force tending to seal the sleeve against the valve plunger. FIG. 10 of the drawings shows the valve plunger in partially opened position. Obviously, the quantity of flow is proportional to the axial movement of the valve plunger.

FIG. 4 of the drawings is a sectional view through a portion of the housing, the sleeve, and the valve plunger when the valve plunger is open and in a central position. It will be noted that the notch 85 in the valve plunger communicates with the passage 57 communicating with the cold water inlet chamber 27, and with the passage 60 leading through the sleeve from the hot water chamber 26. The notch 85 also communicates with the passage 55 leading through the sleeve to the discharge passage 37. Thus a mixture of hot and cold water will flow through the outlet of the device.

As will be obvious from FIGS. 4 and 5, if the valve plunger 14 is rotated in a clockwise direction from the position shown in FIG. 4, the notch 85 will communicate with the cold water passage 57 to a lesser and lesser extent and will communicate with the hot water passage 60 to a greater and greater extent until the cold water is completely cut off. In this position, only hot water will be dispensed. As the valve plunger is moved in a counterclockwise direction toward the position indicated in FIG. 5, the notch 85 will gradually move out of communication with the hot air passage 60 and into communication with the cold water passage 57 so that when the valve plunger reaches the position shown in FIG. 5, only cold water will be dispensed.

The mechanical means for moving the valve plunger 14 both in a rotation and in an axial direction is best illustrated in FIG. 8 of the drawings. This figure shows a cap 90 which includes an end plate 91, and an arcuate depending skirt 92. An axial boss 93 extends downwardly from the end plate 91, and is designed to fit over the end portion 73 of the plunger 14. The end portion 73 is multisided to accommodate a similarily shaped socket 94 in the lower end of the boss 93, so that the cap 90 and plunger 14 rotate in unison. A bolt 95 extends downwardly through the boss 93 and is threaded into the internally threaded socket 74 of the extension 73 to hold the two parts connected. In other words, the cap 90 is connected to the upper end of the valve plunger 14 and actually forms an integral part thereof, the threaded bolt 95 acting to hold the cap from axial movement, and the engagement of the socket 94 with the extension 73 connecting the cap to the plunger for rotation in conjunction therewith.

A fitting 97 is fixedly attached to the upper end of the housing 10, the fitting including an internally threaded ring-shaped member 99 which is threaded to the upper end of the housing 10 and which is sealed with respect thereto. The fitting 97 is provided with an axially extending shank 100 which encircles the boss 93 of the cap 90. The shank 100 is provided with a peripheral groove 101 which is fixed in relation to the housing due to the fact that the fitting 97 is threaded thereto. The boss 93 is slidable with respect to the fitting 97 and is designed to move the valve plunger 14 axially or rotatably with respect thereto.

The handle which operates the valve is indicated in general by the numeral 103. While the shape of the handle may be varied within wide limits, in the particular arrangement illustrated it comprises a three-lobed body of plastic material, the particular shape being employed to simplify the turning of the operating handle and to better identify the position thereof. The handle 103 is mounted upon the end 104 of a cylindrical sleeve 105. A cap 106 having indicia on its outer exposed surface includes a cover plate 107, and a flange 109 extending downwardly therefrom, which extends through the handle 103 and into contact with the cover plate 104. Screws 110 or other similar fastening means extend upwardly through the cover plate 104 and into the flange 109 to attach the handle in place.

With reference now to FIG. 7 of the drawings, a bearing or fulcrum member 111 is mounted upon a shank 112 having a hexagonal end held against the sleeve 105 by a bolt 114 extending through a boss 113 on the outer surface of the sleeve 105, as is perhaps best illustrated in FIGS. 2 and 6 of the drawings. The bearing member 112 forms a fulcrum for pivoting the handle 103 relative to the housing 10. While the axis of the member 111 is fixed in relation to the valve housing, the bearing member 111 may rotate about the axis of the housing, due to its engagement in the circular groove 101.

The sleeve 105 of the handle 103 is pivotally connected to the cap 90 which is shown in FIG. 8 of the drawings. The sleeve 105 is provided with diametrically opposed axial grooves 115 (See FIG. 7) designed to accommodate rectangular plates 116 which are pivotally connected to opposite sides of the cap along axially aligned pivots 117. As is indicated in FIG. 8 of the drawings, approximately one third of the cap 90 is cut away along a plane parallel to the axis of the cap so that the cap may straddle the pivotal connection between the bearing member 111 and the groove 101.

When the handle 103 is in the position indicated in FIG. 2 of the drawings, the valve plunger 14 is in its depressed position, and the valve is closed. When the handle is swung upwardly in the direction of the arrow 120 in FIGS. 2 and 6 of the drawings, the bearing member 111 engages in the fixed groove 101 resulting in axial movement of the cap 90 due to its pivotal connection to the handle sleeve 105. Thus, the movement of the handle from the position shown in FIG. 2 to the position shown in FIG. 6 causes the valve plunger 14 to reciprocate upwardly, opening the valve. Rotation of the handle 103 in a clockwise direction from the position shown in FIG. 4 increases the proportion of hot water relative to the cold water. Rotation of the handle in the opposite direction increases the proportion of cold water with respect to the hot. Thus operation of the single handle 103, first by tilting the same, to open the water supply and then by rotating the same to adjust the water supply causes the valve to accomplish its desired mixing and proportioning function.

It is of importance to note that while a fairly complete description has been made of the operating mechanism, and while this mechanism in itself is considered of importance, one of the most important features of the present invention lies in the manner in which the sleeve 13 and the valve plunger 14 cooperates. Not only does the exterior coating of flexible resilient material on the sleeve seal effectively against the socket of the housing into which it is inserted, but also the coating on the inner surface of the sleeve effectively seals against the highly polished valve plunger to seal there against. Furthermore, the coating is so devised that the pressure of fluid entering the valve acts as a means of sealing the valve, and it is of much importance to note that the pressure which effects the seal is directly proportional to the pressure of the incoming water. The pressure of fluid against the sleeve portions of the rubber coating which extend through the inlet and outlet openings exerts a force against the valve plunger which would not be present with seals of the conventional type.

It is also of importance to note that the device includes no major parts which are subject to wear other than the bearing member 111, which is of durable construction, and the cooperable surfaces of the sleeve and valve plunger. In the event the cooperable interfaces ever become worn, the entire valve may be returned to its original effectiveness, from a practical standpoint, by merely removing the sleeve and the valve plunger, and by replacing them with a similar unit.

I have described the principles of construction and operation of my improvement in fluid mixing and metering device, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that changes may be made within the scope of the following claims without departing from the spirit of my invention.

I claim:

1. A fluid measuring and mixing device including:

a valve housing having a socket therein;

a sleeve supported in said socket;

a valve plunger slidably and rotatably supported in said sleeve;

said housing including a pair of fluid inlet chambers and an outlet chamber outwardly of said socket;

said sleeve having inlet and outlet passages therethrough; and

said sleeve including a rigid supporting body and a covering of resilient material providing a seal between said sleeve and said housing, and between said sleeve and said valve plunger.

2. The structure of claim 1 and in which said socket is tapered and said covering of resilient material within said sleeve forms a generally cylindrical socket for said valve plunger.

3. The structure of claim 1 and in which said resilient covering extends through said inlet and outlet passages and forms a lining therefor.

4. The structure of claim 3 and including an inwardly projecting frame of resilient material extending about each inlet passage.

5. The structure of claim 1 and including integral ribs of

resilient material integral with said covering and sealing against said valve plunger.

6. The structure of claim 1 and including ribs of resilient material integral with said covering and sealing against said housing.

7. The structure of claim 1 and including a series of axially spaced sealing rings extending inwardly from said sleeve against said valve plunger to seal thereagainst, said rings being integral with said resilient covering.

8. The structure of claim 1 and including a rectangular sealing ring encircling each inlet and outlet passage and extending outwardly from said sleeve to seal against said housing.

9. The structure of claim 1 and in which said valve plunger is provided with a smooth plated outer surface.

10. The structure of claim 1 and in which said sleeve has a passage therethrough from the interior to the exterior thereof below said valve plunger, and in which the exterior covering of resilient material is formed to permit fluid passing through said last named passage to escape.