March 20, 1962 R. W. WOLFE 3,025,876

WATER FLUORIDATION DEVICE

Filed Oct. 2, 1959 2 Sheets-Sheet 1

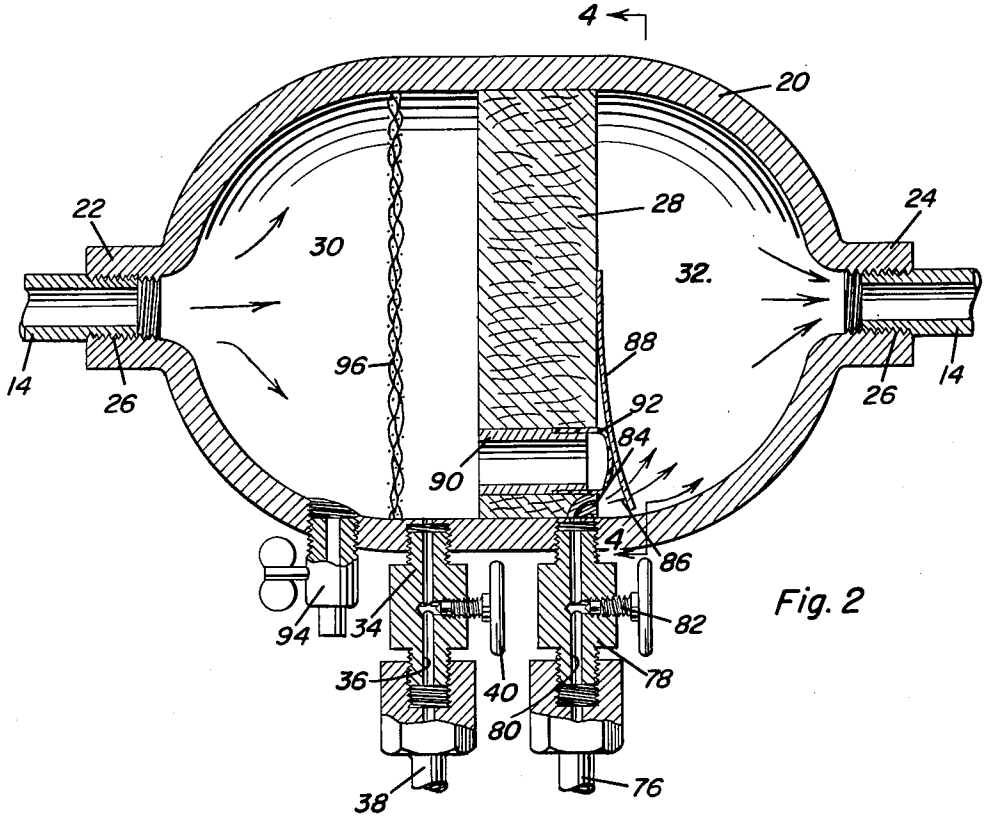


Fig. 2

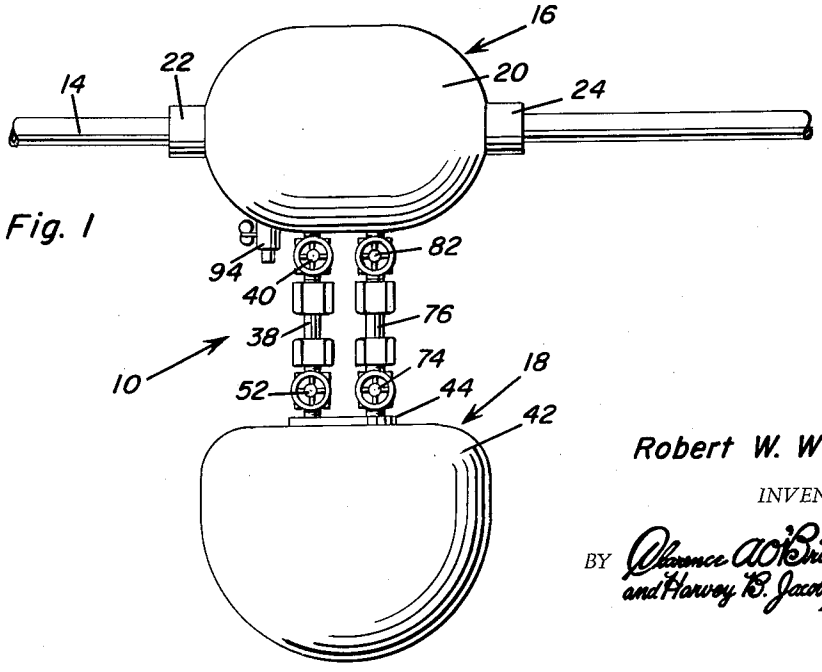


Fig. 1

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Filed Oct. 2, 1959 2 Sheets-Sheet 2

Fig. 3

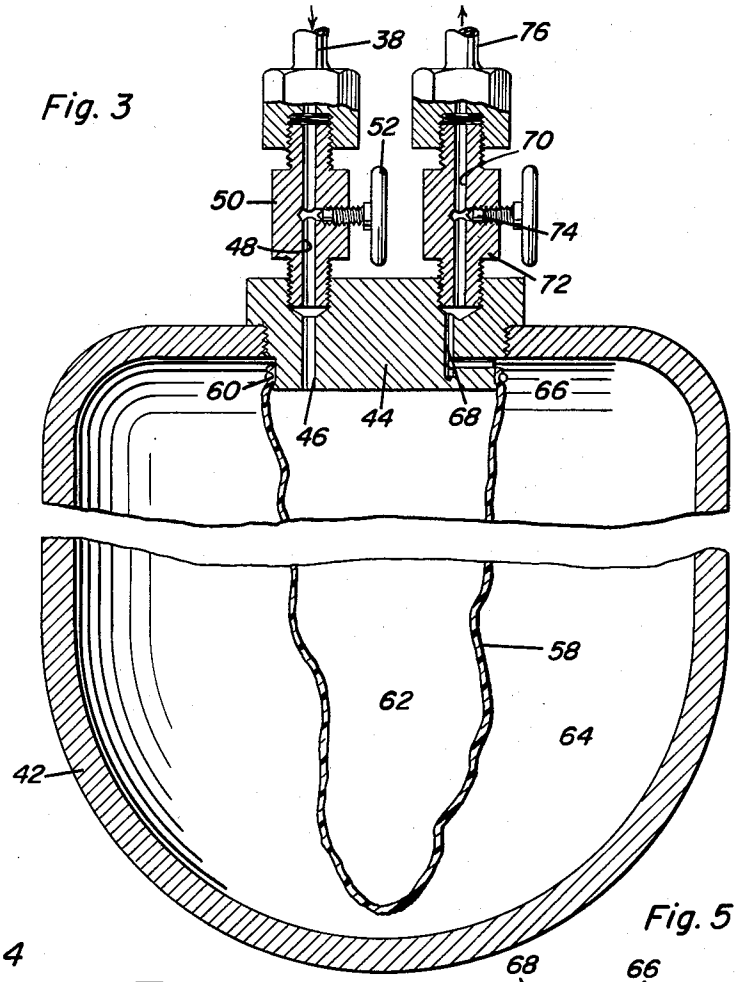


Fig. 4

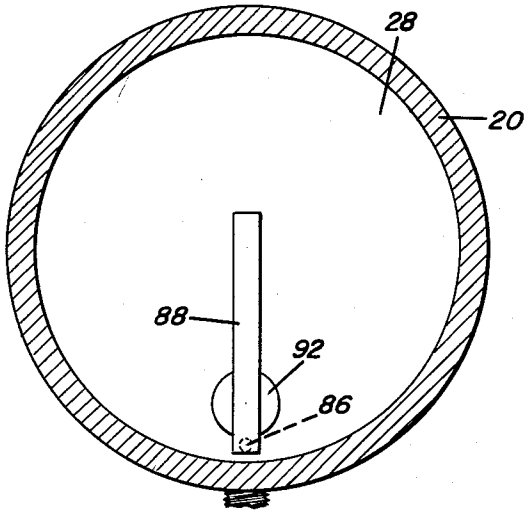
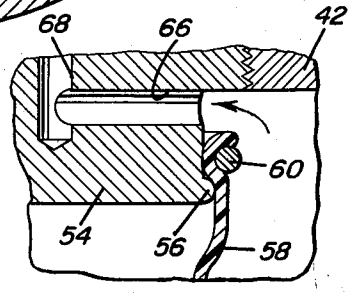


Fig. 5



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WATER FLUORIDATION DEVICE

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The present invention generally relates to a fluoridation device and more particularly a domestic water fluoridation device which provides for a constant proportion of additive or secondary fluid to the flow of the primary fluid such as water.

In prior patents, fluid proportioning devices have been disclosed which operate on the principle of introducing an obstruction in the primary fluid line in the form of an orifice, venturi tube, a Pitot tube or the like which obstruction then causes a static pressure drop in the main line. Pressure taps are situated in the main line to sense this pressure drop and tubes are attached to the pressure taps and are connected to an enclosed tank in which is contained the secondary fluid. The pressure difference in the main line is exerted upon the secondary fluid through an interposed piston or diaphragm or the like and the pressure differential causes the secondary fluid to flow into the primary line through the pressure taps on the low pressure side of the obstruction. While such devices appear to be properly set forth, these devices ignore the dynamic qualities of various fluids. Therefore, it is the primary object of the present invention to provide a fluid proportioning device that is quite accurate and maintains the proportion of secondary fluid to primary fluid constant throughout the range of operation and the device is particularly applicable to fluoridating the water of individual households for the purpose of the retardation of tooth decay with the fluorine being added in about one part per million.

The present invention incorporates the provision of a localized enlargement in the main flow line provided with a porous obstruction together with capillary tubes extending outwardly on the high and low pressure sides of the porous obstruction for causing flow of secondary fluid or fluorine from a container by providing pressure in a confined chamber with their being a flexible separator, bag or the like for separating the primary and secondary fluids so that the pressure of the primary fluid entering the tank from the capillary tube will force the secondary fluid out of the tank through the capillary tube for discharge on the low pressure side of the obstruction.

Another feature of the present invention is the provision of an arrangement in which a discharge flapper valve is provided for the secondary fluid which will close when no flow of the fluid occurs which also shuts off the secondary fluid at its extreme outlet so that no concentration can occur at zero flow from any secondary fluid remaining in the tube thereby assuring exact proportion even when the primary fluid flow is intermittent.

Yet another important feature of the present invention is to provide a fluid proportioning device which is readily mounted on a domestic water supply line and which may have a replaceable component easily removed and replaced.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a side elevation of the water fluoridation device of the present invention;

FIGURE 2 is a longitudinal, sectional view illustrating the construction of the porous obstruction and the local enlargement in a water line;

FIGURE 3 is a sectional view of the tank having the diaphragm and secondary fluid therein;

FIGURE 4 is a detailed sectional view taken substantially upon a plane passing along section line 4—4 of FIGURE 2 illustrating the construction of the flapper valve in relation to the porous obstruction; and

FIGURE 5 is an enlarged fragmental view illustrating the manner in which the secondary fluid enters the capillary tube adapter immediately adjacent the upper end of the diaphragm.

Referring now specifically to the drawings, the numeral **10** generally designates the fluid proportion or fluoridation device of the present invention which is installed in a primary fluid pipe which may conveniently be a household water line **14** which is preferably a cold water pipe on the downstream side of the hot water lead in the interest of economy. The device includes an enlarged chamber generally designated by the numeral **16** installed in the line **14** and a tank generally designated by the numeral **18** disposed in spaced relation thereto.

FIGURES 2 and 4 illustrate the details of construction of the chamber **16** which is in the form of a generally enlarged hollow housing or casing **20** having longitudinally extending nipples **22** and **24** attached to the pipe line **14** by any suitable means such as a screw threaded connection **26** or a soldered connection or the like.

A transversely extending porous member or obstruction **28** divides the housing **20** into two separate halves or chambers **30** and **32**. The chamber **30** is provided with a pressure tap or fitting **34** having a passageway **36** therein which passageway communicates with the chamber **30**. Connected to the pressure tap **34** or the fitting is a tube **38** and a needle valve **40** is provided for selectively opening and closing the passage **36**.

The pressure tank or vessel **18** is shown specifically in FIGURES 3 and 5 and includes an enlarged hollow tank or vessel **42** having a screw threaded plug **44** in the upper end thereof which plug has a passageway **46** communicating with a passageway **48** and a valve body **50** having a needle valve **52** extending into the passageway **48**. The passageway **48** is communicated with the tubes **38** for admitting pressure into the tank **42** through the passageway **46**. The plug **44** is provided with a cylindrical portion **54** extending below the top wall of the tank **42** with the cylindrical portion **54** having a peripheral rib **56** for receiving the mouth of a flexible bag **58** which may be considered a diaphragm which has the mouth end thereof secured in position by an annular ring member **60**. The diaphragm **58** separates the tank into two chambers designated by the numerals **62** and **64** with the chamber **64** containing secondary fluid or fluorine while the chamber **62** receives primary fluid or water. The balloon or bag-like diaphragm **58** is sized so as to be able to completely fill the pressure vessel without distending so that it transmits pressure from the primary to the secondary fluid but does not exert any pressure itself.

The secondary fluid in the chamber **64** communicates with a lateral passageway **66** in the cylindrical projection **54** above the upper edge of the diaphragm **58** with the passageway **66** in turn communicating with a vertical passageway **68** communicating with the passageway **70** in a valve body **72** having a needle valve **74** therein. The passageway **70** communicates with a capillary tube **76**. The tube **76** extends to and is connected to a valve body **78** having a passageway **80** therein with a needle valve **82** selectively closing the passageway and the valve body or pressure tap **78** is communicated with the downstream side of the porous member **28** which faces the chamber **32** and communicates with the same by virtue of an angled discharge member **84**. The opening in the right angled discharge member **84** is closed by a flapper valve **86** carried by the strap spring or leaf spring **88** mounted

on the porous member 28. The porous member 28 is provided with a cylindrical sleeve 90, extending therethrough which provides a passageway therethrough with the discharge end of the passageway being closed by a flexible diaphragm 92 which tests against the inner surface of the spring 88. When the primary fluid is flowing, the pressure drop results across the porous member and the pressure difference acts on the diaphragm 92 which in turn pushes against the lightly sprung flapper valve 86 thereby opening the secondary fluid inlet port and the discharge member 84. When primary fluid is not flowing, the flapper valve 86 will be sealed for closing the discharge port for the secondary fluid.

The casing or housing 20 is provided with a drain petcock 94 which allows any sediment to be drained from the casing 20. A transverse screen or filter 96 is provided on the downstream side of the petcock 94 whereby the petcock 94 will drain any sediment or foreign material collected in front of the screen 96. The screen 96 prevents the porous member from being contaminated by foreign material which might alter its flow rate-pressure drop proportionality. The valves 40 and 82 are for the purpose of shutting off the passageways when the pressure vessel or tank 18 is being replaced for replenishing the supply of secondary fluid.

In operation, flow of primary fluid such as water in the pipe 14 produces a pressure drop across the porous member 28. This pressure differential acts through the tubing and pressure vessel resulting in a flow of secondary fluid into the downstream side of the porous member where it mixes with the primary fluid. The flapper valve 86 shuts off the secondary fluid at its extreme outlet so that no concentration can occur at zero flow from any residual secondary fluid remaining in the capillary tube. This assures exact proportioning even when the primary fluid flow is excessively intermittent.

The enlargement of the primary fluid flow line 14 as formed by the casing 20 reduces the velocity through the porous member in order to keep the pressure drop in the primary line to a minimum and to assure that flow through the porous member is laminar rather than turbulent thereby producing a pressure drop which is linearly proportional to flow. With a given secondary fluid capillary tube diameter and length a constant ratio of primary to secondary flow may be set up. The magnitude of this constant ratio is readily altered by changing the length of the capillary tube in the secondary fluid circuit. However, for a given geometry, the ratio of primary to secondary flow stays constant over a wide range of flow from zero up to a known maximum valve when the primary flow changes from the laminar to the turbulent regime.

The geometry of the tubing and other structure is sized to give the recommended concentration of fluorine of approximately one part per million. For water supplies already containing some fluorine, the geometry can be sized to provide a supplementary quantity of fluorine. In view of the very weak concentration required, a reasonably sized vessel will provide a fluorine supply for a very long period of time and when it is finally exhausted, the four needle valves may be closed and the pressure vessel uncoupled and a full pressure vessel may be installed in lieu thereof.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A fluid proportioning device for introducing a secondary fluid in a substantially constant proportion into a primary fluid comprising a hollow casing interposed in the fluid flow line of the primary fluid, a transversely extending porous member dividing the casing into two compartments with the upstream compartment having a higher pressure than the downstream compartment thereby providing a pressure differential on opposite sides of the porous member, a hollow tank disposed in spaced relation to said casing, said hollow tank including a flexible non-stretchable diaphragm, the portion of the tank outwardly of the diaphragm adapted to contain secondary fluid, means communicating the high pressure compartment of the casing with the interior of the diaphragm for pressurizing the diaphragm with high pressure from the upstream compartment, means communicating the portion of the tank exteriorly of the diaphragm with the low pressure compartment of the casing for admitting secondary fluid into the downstream compartment, said last named means including flow restriction means comprising a capillary tube in communication with a port in the downstream compartment of the casing for restricting the flow of secondary fluid, and means closing the port leading into the downstream chamber from the flow restriction means for preventing residual flow of secondary fluid into the downstream compartment when there is no primary fluid flow.

2. A fluid proportioning device for introducing a secondary fluid in a substantially constant proportion into a primary fluid comprising a hollow casing interposed in the fluid flow line of the primary fluid, a transversely extending porous member dividing the casing into two compartments with the upstream compartment having a higher pressure than the downstream compartment thereby providing a pressure differential on opposite sides of the porous member, a hollow tank disposed in spaced relation to said casing, said hollow tank including a flexible non-stretchable diaphragm, the portion of the tank outwardly of the diaphragm adapted to contain secondary fluid, means communicating the high pressure compartment of the casing with the interior of the diaphragm for pressurizing the diaphragm with high pressure from the upstream compartment, means communicating the portion of the tank exteriorly of the diaphragm with the low pressure compartment of the casing for admitting secondary fluid into the downstream compartment, said last named means including flow restriction means comprising a capillary tube communicated with a port in the downstream compartment of the casing for restricting the flow of secondary fluid, and means closing the port leading into the downstream chamber from the flow restriction means for preventing residual flow of secondary fluid into the downstream compartment when there is no primary fluid flow, said port closing means including a spring urged flapper valve normally closing the inlet port for the secondary fluid, a diaphragm mounted in the porous member and engaged with the flapper valve, and means extending through the porous member for communicating the diaphragm with the high pressure compartment whereby pressure of flow of primary fluid will cause the diaphragm mounted in the porous member to move the valve away from the inlet port for the secondary fluid thereby allowing the secondary fluid to enter the low pressure compartment and to mix with the primary fluid.

3. The structure as defined in claim 2 wherein said diaphragm is in the form of a bag-like member having a size sufficient to just fill the hollow tank without being distended thereby eliminating any erroneous proportional flow caused by any resilient pressure created by the diaphragm were it distended.

4. The combination of claim 3 wherein said casing is provided with a transverse screen on the upstream side of the porous member, and a drain petcock in the casing on the upstream side of the screen for draining foreign materials from the casing before they become embedded in the porous member.

5. The combination of claim 4 wherein said tank is

detachable from the casing thereby allowing the pressure tank to be replaced without disturbing any of the structure of the porous member, casing and the like.

6. A fluid proportioning device for introducing a secondary fluid in a substantially constant proportion into a primary fluid comprising a hollow casing interposed in the fluid flow line of the primary fluid, a transversely extending porous member dividing the casing into two compartments with the upstream compartment having a higher pressure than the downstream compartment thereby providing a pressure differential on opposite sides of the porous member, a hollow tank disposed in spaced relation to said casing, said hollow tank including a flexible non-stretchable diaphragm, the portion of the tank outwardly of the diaphragm adapted to contain secondary fluid, means communicating the high pressure compartment of the casing with the interior of the diaphragm for pressurizing the diaphragm with high pressure from the upstream compartment, means communicating the portion of the tank exteriorly of the diaphragm wtih the low pressure compartment of the casing for admitting secondary fluid into the downstream compartment, said last named means including flow restriction means comprising a capillary tube communicated with a port in the downstream compartment of the casing for restricting the flow of secondary fluid into the downstream compartment.

7. A fluid proportioning device for introducing a secondary fluid in a substantially constant proportion into a primary fluid comprising a hollow casing interposed in the fluid flow line of the primary fluid, a transversely extending porous member dividing the casing into two compartments with the upstream compartment having a higher

pressure than the downstream compartment thereby providing a pressure differential on opposite sides of the porous member, a hollow tank disposed in spaced relation to said casing, said hollow tank including a flexible non-stretchable diaphragm, the portion of the tank outwardly of the diaphragm adapted to contain secondary fluid, means communicating the high pressure compartment of the casing with the interior of the diaphragm for pressurizing the diaphragm with high pressure from the upstream compartment, means communicating the portion of the tank exteriorly of the diaphragm with the low pressure compartment of the casing for admitting secondary fluid into the downstream compartment, said last named means including a flow restriction device for restricting the flow of secondary fluid during normal operation of the device and stopping flow of secondary fluid when primary fluid flow is stopped said flow restriction device is in the form of a capillary tube interconnecting the downstream compartment and the portion of the tank exteriorly of the diaphragm.

References Cited in the file of this patent

UNITED STATES PATENTS

1,883,720	Grimes	Oct. 18, 1932
1,947,586	Fletcher	Feb. 20, 1934
2,310,051	Baer	Feb. 2, 1943
2,323,618	Ottoson	July 6, 1943
2,573,299	Bast	Oct. 30, 1951

FOREIGN PATENTS

539,548	Belgium	July 30, 1955