C. H. SANFORD.

FLUID MIXING APPARATUS.

APPLICATION FILED APR. 18, 1919.

1,338,592. **Patented Apr. 27, 1920.**

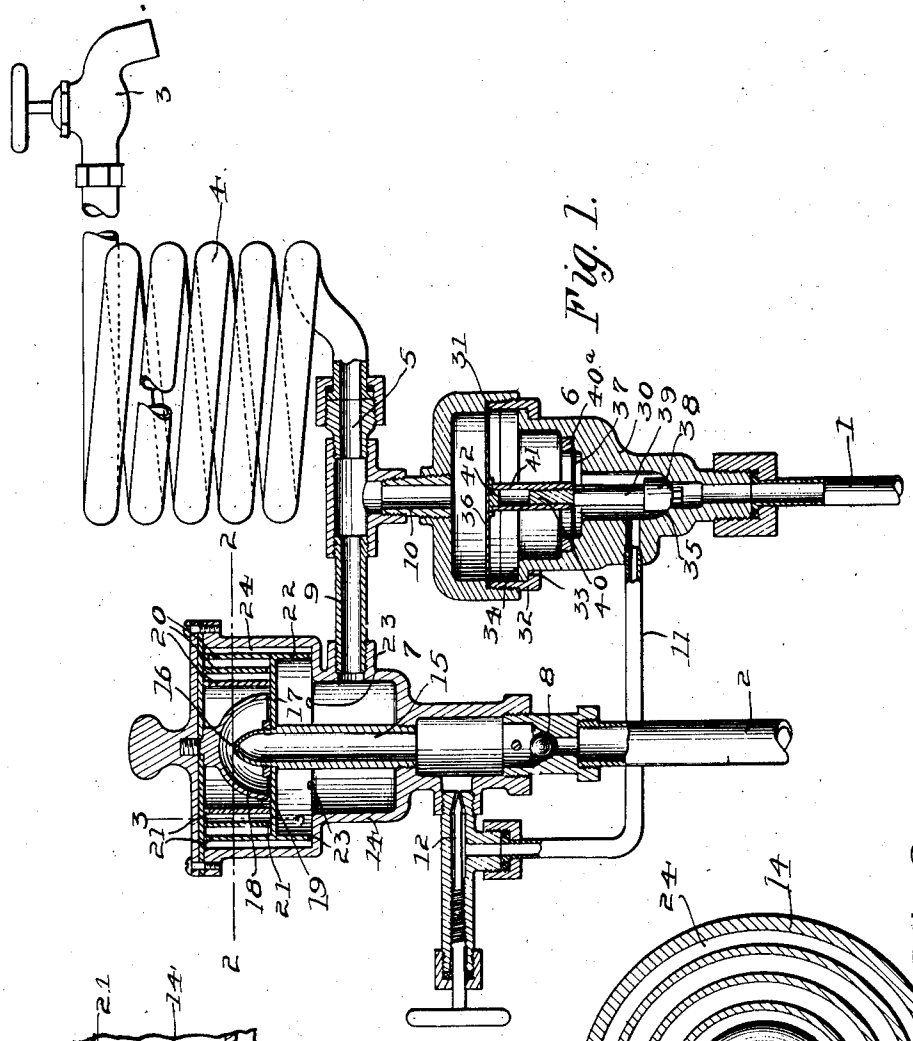


Fig. 1.

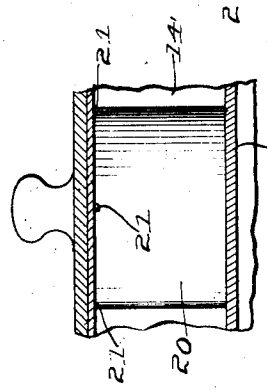


Fig. 3.

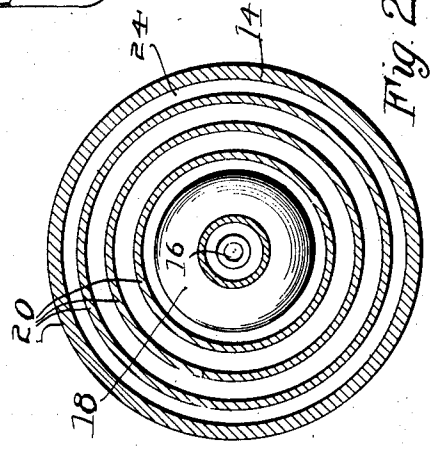


Fig. 2.

Witnesses

W. A. Thomas

T. C. Tinsley

Inventor

Crocker H. Sanford.

By Victor J. Evans

Attorney

UNITED STATES PATENT OFFICE.

CROCKER H. SANFORD, OF BALTIMORE, MARYLAND, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE OLD DOMINION SPECIALTY CO., INC., OF BALTIMORE, MARYLAND, A CORPORATION OF MARYLAND.

FLUID-MIXING APPARATUS.

1,338,592. Specification of Letters Patent. Patented Apr. 27, 1920.

Application filed April 18, 1919. Serial No. 291,078.

To all whom it may concern:

Be it known that I, CROCKER H. SANFORD, a citizen of the United States, residing at Baltimore and State of Maryland, have invented new and useful Improvements in Fluid-Mixing Apparatus, of which the following is a specification.

My present invention pertains to the commingling of gas and water.

One of the objects of the invention is the provision of an apparatus of such character that water and gas under pressure are thoroughly commingled by reason of their pressures when the eduction orifice of the apparatus is opened.

Another object of the invention is the provision of an apparatus designed especially for charging or commingling water with carbonic acid gas; the said apparatus being especially designed to form part of a soda water dispensing system and being characterized by such provisions that thorough commingling of the gas and water—*i. e.*, the impregnation of the water with gas, is brought about as a sequence to the opening of the outlet spigot of the system.

Another object is to provide an apparatus for the purpose stated in which provision is made for effectually preventing the water in the house pipe with which the apparatus is connected from being carbonated, this in order to preclude the ordinary water supply to the several spigots of a house from being changed in character or otherwise affected by reason of my apparatus being connected with the water system of the house.

To the attainment of the foregoing the invention consists, first—in my novel apparatus, second—in the peculiar and advantageous differential valve comprised in the apparatus, and third—in the simple and advantageous non-return means for preventing the gas from affecting the water contained in the pipe system of a house, as hereinafter described and definitely pointed out in my appended claims.

In the accompanying drawings which are hereby made part hereof:

Figure 1 is a vertical sectional view, diagrammatic in character, and illustrating the best practical embodiment of my invention of which I am cognizant, as properly connected to a water supply pipe and gas supply pipe and to the coil ordinarily interposed between a source of carbonated water supply and a spigot.

Fig. 2 is a horizontal section taken through the mixing or commingling unit of the apparatus in the plane indicated by the line 2—2 of Fig. 1 looking downwardly.

Fig. 3 is a vertical section taken in the plane indicated by the line 3—3 of Fig. 1 and showing the minute character of the openings in the annular walls of the mixer whereby the water and gas are retarded and are jetted while *en route* through the mixer with a view to increasing the commingling capacity of the mixer.

Similar numerals of reference designate corresponding parts in all of the views of the drawings.

My novel apparatus is designed more especially for use in conjunction with a pipe 1 designed to lead from a source of carbonic acid gas supply, a pipe 2 designed to lead from a street main or other source of water supply, a spigot 3 which may form part of a soda water fountain and a refrigerating coil 4 interposed between the eduction orifice 5 of the apparatus and the spigot 3. It will be understood, of course, that the coil 4 is not of my invention and that the spigot or any other closure means may be connected directly to the apparatus to control the orifice 5 without in any way affecting my invention.

Among other elements my novel apparatus comprises a differential valve 6 the casing of which is connected to the pipe 1, a mixer 7 the casing of which is connected to the pipe 2, a non-return valve 8 controlling communication between the pipe 2 and the mixer 7, a pipe or conduit 9, hereinafter referred to as the discharge pipe, leading from the casing of the mixer 7 to the eduction orifice of the apparatus, a pipe 10 interposed between the casing of the differential valve and the pipe 9 at an intermediate point in the length of the latter, and a pipe 11 leading from the lower chamber of the valve 6 to the mixer 7 and designed to be controlled by a valve 12 which is preferably of the needle type though it may be of any other type compatible with the purpose of my invention without departure from the scope thereof.

By comparison of Figs. 1, 2, and 3, the mixer 7 will be understood as comprising

a casing 14, a central nozzle 15 in said casing and having a reduced orifice 16, a partition 17 surrounding said nozzle, a preferably concavo-convex baffle 18 opposed to and spaced from said orifice and having its edge closely arranged to the partition 17 so as to afford between the two an infinitesimal passage 19, three more or less annular spaced walls 20 surrounding the baffle and each having one or more minute apertures or passages 21, and an annular wall 22 depending from the marginal edge of the partition 17 and having one or more minute apertures 23. The depending annular wall 22 is by preference a continuation of the wall 20 as shown, and an annular space 24 is formed between the said wall 20—22 and the adjacent portion of the casing wall. The mixer as its name imports is designed to bring about thorough commingling of the water and gas or thorough impregnation of the former with the latter, and when it is remembered that the water and gas enter the lower end of the nozzle 15 together, the efficiency of the mixer will be readily appreciated when it is stated that the column of water and gas is contracted by the orifice 16 and jetted against and spread over the concave surface of the baffle 18 which contributes materially to the commingling action. The water and gas are then carried in the form of a thin film outwardly through the space 19 which contributes to the commingling action after which the water and gas are carried in a tortuous manner through the apertures of the annular walls and between said walls and then through the annular space 24 and the apertures 23 into the chamber of the mixer that communicates with the discharge pipe 9.

Incidental to the lateral movements of the water and gas in the mixer it will be noted that the same will first be jetted through the apertures 21 of the inner wall 20 against the imperforate portion of the intermediate wall 20, then after passing downwardly will be jetted through the apertures 21 of the intermediate wall 20 against the outer wall 20, then after passing upwardly between the intermediate and outer walls 20 will be jetted through the apertures 21 of the latter against the casing wall, and then after passing downwardly in the space 24 will be discharged through the apertures 23 into the discharge chamber of the mixer. In this way the water and gas will be carried in a tortuous manner through the mixer and incidental to such passage will be considerably retarded in the presence of each other and will be thrown violently against abutments with the result that when the water and gas reach the discharge chamber of the mixer they will be commingled or mixed to a high degree of intimacy.

In the preferred embodiment of my invention the casing of the differential valve 6 is made up of a lower section 30, an upper section 31 and a joining annulus 32 which is threaded into the section 31 and is flanged at 33 to engage a complementary flange 34 on the section 30, this mode of connection being advantageous inasmuch as it permits of one of the sections being adjusted relative to the other by simply turning the annulus 32 through the medium of a spanner or any other suitable device for which the annulus is fitted. In addition to the casing in the lower portion of which is a valve seat 35, the differential valve comprises an upper comparatively large diaphragm 36 a lower relatively small diaphragm 37, and a valve body 38 carried on a stem 39 which abuts against the diaphragm 37 and has a reduced and threaded portion 40 extended through said diaphragm and engaged with an interiorly threaded tube 41 which latter receives in its upper end a protuberance 42 on the underside of the diaphragm 36. The diaphragm 36 bears upwardly at its edge against an interior abutment in the casing section 31, Fig. 1, upward movement of said diaphragm is thereby limited. It will be readily understood that when the eduction orifice 5 of the apparatus is open and the pressure above the diaphragm 36 released, the pressure of gas against the diaphragm 37 will promptly unseat the valve 38 so as to permit the passage of the gas to the mixer 7. When, however, the eduction orifice 5 of the apparatus is closed the pressure above the diaphragm 36 will overcome the stronger pressure below the diaphragm 37 by reason of the difference in size of the diaphragms with the result that the valve 38 will be promptly and effectually closed, and the gas cut off from the mixer.

In the present and preferred embodiment of my invention the diaphragm 37 is secured in position by being interposed between the valve casing and a threaded annulus 40^a secured in said casing as shown.

Interposed between the induction orifice of the mixer 7 and the source of water supply is a non-return valve 8 arranged to seat in a direction away from the mixer. By virtue of this provision the important purpose is attained of preventing any of the carbonated water moving to the water supply pipe and affecting the character of the water conducted in the several pipes of a house or building.

The general operation of my novel apparatus is as follows:

When the eduction orifice 5 is open, the predominating pressure above the diaphragm 36 of the differential valve is reduced, whereupon the gas unseats the valve 38 and is supplied when the valve 12 is open to the water entering the mixer through the induction orifice thereof. From

the said induction orifice the water and gas are conducted through the mixer, being thoroughly commingled *en route*, and from the mixer the water and gas are carried through the pipe 9 to the point of use.

The practical advantage of the differential valve 6 will be appreciated when it is stated that promptly upon closing of the eduction orifice 5 of the apparatus, the pressure above the diaphragm 36 will operate to promptly close the valve 38 and cut off the supply of gas, and this notwithstanding the pressure of the gas below the diaphragm 37 may be greater than the pressure above the diaphragm 36.

While I prefer for obvious reasons, to employ a mixer such as shown and explicitly described as part of my novel apparatus, I do not desire to be understood as confining myself to the said specific mixer, inasmuch as a mixer of any other suitable description may be employed without departure from the scope of my appended claims.

The mixing element *per se* is not claimed herein, inasmuch as it constitutes the subject of my contemporary application filed July 19, 1918, Serial No. 245,710.

Having described my invention what I claim and desire to secure by Letters Patent is:—

1. A water and gas commingling apparatus, comprising a valve casing adapted for connection with a source of gas supply, and comprising diaphragm means and a valve body, a mixer adapted for connection with a source of water supply, a conduit connected with the valve casing at the opposite side of the diaphragm means, with reference to the gas inlet and the mixer, and having a normally closed eduction orifice and means for controlling the same, and a conduit intermediate the valve casing, at the same side of the diaphragm means as the gas inlet, and the water inlet of the mixer.

2. An apparatus for commingling water and gas comprising a mixing element, a valve casing adapted for connection with a source of gas supply and comprising diaphragm means and a valve body, a conduit connected with the mixer and also connected with the valve casing, at the opposite side of the diaphragm means to the gas inlet, and having a normally closed eduction orifice and means for closing the same, a conduit intermediate the valve casing and the water inlet of the mixing element and means for controlling said conduit.

3. An apparatus for commingling water and gas comprising a valve casing adapted for connection with a source of gas supply and comprising diaphragm means and a valve body, conduit means adapted for connection with a source of water supply and connected with the valve casing at the opposite side of the diaphragm means to the gas inlet and having an eduction orifice and means for controlling the same, and a conduit intermediate the valve casing, at the gas side of the diaphragm means, and the said conduit means.

4. An apparatus for commingling water and gas comprising a valve casing adapted for connection with a source of gas supply and comprising diaphragm means and a valve body, conduit means adapted for connection with a source of water supply and connected with the valve casing, at the opposite side of the diaphragm means to the gas connection and having beyond the valve an eduction orifice and means for controlling the same, a conduit intermediate the valve casing, at the gas side of the diaphragm means, and the conduit means, and means for controlling said intermediate conduit.

5. An apparatus for commingling water and gas comprising a valve casing adapted for connection with a source of gas supply and comprising a valve body and means constructed and arranged to enable a lesser pressure at the opposite side of the valve casing to the valve body to seat the valve body against the greater gas pressure, conduit means adapted for connection with a source of water supply and connected with the valve casing at the last named side thereof and having an eduction orifice, and a conduit intermediate the gas side of the valve casing and the said conduit means.

6. An apparatus for commingling water and gas comprising a valve casing adapted for connection with a source of gas supply and comprising a valve body and means constructed and arranged to enable a lesser pressure at the opposite side of the valve casing to the valve body to seat the valve body against the greater gas pressure, conduit means adapted for connection with a source of water supply and connected with the valve casing at the last named side thereof and having an eduction orifice, a conduit intermediate the gas side of the valve casing and said conduit means, and means for controlling said conduit.

7. An apparatus for commingling water and gas comprising a valve casing adapted for connection with a source of gas supply and comprising a valve body and means constructed and arranged to enable a lesser pressure at the opposite side of the valve casing to the valve body to seat the valve body against the greater gas pressure, conduit means adapted for connection with a source of water supply and connected with the valve casing at the last named side thereof and having an eduction orifice, a conduit intermediate the gas side of the valve casing and said conduit means, and means for controlling said conduit.

8. An apparatus for commingling water and gas, comprising a mixer constituting

part of conduit means and adapted for connection with a source of water supply, a valve casing adapted for connection with a source of gas supply and comprising a valve body and differential means connected therewith, a conduit forming part of said conduit means and connected to the mixer and to the valve casing at the opposite side of the differential means to the valve body and having an eduction orifice beyond the valve casing and means for controlling said orifice, and a conduit intermediate the gas side of the valve casing and the mixer.

9. An apparatus for commingling water and gas, comprising a valve casing adapted for connection with a source of gas supply and comprising a valve body and differential means connected therewith, conduit means adapted for connection with a source of water supply and connected with the valve casing at the opposite side of the differential means to the gas inlet and having an eduction orifice beyond the valve casing and means for controlling said orifice, a conduit intermediate the gas side of the valve casing and the conduit means, and non-return means in the conduit means at a point between the source of water supply and the point at which gas is let into the water.

10. An apparatus for commingling water and gas, comprising a valve casing adapted for connection with a source of gas supply, and comprising a valve body and diaphragm means connected therewith, conduit means adapted for connection with a source of water supply and connected with the valve casing at the opposite side thereof to the gas inlet and having beyond the valve casing an eduction orifice and means for controlling the same, non-return means in the conduit means and arranged to open away from the source of water supply, and a conduit between the gas side of the valve casing and the conduit means at the opposite side of the non-return means, with reference to the source of water supply.

11. An apparatus for commingling water and gas, comprising a valve casing adapted for connection with a source of gas supply and comprising a valve body and differential diaphragms connected therewith, the smaller diaphragm being adjacent the gas inlet, a mixer, a conduit leading from the mixer and connected with the opposite side of the valve casing to the gas inlet, means for supplying water to the mixer, and a suitably controlled conduit intermediate the gas side of the valve casing and the mixer.

12. An apparatus for commingling water and gas, comprising a valve casing adapted for connection with a source of gas supply and comprising a valve body and differential diaphragms connected therewith, the smaller diaphragm being adjacent the gas inlet, a mixer, a conduit leading from the mixer and connected with the opposite side of the valve casing to the gas inlet, means for supplying water to the mixer, a suitably controlled conduit intermediate the gas side of the valve casing and the mixer, and non-return means intermediate the mixer and the source of water supply.

13. A water and gas commingling apparatus, comprising a differential valve adapted for connection with a source of gas supply, conduit means adapted for connection with a source of water supply and connected with the valve, at the opposite side of the differential means thereof to the gas inlet, and having an eduction orifice, and a conduit intermediate the gas outlet side of the valve and the conduit means.

14. A water and gas commingling apparatus, comprising a differential valve adapted for connection with a source of gas supply, conduit means adapted for connection with a source of water supply and connected with the valve, at the opposite side of the differential means thereof to the gas inlet, and having an eduction orifice, a conduit intermediate the gas outlet side of the valve and the conduit means, and means for controlling said conduit.

In testimony whereof I affix my signature.

CROCKER H. SANFORD.