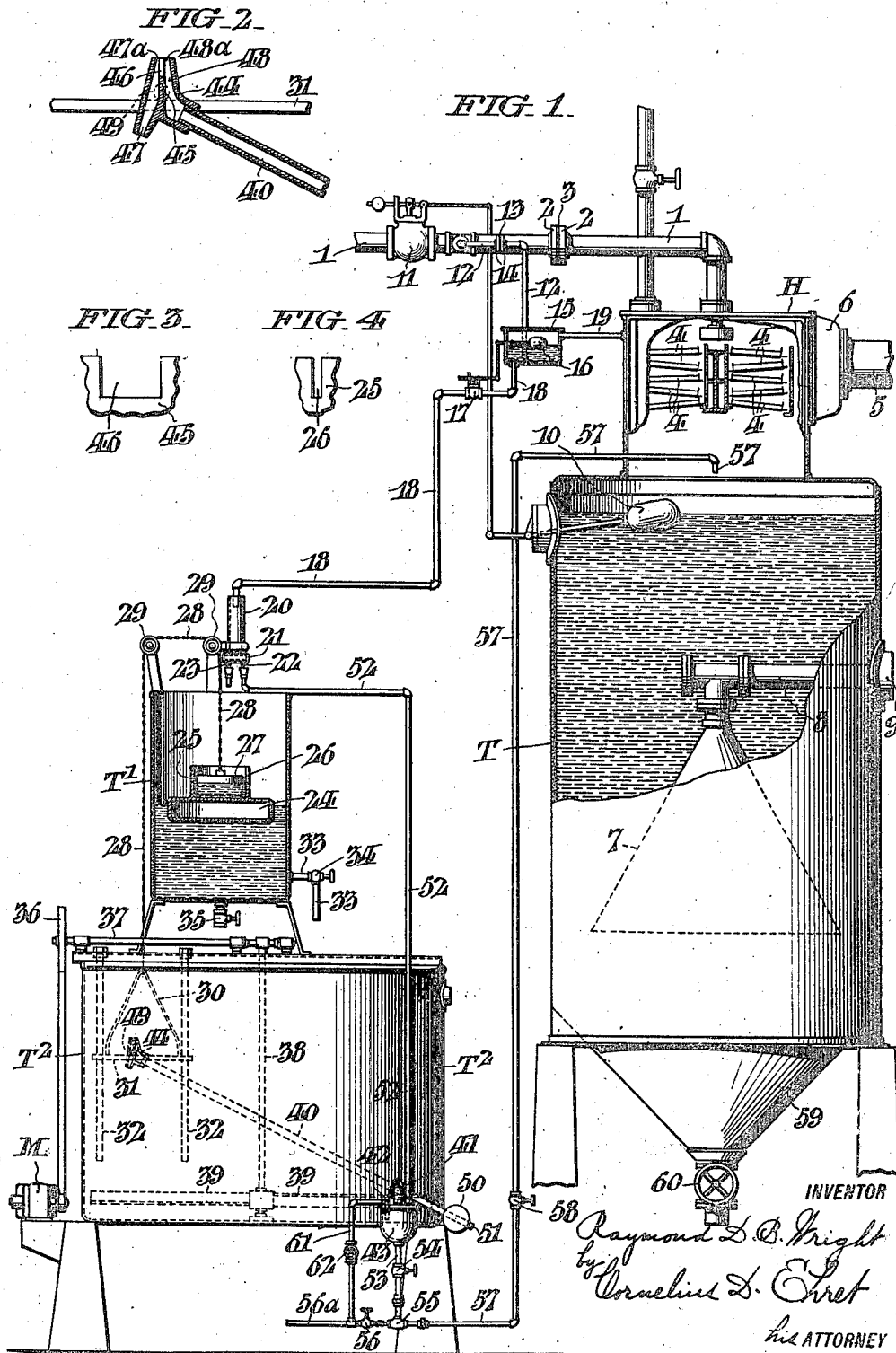


R. D. B. WRIGHT.  
 FLUID PROPORTIONING APPARATUS.  
 APPLICATION FILED MAR. 11, 1918.

1,296,150.

Patented Mar. 4, 1919.



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# UNITED STATES PATENT OFFICE.

RAYMOND D. B. WRIGHT, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO HARRISON SAFETY BOILER WORKS, OF PHILADELPHIA, PENNSYLVANIA, A FIRM COMPOSED OF JOSEPH S. LOVERING WHARTON, WILLIAM S. HALLOWELL, AND JOHN C. JONES.

## FLUID-PROPORTIONING APPARATUS.

1,296,150.

Specification of Letters Patent.

Patented Mar. 4, 1919.

Application filed March 11, 1918. Serial No. 221,874.

*To all whom it may concern:*

Be it known that I, RAYMOND D. B. WRIGHT, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Fluid-Proportioning Apparatus; of which the following is a specification.

My invention relates to a system of or apparatus for automatically proportioning the quantity or rate of flow of one fluid with respect to the quantity or rate of flow of another fluid, as for example, for proportioning a chemical-containing liquid with respect to the quantity or rate of flow of another liquid having content with which the chemical is to react; and more particularly, my invention relates to a system or apparatus of the character referred to for proportioning a chemical-containing liquid with respect to water passed through a heater and constituting the feed water for a steam boiler or the like.

My invention resides in a system or apparatus of the character referred to wherein the one liquid, as a chemical-containing liquid, is delivered through a conduit, the elevation of whose intake within said liquid is varied with accuracy and nicety equally or proportionately to variation of depth of a liquid which is proportional to the quantity or rate of flow of a liquid with respect to which the first named liquid is to be proportioned.

My invention resides also in a system and apparatus of the character referred to wherein the rate of delivery of one liquid, as a chemical-containing liquid, is promptly and with nicety varied in proportion to a second liquid, notwithstanding sudden variations in the quantity or rate of flow of said second liquid.

My invention resides in apparatus of the character hereinafter described and claimed.

For an illustration of one of the various forms my invention may take, reference is to be had to the accompanying drawing, in which:

Figure 1 is a side elevational view, partly in section, of apparatus involving my inven-

tion as applied to feed water heating and purifying apparatus.

Fig. 2 is a fragmentary view in section, on enlarged scale, of part of the structure shown in Fig. 1.

Fig. 3 is an elevational view of a notch as employed in the structure of Fig. 2.

Fig. 4 is an elevational view of a notch as employed in another part of the apparatus of Fig. 1.

Referring to the drawing, 1 is a pipe through which there is delivered under pressure one of the liquids, as water, to be employed as the feed water for a steam boiler or for any other purpose. In the pipe 1 there is interposed between the flanges 2, 2 a plate 3 having an orifice of suitable area determining the quantity of water passing therethrough to the heater H of any suitable type, here illustrated as one provided with the trays 4 to which the water is delivered from pipe 1. The water while upon the trays and in flowing from one to the other in succession comes into direct contact with steam, as exhaust steam supplied through the pipe 5 to separator 6 from which it is discharged to the interior of the heater H. As well understood in the art, the water is raised in temperature by its contact with the steam and falls into the treating tank T, within which is disposed the conical chamber 7 discharging at its upper end into the pipe 8 extending to the exterior of the tank T at 9 and communicating with the boiler feed pump, or delivering to any other suitable receptacle or device. Upon the water within the tank T rests a float 10, which through any suitable connecting means controls the valve 11 in the pipe 1. At any suitable point between the valve 11 and the orifice plate 3 is connected a pipe 12, in which is disposed a plate 13 having a smaller aperture or orifice of suitable area, the plate 13 being held between the flanges 14. The pipe 12 delivers water, operating as a control liquid, into the closed float box or vessel 15 below the water level therein. Within the box or vessel is disposed the float 16 on the end of a pivoted arm which actuates a valve 17 controlling discharge of wa-

ter from the box 15 to the pipe 18. Communicating with the interior of the float box 15 above the level of water therein is a pipe 19 which at its other end communicates with the interior of the heater H, whereby there exists in the box 15 above the water therein a pressure equal to the pressure within the heater H.

The pipe 18 delivers the control water into the receptacle 20 having at its bottom the chamber 21 having the two outlets 22 and 23 of equal areas, or having areas bearing any suitable proportion to each other. The receptacle 20 is supported upon tank T<sup>1</sup>, within which is disposed the float 24 carrying on its upper side a receptacle 25 having an orifice or notch 26 through which water delivered from outlet 23 into receptacle 25 overflows into the tank T<sup>1</sup>. Floating upon the water in the receptacle 25 is a float 27 to which is attached a cord or chain 28 passing over the idler pulleys 29 supported upon the tank T<sup>1</sup> and connected at its other end to the bail or member 30 carrying the horizontal rod or bar 31 movable vertically upon the guides 32 carried by and extending into the tank T<sup>2</sup> which contains the liquid, as chemical-containing liquid, which is to be proportioned with respect to the water flowing through pipe 1 into the heater H and tank T. At suitable height above the bottom of the tank T<sup>1</sup> is provided a draw-off pipe 33 controlled by valve 34, whereby the water within the tank T<sup>1</sup> may be drawn off, preferably into the tank T<sup>2</sup>. In the bottom of the tank T<sup>1</sup> is provided a draw-off controlled by valve 35 for completely emptying or cleaning the tank T<sup>1</sup>.

The motor M, as an electric motor, is belted to the wheel 36 upon the shaft 37 journaled upon the top of the tank T<sup>2</sup>, the shaft 37 driving through suitable gearing the vertical shaft 38 to rotate the paddles or stirring means 39 within the tank T<sup>2</sup>, to cause mixture or solution of the chemical in the water contained in tank T<sup>2</sup> and for keeping it constantly in agitation so that from a chemical standpoint it shall be of uniform strength or concentration.

Within the liquid in the tank T<sup>2</sup> is disposed the chemical discharging pipe or conduit 40, pivoted at 41 and discharging through the stationary pipe 42 into the funnel or receptacle 43. At its upper end the pipe 40 is secured to or communicates with a head 44 partially submerged in the liquid in tank T<sup>2</sup> and within which is disposed the transverse diaphragm or partition 45 having an orifice or notch 46, to one side of which liquid in the tank T<sup>2</sup> rises through the passage 47, overflowing through the notch 46 into the passage 48, from which latter it flows into pipe 40 and is discharged through pipe 42 into receptacle 43. The passages 47 and 48 are preferably open at their upper

ends at 47<sup>a</sup> and 48<sup>a</sup>. By this structure liquid from tank T<sup>2</sup> is admitted at a point below its surface into the head 44, whereby ripples or waves upon the surface of the liquid due to paddles 39 or other causes will not cause irregular or undesired variation of head upon the notch 46.

Upon the pipe 40 or the head 44 is a roller 49 rolling upon the aforementioned bar 31. The pipe 40 is counterweighted by the member 50 movable to any desired position upon a lever 51 having suitable attachment to the pipe 40 through a wall of the tank T<sup>2</sup>.

The discharge outlet 22 from chamber 21 delivers into the pipe 52, which may discharge into receptacle 43, which latter discharges through pipe 53 controlled by valve 54 into the suction or intake of the injector or ejector 55, to which motive fluid, as steam or hot or cold water, preferably having no content reacting with the chemical in tank T<sup>2</sup>, is delivered through pipe 56<sup>a</sup> controlled by valve 56. The ejector 55 discharges both the motive fluid and the liquid from receptacle 43 through the pipe 57 controlled by valve 58 into the heater H or tank T into the water in the latter.

The chemical in the water discharged from pipe 57 into the tank T reacts with content of the water entering heater H from pipe 1, and the precipitate formed sedimentizes and collects in the sludge cone 59, from which it may be drawn off from time to time through the valve 60. The clarified and treated water passes upwardly through the cone 7 and through pipe 8 and is delivered to any desired device or receptacle, as for example, a boiler feed pump.

Some steam enters the box 15 from heater H through the pressure equalizing pipe 19 and is condensed therein and added to the water discharged from the box 15 through the pipe 18. In order that this condensation shall be a minimum, and so affect to a minimum the proportionality between the quantity of water flowing through the pipe 18 to the quantity flowing through the pipe 1 into the heater H, it is desirable that as little cold water as possible shall come into contact in box 15 with steam entering through the pipe 19. This is accomplished by having the discharge outlet of the pipe 12 substantially below the surface of the working level of the water in the box 15, that is, below an upper layer of higher temperature which induces less condensation.

The water flowing through the orifice in plate 3 is dependent upon the difference in pressures on opposite sides of that plate. The pressure to the right of the plate 3 is affected by the back pressure which may exist in the heater H. In order that the pressure on the right side of the orifice plate 13 shall be the same as that on the right side of orifice plate 3, the connection 19 between box

15 and the heater H is provided. This insures that both orifice plates are subjected to like pressures on their opposite sides and insures strict proportionality between the quantities of water flowing through them.

The operation is as follows:

As water is drawn off through the pipe 8, water is admitted through pipe 1 into the heater H through the valve 11 controlled by float 10 whose position is dependent upon the quantity of water in the tank T or the rate of discharge of water through pipe 8.

The pressure or head of the water in the pipe 1 is the same upon both apertured plates 3 and 13, and in consequence the quantity of water passing through orificed plate 13 is any suitable or desired proportion of the quantity of the water passing through the orifice in the plate 3 to the heater H and tank T, the proportion depending upon the relative areas of the orifices in plates 13 and 3.

There accordingly flows into the float box 15 water whose quantity is a predetermined proportion of that flowing into the heater H and tank T. And the water flowing from box 15 through pipe 18 into receptacle 20 and chamber 21 bears a like proportion to that flowing into the heater and treating tank. A definite proportion of the water received in chamber 21 flows into the receptacle 25 upon float 24, this quantity of water again being a definite proportion of the water flowing into the treating tank T through apertured plate 3.

If the rate of consumption of water from pipe 8 remains substantially constant, the rate of flow of water through apertured plate 3 into the tank T remains substantially constant, and there is a substantially constant head of water in receptacle 25 upon notch 26, the water overflowing through the notch 26 into the tank T<sup>1</sup>, in which the depth of water increases at a practically constant rate, it being remembered that valves 34 and 35 are normally closed. As a result, therefore, the float 27 remains at a substantially constant height with respect to the rising level of the water in tank T<sup>1</sup> on which rests the float 24, and since the latter rises at substantially constant rate, the bar 31 descends at substantially constant rate, with the result that there is substantially constant head upon the notch 46 in the partition or diaphragm 45 in the head 44 resulting in a substantially constant discharge of chemical bearing liquid into the receptacle 43, with substantially constant rate of discharge of chemical bearing liquid by ejector 55 into the water tank T. As a result, the chemical of a given strength or concentration is delivered at substantially constant rate into the tank T and therefore in direct proportion to the amount of water flowing into and drawn off from the tank T.

The notches 26 and 46 are of similar shape, in this case rectangular, and of equal heights. But their widths are so proportioned that the quantities of water flowing through them at any given head, bear the same proportion to each other as the volumes of water per unit of depth in tanks T<sup>1</sup> and T<sup>2</sup>. In other words, both tanks T<sup>1</sup> and T<sup>2</sup> being cylindrical, for example, but being of different diameters, for each unit of depth of water in tank T<sup>1</sup> there is an amount of water which bears the same relation to the amount of water in tank T<sup>2</sup> for each unit of depth that the horizontal cross sectional area of the tank T<sup>1</sup> bears to the horizontal cross sectional area of the tank T<sup>2</sup>. This proportion is the same as the proportion between the widths of notches 26 and 46, whereby for each unit volume of water overflowing through notch 26 into tank T<sup>1</sup> there is the same increase in depth of water in tank T<sup>1</sup> as there is decrease in depth of liquid in tank T<sup>2</sup> because of overflow of liquid through notch 46 into pipe 40.

In case there should be a sudden fluctuation or change in the rate of flow of water through apertured plate 3 into the heater H and tank T, there will be a similarly sudden or proportional variation of flow of water through the apertured plate 13 into the float box 15 and chamber 21, with the result that there will be a sudden fluctuation in the depth of the water in the receptacle 25 which will cause a corresponding sudden change in height of float 27, before a corresponding effect is produced in the depth of the water in the tank T<sup>1</sup>. In consequence of this quick or sudden movement of the float 27 the submergence of the head 44 in the liquid in tank T<sup>2</sup> is also proportionately and suddenly changed, so that as a net result the liquid discharged into the receptacle 43 and finally into the tank T occurs promptly in response to change in level in tank T, but nevertheless the same proportion between the amount of water delivered into the tank T from pipe 1 and the liquid delivered through pipe 57 remains the same.

Accordingly the compound float structure in tank T<sup>1</sup> insures that the rate of flow of liquid through pipe 40 maintains a constant relation with respect to the rate of flow of water through pipe 18, and therefore to the rate of flow of water through pipe 1 into the heater H and tank T, both when the rate of flow of water from pipe 1 into tank T is constant and when it varies either slowly or suddenly.

Notwithstanding the arcuate movement of the head 44 upon pipe 40, the vertical component of its movement is in virtue of the rod 31 and roller 49 always equal or proportional to the vertical movement of the float 27, whereby direct proportionality between the flow of liquid through pipe 40 and the

flow of water through pipe 1 into tank T is accurately maintained.

In case steam is admitted through valve 56 as the motive fluid for the ejector 55, the admixture of the condensed steam with the water in the tank T does not disturb the proportionality between the chemical introduced into tank T and the amount of raw water requiring treatment introduced into that tank, inasmuch as the water resulting from condensation of the steam used as motive fluid in the ejector is practically distilled water and has no content with which the chemical reacts.

And in case the motive fluid is water, either cold or hot, which has been previously purified or chemically treated, or which has no content reacting with chemical of the character delivered from tank T<sup>2</sup>, the amount of chemical introduced into the tank T remains in proper proportion for the content of the raw water introduced into tank T with which the chemical is to react. When hot water is used as the motive fluid for the ejector 55, it may be taken from any suitable source as the boiler, and in the latter case is obviously such as has previously been chemically treated.

The water delivered from outlet 22 through pipe 52 into receptacle 43 is raw water which dilutes the chemical liquid delivered into receptacle 43 from tank T<sup>2</sup>; but this dilution water, being a definite proportion of the water flowing into the tank T from pipe 1, does not disturb the proportionality of the chemical with respect to the water introduced into tank T through pipe 1 and also that delivered indirectly thereto through pipe 52.

When hot water is used as motive fluid for the ejector 55, some of it may be delivered as dilution water to receptacle 43 through pipe 61 controlled by valve 62.

It will be understood that all the water delivered through pipe 18 into receptacle 20 may be delivered into receptacle 25 and the outlet 22 and pipe 52 omitted, in which case pipe 18 may discharge directly into receptacle 25, and receptacle 20 and chamber 21 may be omitted.

The outlet 22 and pipe 52 may be omitted in case the motive fluid for the ejector 55 is hot water requiring no chemical treatment; and in such case the hot water motive fluid passed through the ejector serves as dilution water for the chemical liquid delivered from tank T<sup>2</sup>, whether or not valve 62 is open.

In the example of an application of my invention herein described, the chemical treatment of the water in tank T is effected while hot. The exhaust steam delivered

into the heater H from pipe 5 gives up its heat to the entering water, but this heat is conserved because the water is fed back into the boiler. For like reason the motive fluid for the ejector 55 may be steam, and even when it is live steam, the heat remaining therein after performance of the work of delivering liquid through pipe 57 into the tank T is given up to the water in tank T and so conserved, with the result that even live steam may be employed as motive fluid for the ejector 55 at practically little cost, as measured in heat units lost. The steam for ejector 55 may be the medium for heating the water delivered to the heater H from pipe 1, in which case pipe 57 may discharge above the trays 4 and steam pipe 5 may be omitted, or employed to supply any additional heat over and above that supplied by the fluid from the ejector.

The use of an ejector in the relation described is of further advantage, particularly when the chemical in tank T<sup>2</sup> is milk of lime, which latter has been found to disarrange a pump used for delivering it into tank T by affecting the pump glands or stuffing boxes, causing them continually to leak.

What I claim is:

1. Apparatus for proportioning one fluid with respect to another comprising means producing a flow of control fluid proportional to said other fluid, a receptacle for said one fluid, a discharge conduit for delivering said one fluid from said receptacle, said conduit having an intake movable with respect to the surface of said one fluid in said receptacle, and means for varying the height of said intake comprising a second receptacle, a float therein, a third receptacle carried by said float and receiving said control fluid, said control fluid overflowing from said third receptacle into said second receptacle, and a float in said third receptacle controlling said intake.

2. Apparatus for proportioning one fluid with respect to another comprising means producing a flow of control fluid proportional to said other fluid, a receptacle for said one fluid, a discharge conduit for delivering said one fluid from said receptacle, said conduit having an intake movable with respect to the surface of said one fluid in said receptacle, and means for varying the height of said intake comprising a second receptacle, a float therein, a third receptacle carried by said float and receiving said control fluid, said control fluid overflowing from said third receptacle into said second receptacle, and a float in said third receptacle controlling said intake, said third receptacle and said intake having passages so proportioned with respect to each other that the quantities of fluid passing through them

bear the same proportion to each other as the volumes of fluid per unit of depth in said first and second receptacles.

3. Apparatus for proportioning one fluid with respect to another comprising means determining the flow of said one fluid, and means controlling said means comprising a receptacle, a float therein, a second receptacle carried by said float, means for delivering into said second receptacle fluid proportional to said other fluid, said fluid overflowing from said second receptacle into said first named receptacle, and a float in said second receptacle controlling said first named means.

4. Apparatus for proportioning one fluid with respect to another comprising means determining the flow of said one fluid, and means controlling said means comprising a receptacle, a float therein, a second receptacle carried by said float, means for delivering into said second receptacle fluid proportional to said other fluid, said second receptacle having a passage through which said fluid flows into said first receptacle, and a float in said second receptacle controlling said first named means.

5. Apparatus for controlling fluid delivery comprising a receptacle, a float therein, a second receptacle carried by said float, means delivering fluid into said second receptacle overflowing into said first named receptacle, a float in said second receptacle, and means controlling fluid delivery controlled by said second float.

6. Apparatus for controlling fluid delivery comprising a receptacle containing the fluid, means for discharging fluid from said receptacle comprising a fluid intake movable in an arcuate path with respect to the level of fluid in said receptacle, a horizontal member along which said intake is movable, and means varying the height of said horizontal member.

7. Apparatus for controlling fluid delivery comprising a receptacle containing the fluid, means for discharging fluid from said receptacle comprising a fluid intake movable in an arcuate path with respect to the level of fluid in said receptacle, a horizontal member, a roller movable along said member and supporting said intake, and means for varying the height of said horizontal member.

8. Apparatus for proportioning one fluid with respect to another comprising a receptacle, a float therein, means for delivering to said receptacle fluid proportional to said other fluid, a second receptacle containing said one fluid, a conduit for discharging fluid from said second receptacle, an intake for said conduit movable with respect to the level of fluid in said second receptacle, a horizontal member controlled as to vertical

movement by said float, and means supporting said intake upon the horizontal member and allowing movement longitudinally thereof.

9. Apparatus for proportioning one fluid with respect to another comprising a receptacle, a float therein, means for delivering to said receptacle fluid proportional to said other fluid, a second receptacle containing said one fluid, a conduit for discharging said one fluid from said second receptacle, and an intake head for said conduit controlled by said float and comprising a chamber open at its lower end for receiving fluid from said second receptacle, a second chamber communicating with said conduit, and a partition between said chambers having a passage forming communication between said chambers.

10. Apparatus for proportioning one fluid with respect to another comprising a receptacle, a float therein, means for delivering to said receptacle fluid proportional to said other fluid, a second receptacle containing said one fluid, a conduit for discharging said one fluid from said second receptacle, and an intake head for said conduit controlled by said float and comprising a chamber open at its lower end for receiving fluid from said second receptacle, a second chamber communicating with said conduit, and a partition between said chambers having a notch through which liquid entering said first named chamber flows into said second chamber.

11. Apparatus for proportioning one fluid with respect to another comprising means for delivering said one fluid, and means for controlling said means comprising a float box, means for delivering thereto fluid proportional to said other fluid, a float in said box controlling discharge of said fluid therefrom, a receptacle receiving the fluid discharged from said box, and a float in said receptacle controlling said first named means.

12. The combination with a water heater comprising a closed chamber, of means for delivering water thereto, a float box, means connecting said float box with said chamber, means for delivering into said box water proportional to the water delivered to said heater, a float in said box controlling discharge of water therefrom, and means controlled by the water discharged from said box controlling delivery of a liquid proportional to the water entering said heater.

13. The combination with a water heater comprising a closed chamber, of means for delivering water into said heater chamber, a float box, means for delivering water into said box substantially below the water level therein, a float in said box controlling discharge of water therefrom, a connection

from said heater chamber to said float box above the water level therein, and means controlled by the water discharged from said box controlling delivery of a liquid proportional to the water entering said heater.

14. Apparatus for proportioning one fluid with respect to another comprising means controlling delivery of said one fluid, a closed chamber, an orifice plate through which said other fluid is delivered into said chamber, a float box, an orifice plate whose high pressure side communicates with the high pressure side of said first named plate, and whose low pressure side communicates with said float box, whereby a predetermined proportion of said other fluid is delivered into said float box, a pressure-equalizing connection between said chamber and said float box, a float in said box controlling discharge of fluid therefrom, and means controlled by the fluid discharged from said box controlling said first named means.

15. Apparatus for proportioning one fluid with respect to another comprising means controlling delivery of said one fluid, members having orifices through which said other fluid is delivered, said orifices being so proportioned with respect to each other that the flow through one bears a predetermined relation to the flow through the other, a float box receiving the fluid delivered through one of said orifices, a float in said box controlling discharge of said fluid therefrom, and means controlled by the fluid discharged from said box controlling said first named means.

16. The combination with a water heater comprising a closed chamber, means for delivering heating fluid into said chamber, a member having an orifice through which water is delivered to said heater, a second member having an orifice through which flows water proportional to the water delivered to said heater, a float box receiving the water delivered through said second orifice, a connection from said float box with said heater chamber, a float in said box controlling discharge of water therefrom, means controlling the flow of a liquid, and means controlling said last named means controlled by the water discharged from said float box.

17. Apparatus for proportioning one fluid with respect to another comprising means discharging said one fluid, means producing a flow of control fluid proportional to said other fluid, means controlled by a predetermined fraction of said control fluid controlling said first named means, and means for admixing with said one fluid discharged by said first named means another predetermined fraction of said control fluid.

18. The combination with a closed chamber, of means for delivering liquid thereto, a vessel, means for delivering into said ves-

sel liquid proportional to the liquid delivered to said chamber, a pressure equalizing connection between said chamber and said vessel, means controlling discharge of liquid from said vessel, and means controlled by the liquid discharged from said vessel controlling delivery of liquid proportional to the liquid delivered into said chamber.

19. The combination with a closed chamber, of means for delivering liquid thereto, a vessel, means for delivering into said vessel below the liquid level therein liquid proportional to the liquid delivered to said chamber, a pressure equalizing connection between said chamber and said vessel, means controlling discharge of liquid from said vessel, and means controlled by the liquid discharged from said vessel controlling delivery of liquid proportional to the liquid delivered into said chamber.

20. The combination with a closed chamber, of means for delivering liquid thereto, a vessel, means for delivering into said vessel liquid proportional to the liquid delivered to said chamber, a pressure equalizing connection between said chamber and said vessel, means responsive to change in quantity of liquid in said vessel controlling discharge of liquid therefrom, and means controlled by the liquid discharged from said vessel controlling delivery of liquid proportional to the liquid delivered into said chamber.

21. The combination with a closed chamber, of means for delivering liquid thereto, a vessel, means for delivering into said vessel below the liquid level therein liquid proportional to the liquid delivered to said chamber, a pressure equalizing connection between said chamber and said vessel, means responsive to change in quantity of liquid in said vessel controlling discharge of liquid therefrom, and means controlled by the liquid discharged from said vessel controlling delivery of liquid proportional to the liquid delivered into said chamber.

22. In fluid proportioning apparatus, the combination with a chamber, of means for dividing liquid into streams bearing a predetermined proportion to each other, means for conducting one of said streams into said chamber, a vessel receiving another of said streams, a pressure equalizing connection between said vessel and said chamber, means controlling discharge of liquid from said vessel, and means responsive to change in quantity of liquid in said chamber controlling delivery of liquid to said first named means.

23. The combination with a water heater comprising a chamber, of means for delivering water thereto, a vessel, means for delivering into said vessel water proportional to the water delivered to said heater, a pressure equalizing connection between said ves-

sel and said chamber, means controlling discharge of water from said vessel, and means controlled by the water discharged from said vessel controlling delivery into the  
5 water delivered to said heater of chemical bearing liquid proportional to the water entering said heater.

24. The combination with a water heater comprising a chamber, of means for delivering water thereto, a vessel, means for delivering into said vessel water proportional to the water delivered to said heater, a pressure-equalizing connection between said vessel and said chamber, means responsive to  
10 changes in quantity of water in said vessel controlling discharge of water therefrom, and means controlled by the water discharged from said vessel controlling delivery into the water delivered to said heater  
15 of chemical bearing liquid proportional to the water entering said heater.

25. The combination with a water heater and a treating tank receiving water therefrom, of means for delivering water to said heater, a vessel, means for delivering to said  
25 vessel water bearing a predetermined proportion to the water entering said heater, an equalizing connection between said vessel and said heater, means controlling discharge of water from said vessel, means controlled  
30 by the water discharged from said vessel for delivering into the water delivered to said heater chemical-containing liquid proportional to the water discharged from said vessel, and means responsive to the quantity  
35 of water in said tank controlling delivery of water to said heater and said vessel.

In testimony whereof I have hereunto affixed my signature this 8<sup>th</sup> day of March, 1918.

RAYMOND D. B. WRIGHT.