June 14, 1938. D. W. HAERING 2,120,608

PROPORTIONING APPARATUS

Filed Feb. 24, 1937 3 Sheets-Sheet 1

Fig. 1.

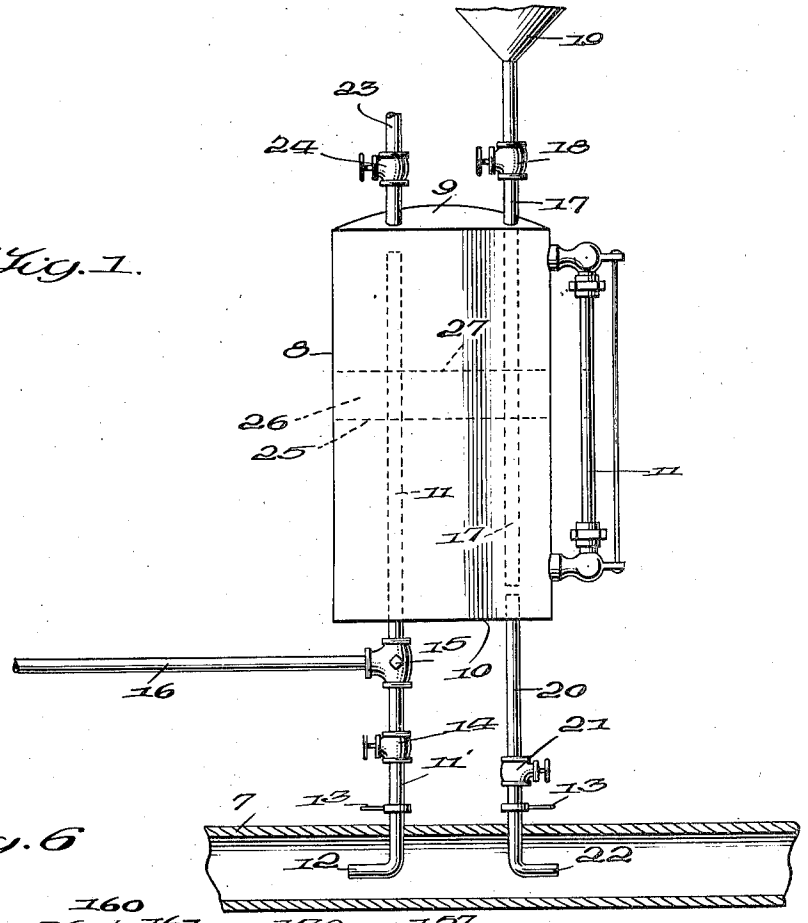
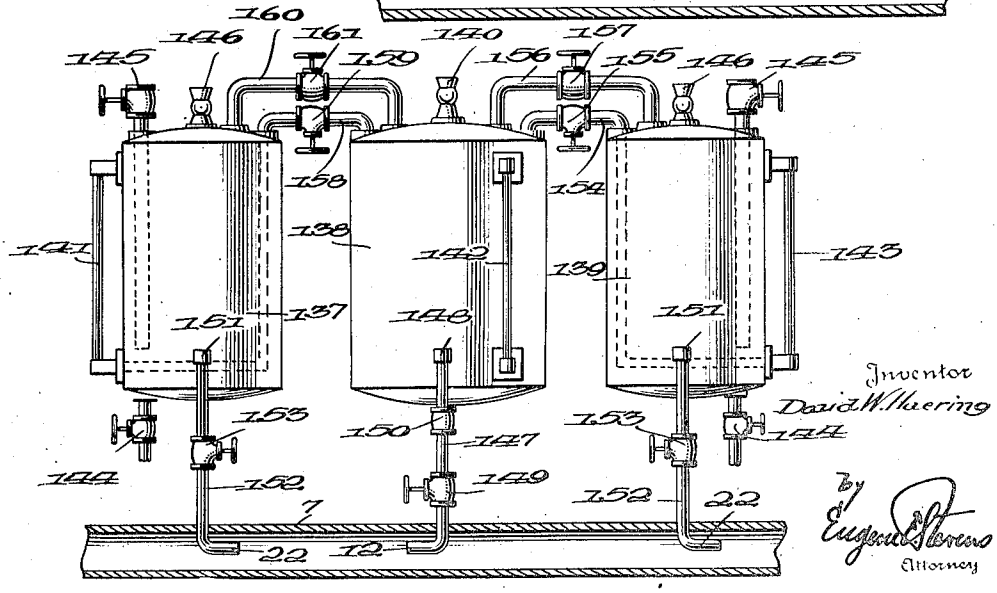


Fig. 6



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Fig. 2.

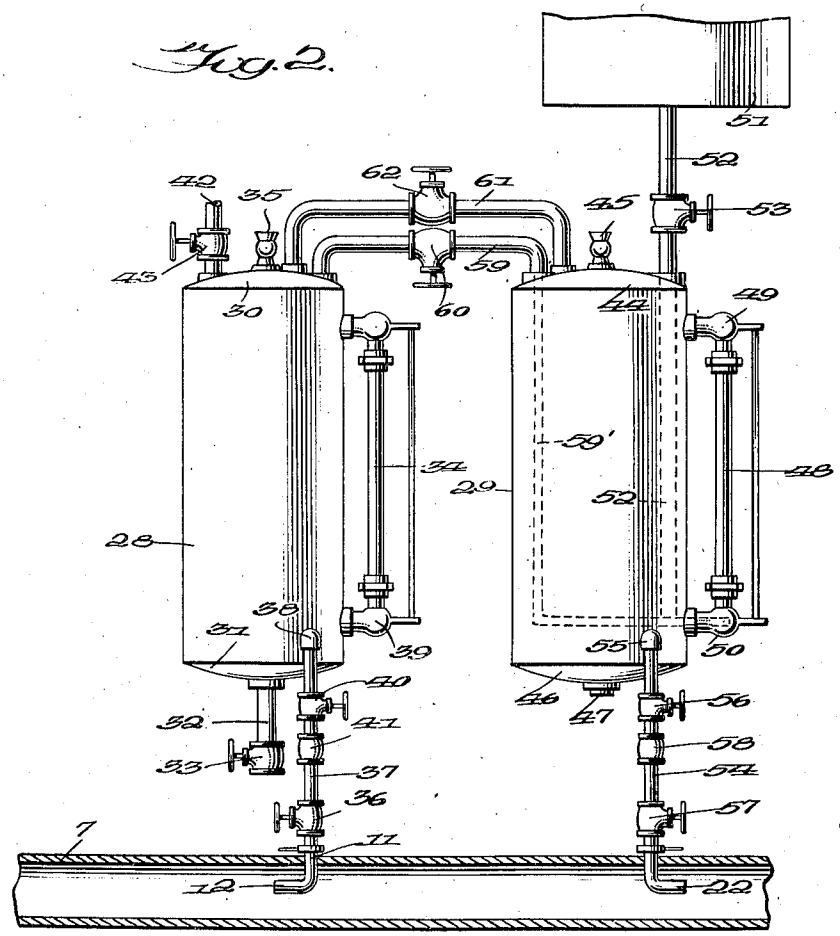
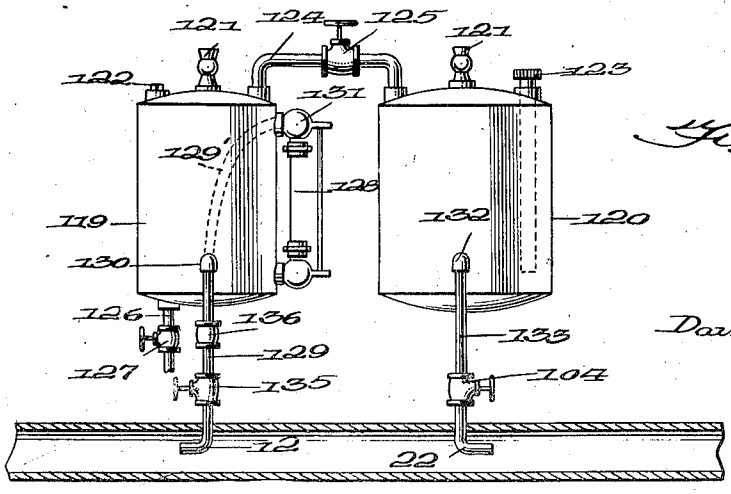


Fig. 5.



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PROPORTIONING APPARATUS

Filed Feb. 24, 1937 3 Sheets-Sheet 3

Fig. 3.

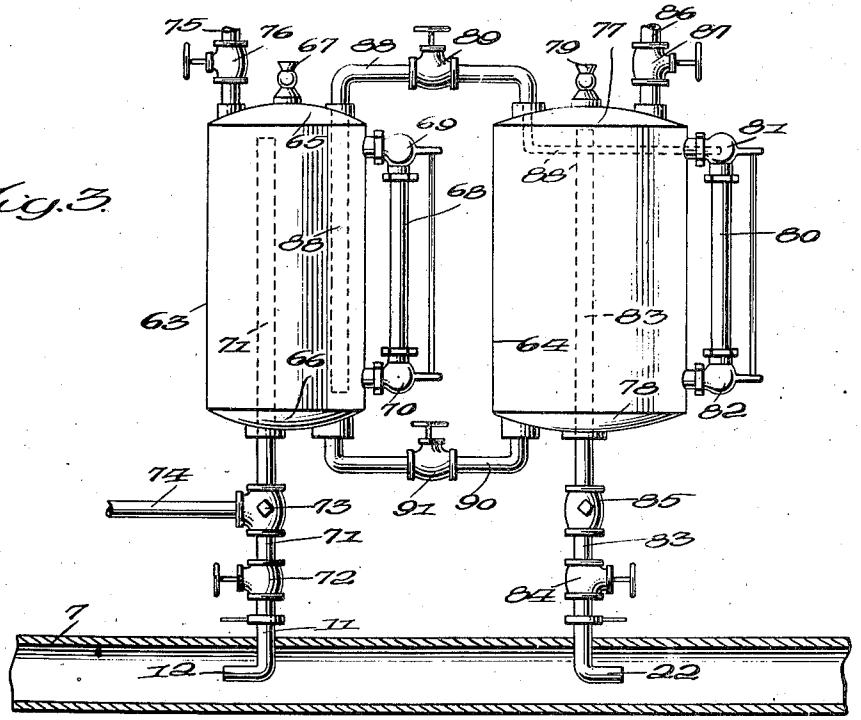
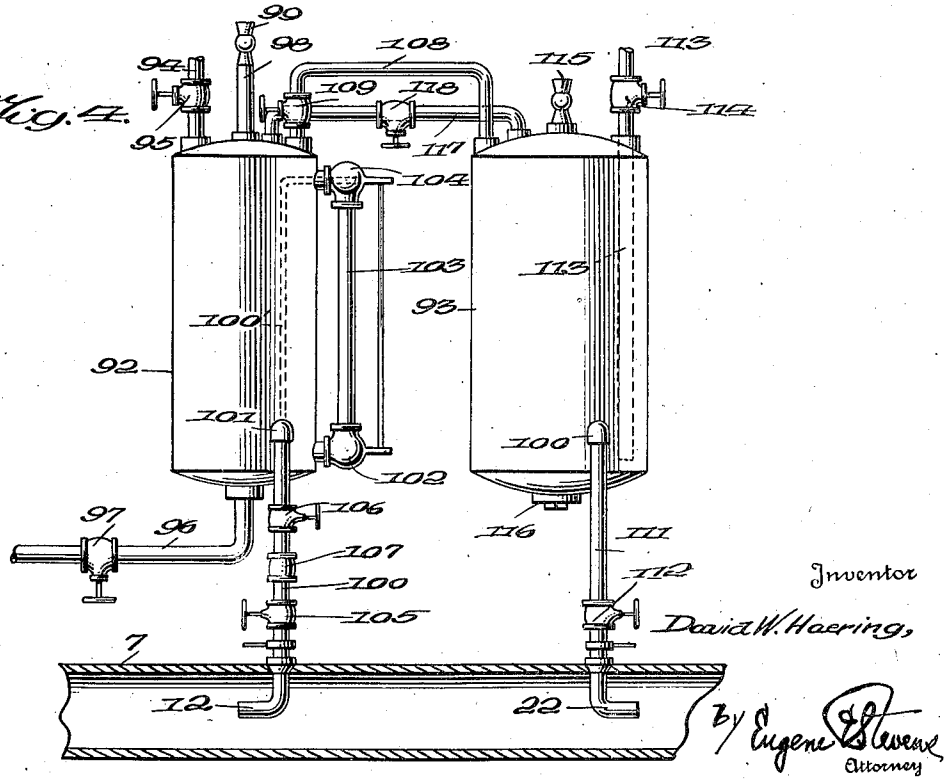


Fig. 4.



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Patented June 14, 1938 2,120,608

UNITED STATES PATENT OFFICE

2,120,608

PROPORTIONING APPARATUS

David W. Haering, Chicago, Ill.

Application February 24, 1937, Serial No. 127,534

6 Claims. (Cl. 210—31)

This invention relates to the art of proportioning liquids into liquids in accordance with process requirements. While many forms of such apparatus are known to the art, no reliable apparatus is believed hitherto to have been produced, wherein the operation is automatic and very highly accurate. Processing requirements generally require great accuracy in proportioning and this has necessitated practically constant supervision by skilled operators. The relatively complicated character and somewhat elaborate construction of proportioning apparatus generally employed, together with the necessity for supervision, has proved expensive and detrimental to wide-spread commercial use of proportioning units.

The present invention has as an object the provision of economical, automatically operable proportioning apparatus of simplified construction adapted for proportioning liquids into liquids in accordance with processing requirements.

Another object is the provision of proportioning apparatus of such character that is adjustable for automatic operation, without supervision, at any desired proportioning rate and which is so designed as to eliminate any possibility of contaminating the processed liquid with undesirable foreign material even though the apparatus be left in operation beyond the point at which its supply of processing liquid is exhausted.

Other objects will be apparent from the description.

The present application is a continuation as to all common subject matter of the invention shown and described in my prior United States Patent No. 2,058,309, of October 20, 1936.

The present disclosure constitutes an exposition of alternative embodiments of apparatus by which the invention is practiced. It is to be understood that the apparatus may be structurally altered in desired respects for adaptation to different service conditions and that various changes and modifications may be made in the structural details to any extent not inconsistent with the scope of the invention as claimed.

In the drawings:

Figure 1 is substantially an elevation of one form of proportioning apparatus constructed in accordance with the invention.

Figure 2 is an elevation of another form of an apparatus.

Figure 3 is an elevation of still another form of proportioning apparatus.

Figure 4 is an elevation of an alternative embodiment of proportioning apparatus particularly designed for handling corrosive material.

Figure 5 is an alternative embodiment of the apparatus arrangement as shown in Figure 2.

Figure 6 is an elevation of an embodiment of proportioning apparatus designed particularly for the processing of liquid with a plurality of separately fed processing reagents.

In all illustrated embodiments of the invention the various types of proportioning units are shown as service connected into a fluid through-put conduit 7 through which, as will be understood by those versed in the art, the fluid to be processed, generally a liquid, is flowed under pressure. In all views the inlet or intake side of the through-put fluid conduit is considered to be at the left while the out-put side is at the right, these being respectively the upstream and downstream sides of the conduit.

The proportioning units herein shown and described are capable of accurately proportioning practically any soluble chemical compound that is to be fed as a solution into a fluid to be processed. By way of example it is pointed out that the disclosed units are particularly efficacious in the feeding of such chemical solutions as acid, alum, ammonia, caustics, aluminates, glucosides, glucosates, alginates, sulphates, phosphates, sulphites, tannates, silicates, soda ash, hypochlorites, ferric chlorides, and many others.

The accuracy of Pitot tubes for measuring rate of flow has been known for many years, but efforts to utilize this principle in proportioning units have not previously been successful because the use of diaphragms, pistons and similar arrangements defeated their own purpose by placing too great a load on the small amount of pressure available and, in addition, required frequent replacement in order to prevent leakage. The present invention overcomes the defects of the prior art in the above respects and is thus enabled to employ the Pitot tube principle, thus making possible extreme accuracy. The pressure difference between Pitot tubes is proportional to velocity head and the present invention makes use of this pressure difference directly and without loss for the automatic operation of the unit.

The proportioning unit shown in Figure 1 comprises a single receptacle such as a tank 8 suitably supported by any appropriate means, not shown, and having a closed top 9 and a closed bottom 10, it being further provided at one side with a conventional sight gauge 11 of the usual glass tube type. In service the upper portion of the tank is in open communication with the input

side of the conduit 7 by means of a riser pipe 11' suitably connected into the conduit 7 at its lower end and having thereon an upstream directed Pitot tube inlet member 12. Externally of the conduit and adjacent thereto the pipe 11' carries an indicator 13 fixed to the pipe to lie in a common vertical plane with the Pitot inlet 12 providing a ready means indicating the position of the latter. Above the indicator 13 the pipe 11' is further provided with a needle valve 14 of a known type of indicating valve by which the flow through the pipe 11' may be regulated to any desired rate by appropriate setting of the valve. Between the bottom of the tank and the regulator valve 14 the pipe 11' is further provided with a three-way valve 15 from which leads a drain pipe 16. The pipe 11' is continued upwardly through the bottom of the tank and opens in its upper portion at a point spaced slightly below the top 9.

Extending downwardly through the top of the tank is a reagent supply pipe 17, controlled by a valve 18, and leading from a source of supply 19. The reagent supply pipe 17 opens into the bottom portion of the tank at a point spaced slightly above its bottom 10. A reagent discharge pipe 20 controlled by a valve 21 opens into the tank bottom substantially flush therewith and extends vertically between the tank bottom and the through-put conduit 7, being suitably connected thereinto on the downsteam side and carrying at its lower end within the conduit a Pitot tube outlet member 22 directed downstream. The pipe 20 also carries an indicator 13 aligned with the Pitot outlet 22. The tank is further provided at its top with a pipe 23 controlled by a valve 24 and opening into the upper end of the tank for a purpose to be described.

Assuming all valves to be closed the tank is charged by opening the valve 24 and supplying through the pipe 23 to the interior of the tank a charge of a liquid 26 that is chemically inert both with respect to the main through-put liquid in the conduit 7 that is to be processed and a particular reagent solution to be employed. The liquid 26 is designed to function as a liquid piston and it is of such composition that it has a higher specific gravity than the main through-put liquid in the conduit 7 and a lower specific gravity than the particular reagent solution employed. The piston fluid 26 is also given a distinctive color so that in the gauge glass 11 it may be sharply defined visually. The addition of coloring material is not necessary where the character of the piston liquid is such that it is readily distinguishable from the main throughput fluid and reagent. The piston liquid 26 is allowed to collect on the bottom of the tank until the desired quantity has been fed thereinto whereafter the valve 24 is closed and the valve 18 is opened to allow a supply of reagent solution from the source receptacle 19 to flow by gravity through the pipe 17 onto the tank bottom displacing the piston liquid 26 which rises as a superposed stratum on top of the reagent solution 25. When the reagent solution reaches the desired height in the tank, as indicated in the gauge glass 11, the valve 18 is closed and the valves 14 and 15 are manipulated to allow the throughput liquid in the conduit 7 to rise through the Pitot tube inlet 12 through the riser pipe 11' to flow into the upper portion of the tank onto the top of the piston liquid 26 under the pressure existing in the flow line 7. Thus the upper portion of the tank becomes entirely filled with the main throughput liquid from the conduit 7 and due to the fact that the piston liquid 26 is of a higher specific gravity than the main throughput liquid, the throughput liquid will remain superposed upon the piston liquid as indicated in Figure 1 wherein dotted line 27 denotes the bottom level of the throughput liquid admitted through the pipe 11'. The valve 14 is set at the proper adjustment for whatever rate of proportioning is selected. Next in order the valve 21 is opened whereupon, as will be apparent, the flow pressure of the main throughput liquid 27 acting downwardly in the tank upon the body of piston liquid 26 will move the liquid piston stratum 26 downwardly towards the reagent solution 25 out through the discharge pipe 20 and discharge Pitot tube 22 into the main throughput liquid flowing through the conduit 7 at a rate of feed determined by the setting of the valve 14.

The piston liquid 26 being immiscible with either the main throughput fluid or the reagent solution and chemically inert with respect to both, acts very effectively as a barrier preventing any possibility of contact between reagent solution and the main throughput liquid within the tank so that the reagent is fed into the flow stream in the conduit 7 in a pure unadulterated state. The operation is entirely automatic and no supervision is required other than observation at predetermined intervals to note the drop in the reagent level as indicated in the sight gauge 11. When the sight gauge indicates that the liquid piston 26 is at the bottom of the gauge glass the observer will be made aware of the fact that the tank is ready for a renewal of the reagent solution charge.

In recharging the valve 15 is manipulated to open the upper portion of the pipe 11' to the drain line 16 and to close the pipe against inlet of liquid from the flow conduit 7. The valve 18 is opened to allow a fresh supply of reagent to flow into the bottom of the tank beneath the liquid piston 26. As the level of the reagent solution rises in the tank the piston 26 forces ahead of it the liquid previously delivered from the flow conduit 7 which is drained back through the pipe 11' into the drain line 16 until the level of the reagent solution reaches the desired point as indicated in the sight gauge 11. At this point the valve 18 is closed and the three-way valve 15 is returned to its normal position to close the drain line and open the riser pipe 11' whereupon the operation is at once resumed and continued until a further recharging is necessary.

In the embodiment of apparatus shown in Figure 2, the receptacle means comprises two compartments, here shown as tanks 28 and 29, the tank 29 being of greater capacity than tank 28. For practical purposes it has been found desirable to make the tank 29 substantially twenty-five per cent larger than the tank 28, for the purpose to be described. The two tanks are appropriately supported by suitable means, not shown, so that they are associated as a unit. The tank 28 is provided with a closed top 30 and a closed bottom 31 both being outwardly dished to facilitate air venting and blowing down for cleaning the interior in the event that sedimentation makes this desirable. A drain pipe 32 controlled by a valve 33 leads from the tank bottom 31. The tank 28 is equipped with a sight gauge glass 34 and is further provided with an air vent 35 of a known type located at the high point of the top 30. In this embodiment of proportioning unit the riser 11' carrying the Pitot inlet 12 in the upstream side of the main throughput

conduit 7 connects through a globe valve 36 with an inlet riser 37 that communicates at its upper end through the connection 38 with the interior of the tank 28 slightly above its bottom 31 and beneath the bottom connecting nipple 39 of the gauge glass 34. In order to facilitate various operations of cleaning, dismantling and the like the intake pipe 37 is further provided with a second globe valve 40 disposed adjacent the connection 38 and between the two globe valves 36 and 40 the intake is further equipped with a check valve 41.

In this unit the tank 28 prior to operation of the apparatus is entirely filled with an inert mineral oil supplied thereto through a filler conduit 42 having a control valve 43 at the top of the tank. It should be mentioned here that in filling the tank 28 the oil is permitted to rise until it overflows through the air vent 35 which is then closed together with the valve 43.

The tank 29 has also a closed top 44 provided at its high point with an air vent 45, and a closed bottom 46 provided with a drain plug 47. The ends of the tanks are outwardly dished as in the case of the tank 28 for similar purposes. The tank 29 is also provided with a sight gauge 48 having its top and bottom connecting nipples 49 and 50 disposed respectively in horizontal planes common to the top and bottom connecting nipples of the sight gauge 34 located on the tank 28. It should further be noted that the two tanks are so arranged that their respective bottoms 31 and 46 occupy a common horizontal plane as do likewise their tops 30 and 44.

The tank 29 is adapted to contain the reagent solution to be fed into the main through-put liquid passing through the flow conduit 7. At a suitable location above the tank 29 there is disposed a source of supply such as a reservoir 51 containing the appropriate reagent fluid and from which the reagent is fed through the supply pipe 52 equipped with a control valve 53 downwardly through the top of the tank into its bottom portion, the lower open end of the reagent supply pipe 52 terminating adjacent the tank bottom at substantially the horizontal plane of the sight gauge connecting nipple 50. The reagent solution from the tank 29 is discharged into the through-put conduit 7 on the downstream side by means of a discharge pipe 54 connected at its lower end with the downstream connected Pitot outlet tube 22 and opening at its top through the connection 55 into the interior of the tank slightly above its bottom and just below the horizontal plane of the connection nipple 50 at the bottom of the sight gauge 48. The reagent discharge pipe 54 is provided with upper and lower globe valves 56 and 57 and with a check valve 58 located between the two. The check valves 41 and 58 act to prevent any possibility of a flow reversal through the system of the unit.

The two tanks 28 and 29 are connected at their tops 30 and 44 by means of an oil flow pipe 59 equipped with a self-indicating needle control valve 60 identical to the needle control valve 14 described in connection with the embodiment shown in Figure 1 and having the same function of determining the rate of feed of the reagent from the unit. The two tanks are further connected at their upper ends by a transfer pipe 61 opening at its ends into the respective tank tops 30 and 44 and equipped with a control valve 62. The oil pipe 59 does not discharge directly into the upper end of the tank 29 but is continued downwardly through the top of the tank by an extension 59' having its lower end portion horizontally directed into and through the inlet aperture of the bottom connecting nipple 50 of the sight gauge 48, the extension 59' terminating in the nipple 50 in the axis of the gauge glass and at its lower end.

The tank 29 prior to operation of the unit is entirely filled with reagent solution from the reservoir 51 until it overflows through the vent 45 whereupon the vent is closed together with the reagent supply valve 53. In this embodiment of the proportioning unit the oil selected as the piston liquid must be chemically inert, immiscible with water and aqueous solutions of all kinds, particularly immiscible with the through-put liquid and the reagent solution, and must be of a color distinctive with respect to the treated and treating liquid. A suitable liquid for such purposes is a chemically inert saturated hydrocarbon, such as a mineral oil, having a specific gravity less than 1 and colored preferably a deep red.

In operation the valves between the flow conduit 7 and the bottom portions of the respective tanks 28 and 29 are opened whereupon a portion of the through-put liquid in the conduit 7 is taken up by the Pitot tube 12 and rises under pressure through the pipe 37 into the bottom portion of the tank 28 in which it collects upon the bottom and being of a higher specific gravity than the oil within the tank it gradually forces the oil upwardly out of the tank through the oil pipe 59 at a rate of flow controlled by the setting of the needle valve 60, ino the tank 29 through the extension 59' to the bottom of the sight gauge glass 48 whence it rises as drops flowing upwardly through the gauge glass and through the upper connecting nipple 49 into the top portion of the tank 29. As the oil is of a lower specific gravity than the reagent solution contained in the tank 29, it will of course collect at the top of the tank and under the inlet pressure will gradually force the reagent down in the tank 29 and out through the discharge pipe 54 into the downstream side of the through-put conduit 7. The rate at which the drops of the distinctively colored piston liquid, which is the oil, rise through the tube 48 affords a visual indication of the rate of proportioning feed of the reagent solution.

As the level of the incoming through-put fluid entering the tank rises therein it indicates, of course, on the sight gauge 34 and when the distinctively colored oil is no longer visible at the top of the sight gauge 34 an attendant is made aware of the fact that the time is approaching for recharging the unit with reagent solution.

To effect a recharge the necessary valves are closed at the bottom portions of the unit and the transfer valve 62 in the line 61 is opened together with the drain valve 33 and the reagent supply valve 53. Under the hydrostatic head of the reagent solution entering through the pipe 52 the reagent as it enters the bottom of the tank 29 forces the contained oil back through the transfer pipe 61 into the top of the tank 28, the portion of the throughput liquid contained in the tank 28 draining from the bottom through the drain pipe 32. When the sight gauge 34 on the tank 28 shows that it is filled with the distinctively colored oil, the attendant knows that the requisite recharge of the reagent solution has been supplied to the tank 29. The transfer valve 62 is then closed together with the drain valve 33 and the reagent supply valve 53 and the valves controlling the pipes 37 and 54 are opened so that the unit resumes an

automatic operation in the manner previously described. In this recharging operation it will be noted that it is not necessary to disturb the setting of the control valve 60 in any respect.

As previously stated herein, the reagent tank 29 is preferably made at least twenty-five per cent larger than the tank 28. Due to this difference in size it is impossible for the through-put liquid passing through the flow conduit 7 to become contaminated by the oil even though the unit be left in operation and unattended for a long period of time, far beyond the point at which the reagent solution charge of the tank 29 is exhausted. This safety control feature arises from the fact that as the oil comprising the piston liquid is of lighter specific gravity than the main through-put liquid from the flow conduit 7, if all of the oil contained in the tank 28 should be discharged into the tank 29 it will fill the tank and as the operation is continued following exhaustion of the reagent solution charge in the tank 29, the main through-put liquid entering through the oil pipe 59 and the extension 59' following the oil will back flow through the lower connecting nipple 50 of the sight gauge 48 into the bottom portion of the tank 29 remaining beneath the body of oil in the upper portion of the tank so that in the continued operation of the unit it passes nothing but the liquid passing through the system from the flow conduit 7. Due to the fact that the control valve 60 has no portion extending above the filling level of oil in the tank 28, as determined by the vent 35, it is obvious that in the normal operation of the unit nothing but oil ever passes through the valve 60. Consequently, it cannot corrode or become clogged so that its control setting functions accurately at all stages of the operation of the unit.

The embodiment of proportioning unit shown in Figure 3 is particularly designed for feeding oils and organic solvents into gasoline, oil or gas lines. It is applicable also to proportioning systems for introducing dyes into oil or gasoline and for introducing oil into gas. In this embodiment the unit consists of two tanks 63 and 64 suitably supported by appropriate means, not shown, the tank 63 having a closed top 65 and a closed bottom 66 outwardly dished to facilitate cleaning where necessary. The top 65 is equipped at its high point with an air vent 67 and is further provided with a sight gauge 68 having connecting nipples 69 and 70 entering the tank respectively from the upper and lower ends of the sight gauge tube at horizontal planes spaced somewhat from the top and bottom of the tank. In this embodiment the main through-put or flow conduit 7 through which flows the particular fluid to be treated has its riser 11' carrying the Pitot tube 12 connected to the vertically upstanding inlet pipe 71 which enters through the tank body 66 passing upwardly to discharge into the upper end of the tank slightly below the top 65. The inlet pipe is further provided with a globe valve 72 and above this with a three-way valve 73 communicating with a drain pipe 74. Also, at the top of the tank 23 is connected a piston fluid inlet pipe 75 having a control valve 76.

The reagent tank 64 is substantially twenty-five per cent larger than the tank 63 and has a closed top 77 and a closed bottom 78 located in respective horizontal planes common to the top and bottom of the tank 63. The ends of the tank 64 are outwardly dished for cleaning purposes and the top 77 is provided with an air vent 79 at the level of the air vent 67 on the tank 63. Tank 64 is likewise provided with a sight gauge 80 having its upper and lower connecting nipples 81 and 82 entering the tank in horizontal planes common to the nipples 69 and 70 of the tank 63. The treating solution or reagent is discharged from the upper end of the tank 64 through discharge pipe 83 extending down through the tank bottom into connection with the Pitot tube outlet 22 on the downstream side of the main fluid through-put conduit 7. The pipe 83 is equipped with a globe valve 84 and between the valve and the bottom of the tank there is also provided a check valve 85, to prevent flow reversal in the line. The treating solution or reagent is supplied to the tank 64 through the supply pipe 86 opening through the top 77 and controlled by the valve 87.

In this embodiment the piston fluid is heavier than the reagent or the main through-put fluid so that it necessarily gravitates to the bottom in each tank. With the unit in operation the through-put fluid enters under pressure from the Pitot inlet 12 rising through the inlet pipe 71 to the upper portion of the tank 63 wherein it displaces the piston fluid in the bottom portion of the tank which in turn rises through pipe 88 extending down through the top of the tank 63 to a point adjacent its bottom and which pipe connects with the tank 64 at its top 77, the rate of passage of the piston fluid through pipe 88 being controlled by the indicator needle control valve 89 similar to the valves 14 and 60 previously described and having the same function. The pipe 88 does not open directly into the tank 64 but is continued therein as an extension 88' horizontally directed through the top portion of the tank to extend into the nipple 81 of the sight gauge 80 and opening therein in the axis of the sight gauge tube. As the piston fluid is forced through the pipe 88 and its extension 88' it discharges in the nipple 81 at the upper end of the gauge glass of the sight gauge 80 whence it passes down therethrough in drops which enter the bottom portion of the tank 64 through the lower connecting nipple 82. As the piston fluid is heavier than the reagent solution contained in the tank 24 it forces the reagent solution upwardly within the tank to discharge from its upper end down through the outlet pipe 83 to the main through-put conduit 7 on the downstream side, the rate of feed being controlled by the setting of the valve 89. A transfer pipe 90, controlled by valve 91, connects the two tanks at their bottoms.

When the sight gauges indicate the necessity for a recharge of the treating solution in tank 64 the appropriate valves are manipulated to allow a fresh supply of reagent to enter the tank 64 through the pipe 86, the three-way valve 73 being open to the drain 74 so that the inlet pressure of the reagent supply forces the piston fluid back through the transfer pipe 90, the valve 91 being opened for the purpose, into the tank 63 wherein it replaces the through-put fluid in the upper portion of the tank down through the pipe 71 through the drain 74 until the requisite amount of reagent solution has been recharged into the tank 64. The valves are then manipulated to set the unit again in operation in the manner previously described.

Many of the materials used in processing fluids are very corrosive to the common metals and this is particularly true of the hypochlorite solutions used for sterilizing water supplies. A pro-

portioning unit particularly designed for handling corrosive material is shown in Figure 4 and consists of two appropriately supported tanks 93 disposed with their opposite ends occupying common horizontal planes and with the reagent solution tank 93 being substantially 25 per cent larger than the tank 92. In this embodiment the reagent tank, being designed to handle corrosive fluids, is rubber lined and hard rubber valves and fittings are employed wherever contact with the corrosive reagent is possible. This unit employs the heretofore described oil as the piston fluid which is supplied to the tank 92 through the supply pipe 94 having a control 95 and opening into the top of the tank. At the bottom of the tank a drain pipe 96 having a control valve 97 is provided for draining and recharging the unit. From the high point of the tank 22 a vent pipe 98 extends upwardly having its upper end provided with an air vent 99 located at a point higher than any point in which there is any transfer between the respective tanks. The through-put liquid in the main through-put conduit 7 rises through the impact of the Pitot tube 12 through the intake 100 which opens into the bottom portion of the tank 92 through the connection 101 at a point slightly above the horizontal plane of the bottom connecting nipple 102 of a sight gauge 103 carried by the tank and having its upper inlet nipple 104 entering the top portion of the tank at a point slightly below its top. The inlet pipe 100 is provided with spaced globe valves 105 and 106 between which is disposed a check valve 107. Within the tank 92 the inlet pipe 100 is continued as an extension 100' horizontally directed in the upper portion of the tank to extend into the sight gauge connecting nipple 104 to open therein in the axis of the sight gauge glass. In this unit the piston fluid is lighter than either the main through-put fluid or the particular corrosive reagent employed and as the through-put fluid enters through the inlet 100' it passes down through the sight gauge glass 103 in the form of drops entering the tank 92 at its bottom portion and collecting therein to force the piston fluid out of the top of the tank through the piston fluid conduit 108 at a rate of speed which is regulated by the indicating needle control valve 109 in the line 108 which valve is identical to the needle control valve previously described and which performs the same function. As the piston fluid is forced through the line 108 it enters at the top of the tank 93 and replaces the corrosive reagent discharging same through the connection 110 to the discharge pipe 111 controlled by the globe valve 112 and connecting with the Pitot discharge tube 22 located on the down-stream side of the conduit 7. The corrosive reagent is supplied to the tank at its bottom portion by means of the inlet pipe 113 leading from a suitable source of supply and controlled by the valve 114. The tank 93 is provided at the top with an air vent 115 and at its bottom with a drain plug 116.

A transfer pipe 117 controlled by a valve 118 establishes communication between the tops of the tanks 92 and 93 so that in a recharging operation the piston fluid flows back into the tank 92 through the line 117. It is important to note here that the location of the vent 99 at the high point of the system precludes any possibility of the pipes 108 and 117 and the control valve 109 and the valve 118 from handling anything other than the piston fluid which is, of course, non-corrosive and chemically inert.

The proportioning unit illustrated in Figure 5 embodies the principles of the units previously described but in a much more simplified structural arrangement. In this unit the two tanks 119 and 120 are appropriately associated by supporting means, not shown, with their tops and bottoms occupying common horizontal planes and with the reagent solution tank 120 being approximately twenty-five percent larger than the pipe 119. Each tank is provided at its top with an air vent 121 and the tank 119 is designed to carry the distinctively colored oil embodying the piston fluid which is supplied at the top of the tank through the inlet fitting 122. In the reagent tank 120 the reagent is supplied through the inlet fitting 123 through which the reagent is supplied into the bottom portion of the tank. The tanks are in open communication across their tops by means of a piston fluid conduit 124 equipped with the indicating needle control valve 125 identical with the indicating needle control valve previously described and having the same functions of regulating the rate of proportioning feed of reagent from the tank 120. The tank 119 is provided with a drain pipe 126 controlled by a valve 127.

In this unit the tank 119 is equipped with a sight gauge 128 and the through-put fluid entering from the impact Pitot tube 12 in the flow line 7 rises under the flow pressure through the inlet pipe 129 into the bottom portion of the tank through the connection 130. The inlet pipe 129 is continued through the tank 119 as an extension 129' which is continued into and opens in the upper connecting nipple 131 of the sight gauge 128 in the axis of the gauge tube. The reagent tank 120 discharges from its bottom portion through the connection 132 to the reagent discharge pipe 133 controlled by the valve 104 and in communication with the discharge Pitot tube 22 on the downstream side of the through-put conduit 7. The intake pipe 129 is provided with a globe valve 135 and with a check valve 136.

In the operation of this unit as the through-put fluid runs through the intake 129 it discharges from the extension 129' into the upper connecting nipple 131 of the sight gauge on the tank 119 whence it passes in the form of drops downwardly through the sight gauge glass into the bottom portion of the tank and displaces therefrom the body of the piston fluid, which is the distinctively colored oil, which passes through the conduit 124 under the control of the valve 125 into the top portion of the reagent tank 120 whence it displaces a proportionate amount of the reagent, discharging the same through the discharge pipe 133 into the through-put conduit on the downstream side. In recharging in this unit the recharging is effected by back transfer through the line 124, the drain 126 being open for the purpose.

The proportioning unit shown in Figure 6 is designed for proportioning two different reagent solutions simultaneously. It is particularly effective for all processing problems requiring twin feeding and will handle the feeding of soda ash and alum, soda ash and sodium aluminate, ammonia and hypochlorite, tannin and phosphate, tannin and caustic soda, ferric sulphate and soda ash, and various other combinations. Sodium sulphite may be fed in this unit in conjunction with pH adjustments or water softening chemicals.

In this unit the piston fluid is preferably the distinctively colored chemically inert oil previously described and the unit consists of three tanks, 137, 138 and 139, the intermediate tank 138 being

filled with the piston fluid until it overflows through the air vent 140 located in the top of this tank. Each tank is respectively provided with a sight gauge these being indicated as at 141, 142 and 143, the two end tanks being also provided with valve controlled drains 144. Each of the tanks 137 and 139 is filled with a different type of reagent the same being supplied thereto through the valve controlled supply pipe 145 which extends downwardly into the bottom portions of the respective tanks. The end tanks are also equipped with air vents 146. In this embodiment the through-put fluid conduit 7 has one impact Pitot tube 12 directed upstream and connecting with an intake pipe 147 entering the bottom portion of the central tank 138 through the connection 148. This intake pipe is provided with a globe valve 149 and with a check valve 150. Each of the tanks 137 and 139 discharges its respective reagent solution from its bottom portion through a connection 151 to the discharge pipe 152 equipped with a globe valve 153 and communicating with the discharge Pitot tube 22 in the through-put conduit 7 and directed down-stream thereof. The respective tanks 138 and 139 are in open communication between their tops by means of a piston fluid conduit 154 equipped with an indicating needle controlled valve 155 similar to the one previously described and having the same function. For recharging purposes the tops of these two tanks are in communication by means of a transfer pipe 156 controlled by a valve 157 so that in the recharging operation the setting of the control valve 155 need not be disturbed. Between the respective tanks 138 and 137 the same system lies, the two tanks being in open communication at their tops by a piston fluid conduit 158 having the indicating needle control valve 159 for regulating the rate of feed. These two tanks are also provided with a piston fluid transfer pipe 160 controlled by a valve 161 for effecting a recharge.

The operating principles of this unit are the same as those of the previously described units except that by proper manipulation of the control valves 159 and 155 the two different reagent solutions may be fed independently at different rates of speed. The principle is the same in that the through-put fluid entering the central tank through the intake 147 under the pressure in the conduit 7 displaces the piston fluid therein which passes through the respective conduits 154 and 158 into the reagent containing tanks for displacing the reagent solution contained therein through the discharge pipes 152 into the down-stream side of the through-put conduit.

Attention is directed to the fact that in all embodiments of the invention the requisite pressure for feeding the reagent solution is insured through a fluid piston, that is, a body of fluid material separates the main through-put fluid from the reagent at all times and such body of material, by reason of its fluid nature operates to transmit pressure equally over the entire engaged area of the reagent solution. Being a fluid body it is essentially mobile and instantaneously self-conforming to every surface irregularity and without hindrance to the transmission of pressure. It is important to observe that in no case is there possibility of contamination between the respective fluids for in those instances wherein the input fluid is passed through the piston fluid, the piston fluid does not pass through the reagent solution, and in those instances where the piston fluid is passed through the reagent solution the input fluid is not passed through the piston fluid. It is known to the prior art to utilize an intermediate fluid body between two fluids in the art of proportioning but in such known instances of the prior art there is an ever present possibility of contamination due to the fact that in the said prior art practice the input fluid is passed through the piston fluid and the piston fluid is in turn passed through the reagent solution. Thus it is possible for considerable contamination to occur by the transfer of impurities and foreign matter from one body to another as they are successively commingled in the operation of the apparatus.

I claim:

1. A proportioning apparatus comprising in combination with a fluid through-put conduit, a closed receptacle, an inlet pipe between the bottom portion of said receptacle and the conduit, a second receptacle having a capacity in excess of the capacity of the first receptacle, means for supplying a treating fluid to the second receptacle, a pipe between the upper ends of said receptacles and communicating at the top of each, a valve in said pipe for regulating by predetermined adjustment the rate of passage of fluid therethrough between said receptacles, a treating fluid outlet pipe between the bottom of said second receptacle and the conduit, and a body of liquid in the receptacles between the through-put fluid and the treating fluid, said body of liquid being chemically inert and immiscible relative to the through-put fluid and the treating fluid.

2. A proportioning apparatus comprising in combination with a through-put fluid conduit, a receptacle, a through-put fluid inlet pipe between said conduit and one end of said receptacle, a second receptacle, a treating fluid discharge pipe between said conduit and one end of said second receptacle, a body of treating fluid in said second receptacle, a pipe establishing communication between said receptacles, a valve means adjustable to determine the rate of flow through said pipe, a second pipe establishing communication between said receptacles at another point, valve means in said second pipe, and a body of liquid completely filling said receptacles and first-named pipe between the through-put fluid and the treating fluid.

3. A proportioning apparatus comprising in combination with a fluid through-put conduit, a closed receptacle, an inlet pipe between the through-put conduit and one end of said receptacle, a second and larger receptacle having a capacity in excess of the capacity of the first receptacle, means for supplying a treating fluid to one end portion of said larger receptacle, a pipe establishing communication between said receptacles at substantially opposite end portions of each, a valve in said pipe and adjustable to determine the rate of flow therethrough, a body of liquid filling said receptacle and pipe at all times between the through-put fluid and the treating fluid, and means for transferring the fluid from one tank into another independently of said valve controlled pipe.

4. A proportioning apparatus comprising in combination with a through-put fluid conduit, a pair of closed receptacles having their tops and bottoms arranged in common horizontal planes, one of said receptacles being larger than the other, a sight gauge on said larger receptacle and having connecting nipples opening to the interior thereof at the top and bottom of the gauge,

means for supplying through-put fluid under pressure from the upstream side of said conduit to one end of the smaller receptacle, means for supplying a charge of treating fluid to said larger receptacle at the lower end thereof, means for discharging treating fluid from said larger receptacle to the downstream side of said conduit, a pipe between said receptacles and opening into the top of said small receptacle, said pipe having an extension in said larger receptacle and terminating in the lower connecting nipple of said sight gauge, a valve in said pipe adjustable to determine the rate of flow therethrough, and a body of liquid filling said receptacles at all times between the through-put fluid and the treating fluid, said body of liquid being of a specific gravity differing from the treating fluid and the inlet fluid and chemically inert with respect thereto.

5. A proportioning apparatus comprising in combination with a through-put fluid conduit, a receptacle, an inlet pipe communicating between the upstream side of said conduit and one end portion of said receptacle, a second and larger receptacle, means for supplying a charge of treating fluid into said larger receptacle, a treating fluid exhaust pipe communicating between an end of said larger receptacle and the downstream side of said conduit, a pipe between said receptacles and communicating at one end to the end portion of said first receptacle spaced from the discharge end of said through-put fluid inlet pipe and at its other end passing through said larger receptacle to discharge therein at a point remote from the treating fluid discharge pipe, a valve in said connecting pipe adjustable to determine the rate of flow therethrough, vent means carried by said smaller receptacle at a point above the horizontal level of said pipe connecting the two receptacles, and a body of liquid filling said receptacles and pipe at all times between the through-put fluid and the treating fluid, said body of liquid being of a specific gravity differing from that of the through-put fluid and the treating fluid and being chemically inert with respect to both.

6. A proportioning apparatus comprising in combination with a through-put fluid conduit, a plurality of closed receptacles, an inlet pipe between the upstream side of said conduit and one end of one of said receptacles for admitting through-put fluid thereto under pressure, means for supplying individually different treating fluids to the remaining receptacles, each said remaining receptacle having a treating fluid discharge pipe connecting the bottom thereof with the downstream side of said conduit, pipes establishing communication between the top of said first named receptacle and each of the remaining receptacles, valves in said communicating pipes and adjustable to determine the rate of flow individually through each, and a body of liquid completely filling the space between the through-put fluid in said first receptacle and the respective treating fluids in the remaining receptacles and said connecting pipes, said body of liquid being chemically inert with respect to the through-put fluid and the various treating fluids and immiscible with any.

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