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FLUID TREATING APPARATUS.

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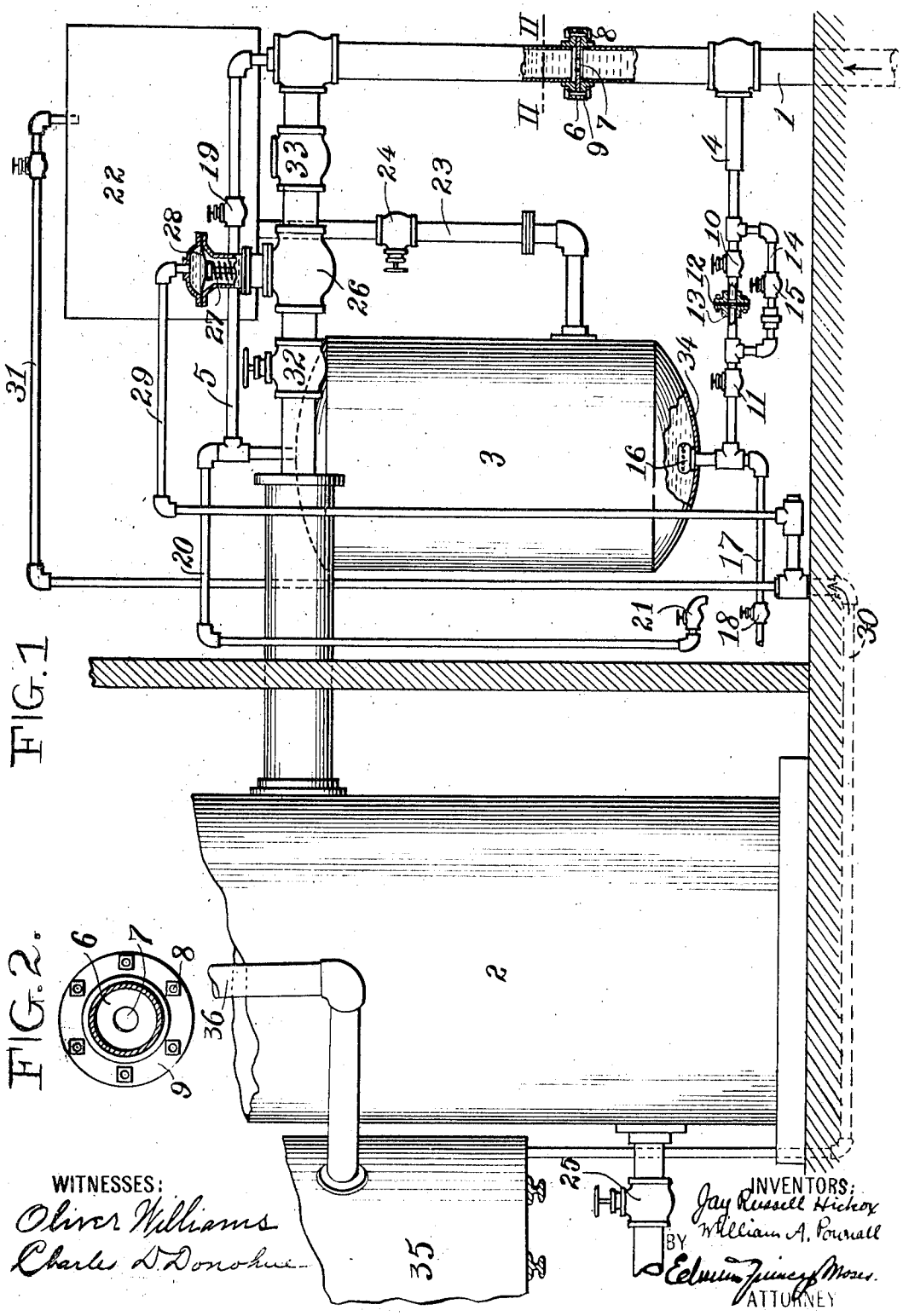

FIG. 1

FIG. 2.

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FLUID-TREATING APPARATUS.

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To all whom it may concern:

Be it known that we, JAY RUSSELL HICKOX, a citizen of the United States, and a resident of Alliance, in the county of Boxbutte and State of Nebraska, and WILLIAM A. POWNALL, a citizen of the United States, and a resident of Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Fluid-Treating Apparatus, of which the following is a specification.

In the purification of water and other fluids, it frequently is desirable and necessary to treat them with a reagent for the purpose of counteracting or causing to settle an impurity carried by the water, either in solution or suspension.

Our invention relates to an apparatus for automatically introducing a treating substance into the fluid to be treated.

More particularly our invention relates to apparatus for introducing a suitable reagent into hard, muddy, or otherwise impure waters to fit them for use in steam boilers. For waters in which much foreign matter is carried in suspension, ordinary lime, if introduced in proper quantities, in solution, is frequently found to give satisfactory results, or for softening hard waters, soda ash or barium hydrate may be found desirable. Our apparatus may be used to introduce either of these or any other suitable reagent, depending upon the nature of the impurity to be removed.

For the purpose of illustration and explanation, we have shown in the drawing forming part of this specification, and will hereafter describe in detail, a specific embodiment of our invention designed as a treating plant for a locomotive water station, but it is obvious that our invention is capable of a great variety of modifications, and may be put to other uses.

In the accompanying drawings, Figure 1, is an elevation of an apparatus embodying our invention, and Fig. 2 is a transverse section on line II—II of Fig. 1.

Referring to the drawings in detail, 1 is a main pipe coming from a reservoir or other source of supply and discharging into a settling tower 2.

3 is the receptacle for holding the lime or other treating material. A branch pipe 4 is led from the main pipe to one part of the treating tank 3, a return pipe 5 leading from another part of the tank back into the main pipe. A by-pass is thus formed, through which a part of main supply is diverted, caused to dissolve and take up a portion of the treating substance, and carry it back into the main channel where it at once thoroughly commingles with the main body of the stream. The water is thus made to automatically treat itself with the reagent without the use of any external force and without waste.

In order to force a sufficient quantity of the water through the by-pass, and to cause it to overcome the resistance to percolation through the treating material, we provide in the main pipe between the inlet to pipe 4 and outlet to pipe 5, a constriction which produces a difference of pressure in the portions of the main on the two sides thereof as soon as the fluid begins to flow. Thus the pressure in main pipe at the outlet to pipe 5 becomes less than that at the inlet to pipe 4 and the necessary motive force is supplied to overcome the obstacle in the path of the by-passed fluid. We prefer to make this constriction by inserting between two sections of pipe, a perforated diaphragm or gasket 6 shown in section in Fig. 1 and in plan in Fig. 2, the perforation 7 being formed of such area relative to the size of the pipe as is found to produce sufficient drop in pressure to result in a satisfactory flow through the by-pass. In the construction shown, the gasket is a thin sheet of metal, preferably copper, bolted by bolts 8 between the flanges 9, which are screwed to the ends of the pipe sections. In the inlet pipe 4, we preferably provide cut off valves 10 and 11 and a gasket or diaphragm 12 pierced with a perforation 13 of a size to permit the desired quantity of water to flow through the treating tank. In order to permit free flow of water into the treating tank while starting, a by-pass is preferably provided around the gasket. A cut off valve 15 serves to close the by-pass 14 and force the water through the perforation 13 in the regulating gasket, when the apparatus is in operation. The water preferably enters the treating tank at its lower end, and is discharged through a spray head 16. A pipe 17 normally closed by a valve 18 serves to drain the treating tank prior to recharging. The outlet pipe 5 preferably leads from the top of the treat-

ing tank, and is provided with a valve 19. Connected with this pipe, or directly with the upper part of the treating tank, is a pipe 20 provided with a valve or faucet 21. This pipe provides an outlet for the air when filling the treating tank, and by the flow of water from the faucet, shows when the treating tank is full.

For slaking the lime used to charge the treating tank, we preferably provide a slaking vat 22 placed at a higher level than that of the treating tank, and connected therewith by means of a pipe 23 which may be closed by a valve 24.

From the upper part of the settling tower the clear water is drawn into the supply tank 35 through the pipe 36 from which it is delivered to the locomotives. The sediment is removed from time to time from the lower part of the tower through the sludge valve 25. The flow of water to the supply tank is preferably regulated automatically in such a way as to keep the water in the tank at a substantially constant level. This may be conveniently done by placing in the main 1 an automatic valve 26. In the form shown in the drawings, a spring 27 tends to keep the valve normally off its seat, the valve being closed by water pressure on a diaphragm 28. The pressure is communicated to the space above the diaphragm through pipe 29 which is connected to pipe 30 leading from the supply tank. The pipe 30 also forms a convenient source of supply from which to draw water to slake the lime in the slaking vat. Pipe 31 is provided for this purpose. In the main 1 are preferably provided a manually operated gate 32 and a meter 33.

We prefer to make the treating tank with a conical or convex bottom 34, introducing the water at the lowest point or apex thereof as this produces a better distribution and facilitates mixing.

The operation of the apparatus is as follows: Gate 32 and valves 10, 15, 18 and 19 being closed, lime or other treating substance is put into vat 22 and slaked by water from pipe 31 if slaking is necessary. Valve 24 is then opened and tank 3 charged with a suitable quantity of the treating agent, the valve 21 being left open to permit escape of air. Valve 24 is then closed, valve 15 opened and water permitted to enter tank 3 till it overflows at valve or faucet 21 showing that the tank is full. Valves 15 and 21 are then closed and valves 10 and 19 opened. After allowing sufficient time to elapse for the lime in the treating tank to settle, the apparatus is put into operation by opening the gate 32. When the water begins to flow through main 1, a drop in pressure immediately occurs beyond the gasket 6 with the result that some of the water is shunted through pipe 4 and spray head 16, and, passing through the substance in tank 3, dissolves some thereof, and carries it through pipe 5 back into the main. The treated water discharged into the lower part of tower 2 rises slowly therethrough, leaving all mud and impurities behind, and flowing clear from the upper part of the tower to the supply tank 35. When the tank 35 is full, the pressure on diaphragm 28 overcomes the tension of spring 27 and closes valve 26 until water is drawn from the supply tank causing the pressure to fall again.

It will be seen that the operation of mixing as carried out by our apparatus is continuous throughout the time of flow and all water passing to the settling tower is thoroughly mixed with the treating agent in a predetermined proportion before entering the tower. Also by reason of the admission of the fluid at the bottom of the treating chamber and its outlet at the top, none of the reagent finds its way into the main by gravity but only as it is carried therein by the by-passed fluid. Much greater uniformity of the mixture is thus obtained than if quantities of the reagent are injected into the tower at intervals and left to mix as they may with the contents thereof.

It is desirable to place valve 26 either beyond the point of discharge of pipe 5 into the main, as shown, or to have it in advance of pipe 4, in order that its operation may not disturb the pressure ratio between the main and by-pass and affect the proportion of the treating agent introduced. Gate 32 should in like manner not be placed between the inlet and the outlet of the by-pass. We find the use of gaskets to cause the drop of pressure in the main pipe and to regulate the flow through the pipe 4 most satisfactory, as they determine these most important factors in the operation of the apparatus, positively, and leave no chance for an ignorant or careless operator to make a mistake, as might occur if the regulation of the flow by the adjustment of valves were left to him. Withal, if at any time a change should become necessary, a gasket having a different sized orifice could be cheaply made and readily put in place.

Having thus described our invention, we claim:

1. In fluid treating apparatus, a main through which the fluid to be treated passes as a continuous uni-directional current, and means for gradually and continuously introducing a treating agent into the fluid passing through said main, in quantities definitely proportioned to the amount of fluid passing through said main, said means comprising a tank for the treating agent having a conoidal bottom, a pipe leading from the main to said tank, a spray head located at the apex of said bottom through

which said pipe discharges, an outlet pipe leading from the top of said tank and discharging into said main at a point farther along the same in the direction of the flow of the fluid than the point of connection of the inlet pipe, the cross-sectional area of said main being reduced at a point between the inlet and outlet pipes.

2. In fluid treating apparatus, in combination, a main for the fluid to be treated, a receptacle for the treating agent, a pipe leading from the main to said receptacle, a constriction of fixed area in said pipe, a by-pass around said constriction and a valve in said by-pass, and a pipe leading from the receptacle back to the main at a point beyond the point of connection of the first named pipe.

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