No. 651,835. Patented June 19, 1900.

W. M. DEUTSCH.

APPARATUS FOR CLARIFYING WATER.

(Application filed Dec. 27, 1897.)

(No Model.) 5 Sheets—Sheet 1

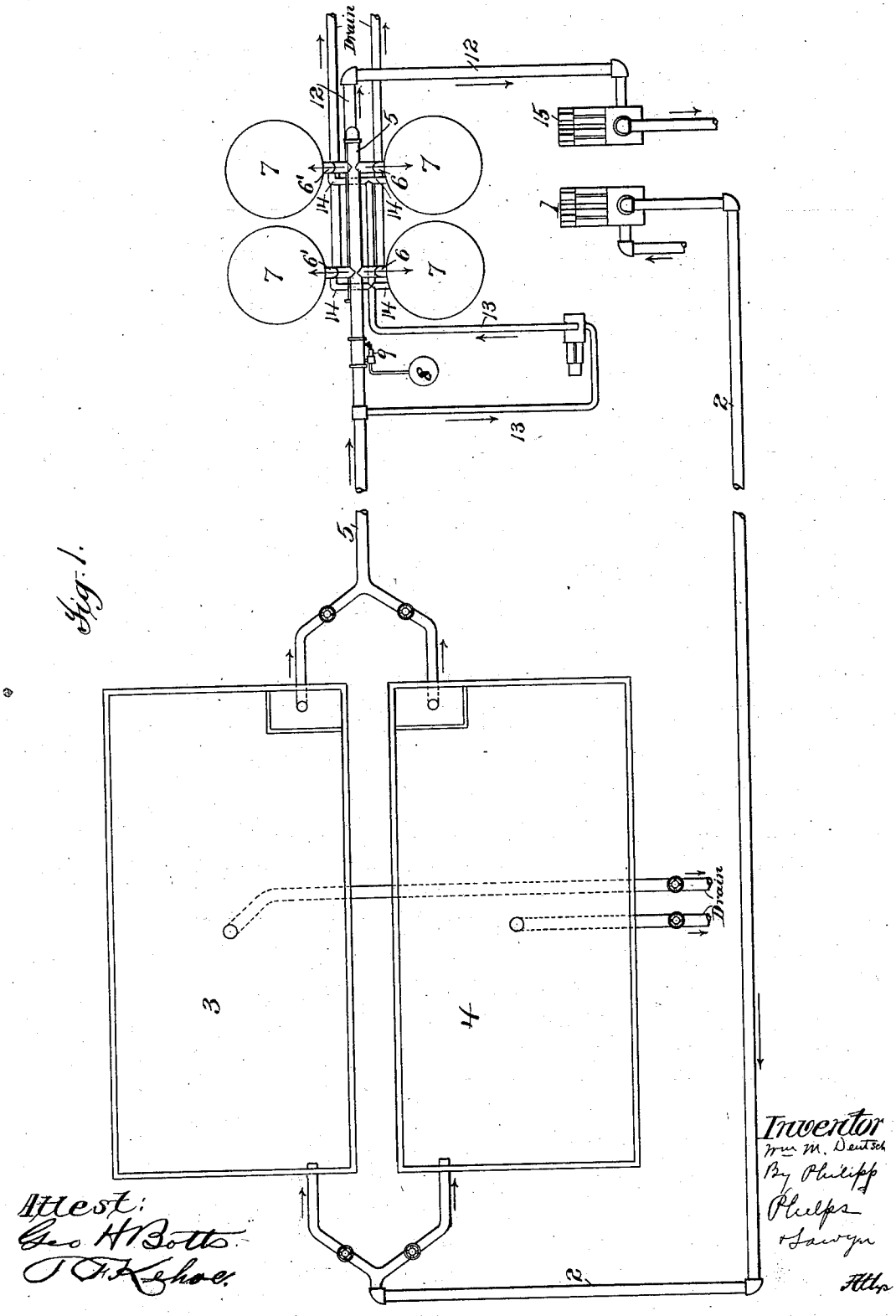


Fig. 1.

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Fig. 2.

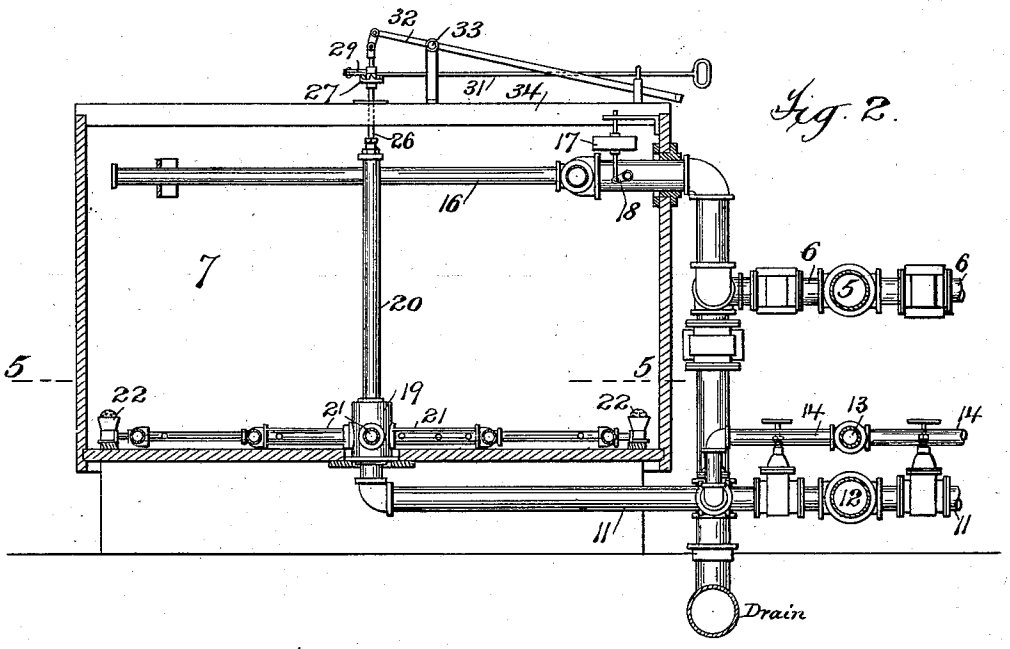


Fig. 3.

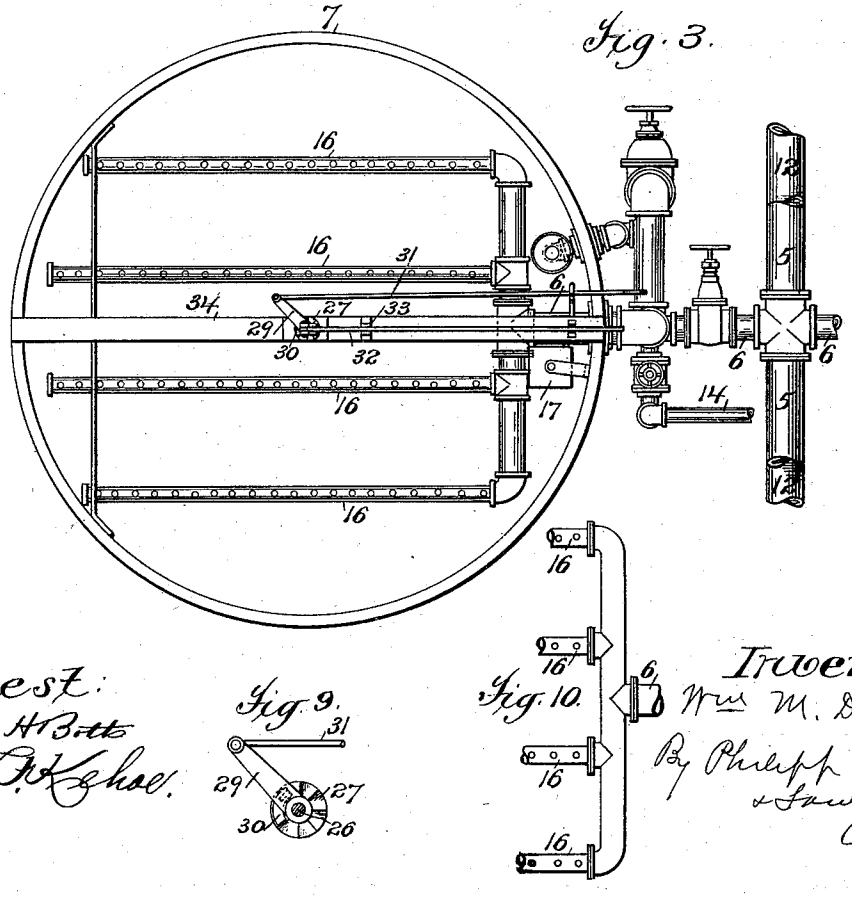


Fig. 9.

Fig. 10.

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Fig. 4.

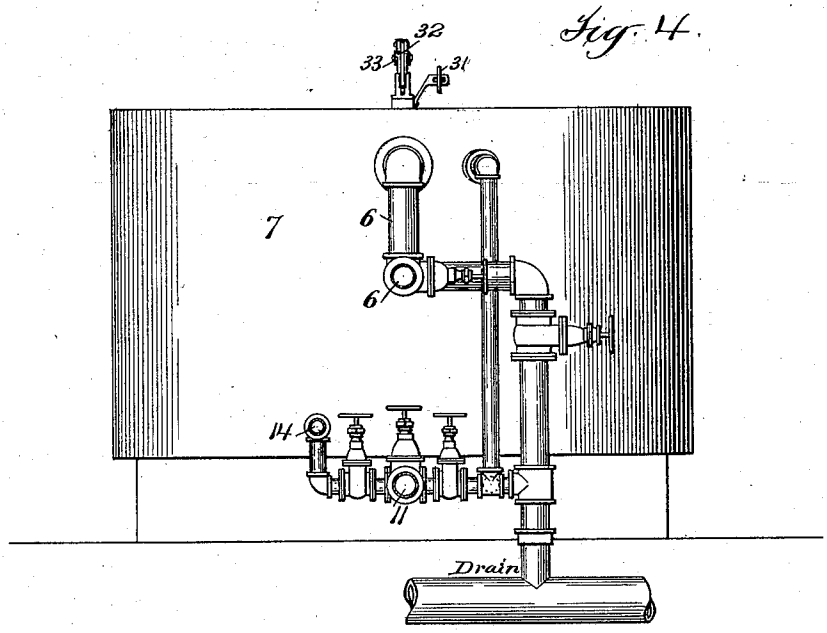
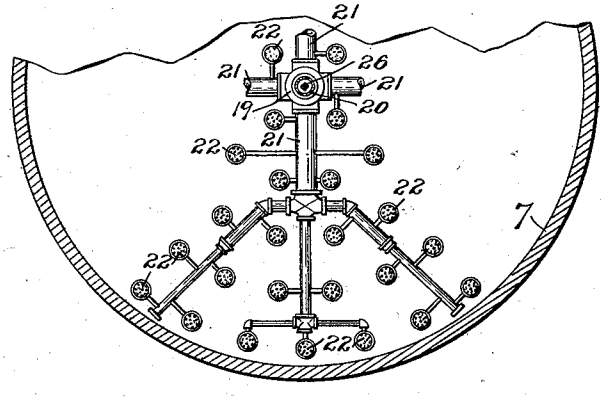


Fig. 5.



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Fig. 6.

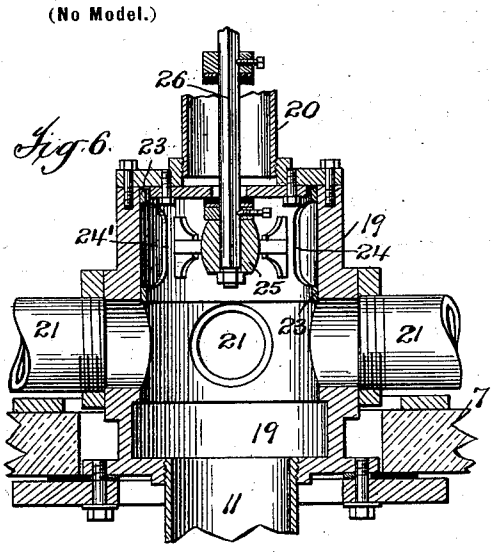


Fig. 7.

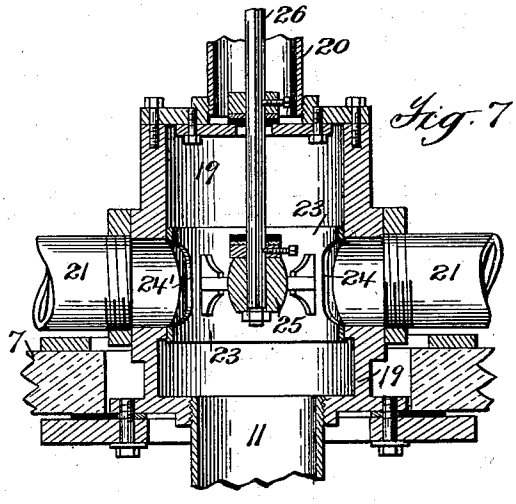
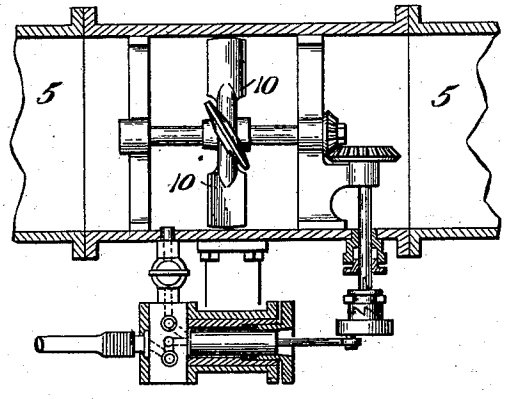


Fig. 8.



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Fig. 11.

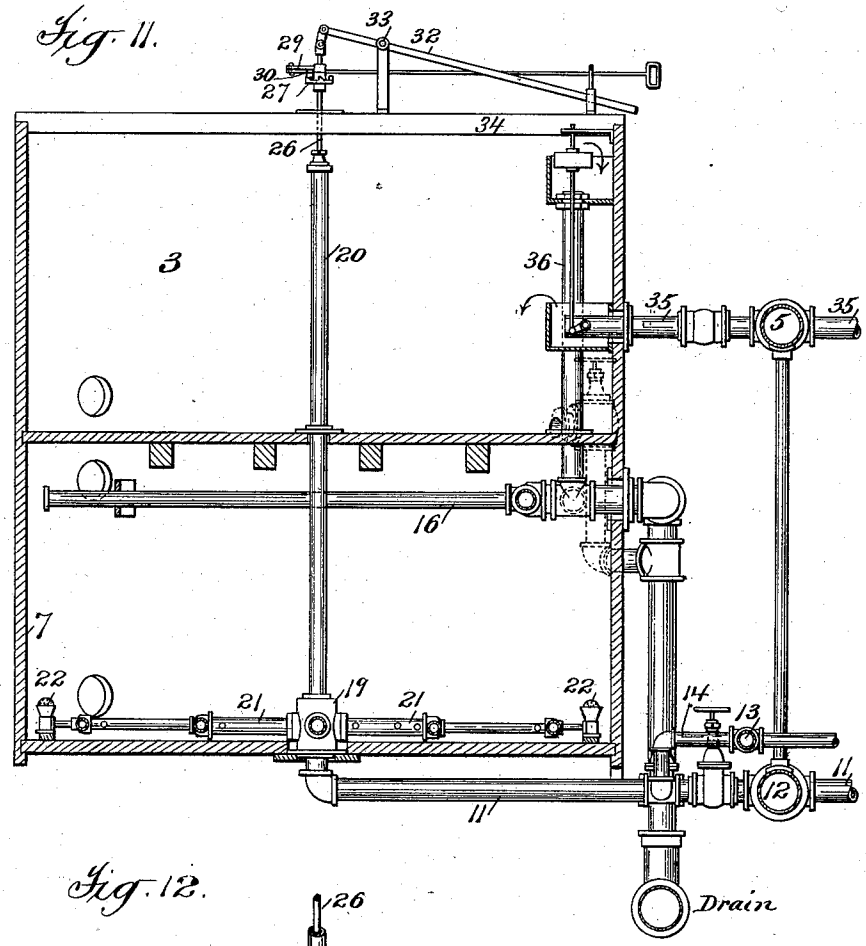
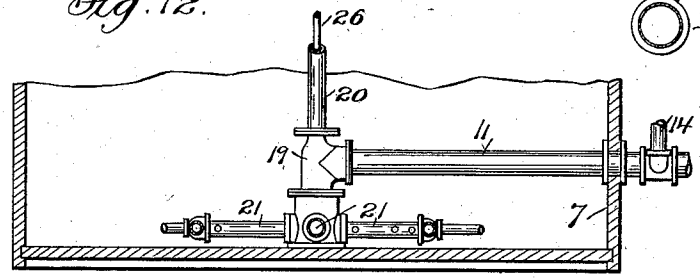


Fig. 12.



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UNITED STATES PATENT OFFICE.

WILLIAM M. DEUTSCH, OF ELIZABETH, NEW JERSEY.

APPARATUS FOR CLARIFYING WATER.

SPECIFICATION forming part of Letters Patent No. 651,835, dated June 19, 1900.

Application filed December 27, 1897. Serial No. 663,446. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM M. DEUTSCH, a citizen of the United States, residing at Elizabeth, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Apparatus for Clarifying Water, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

My invention relates to the clarification of water on a considerable scale. Heretofore it has been common to clarify water by passing it through filters, with the preliminary addition of a coagulant added to the water on its way to or into the filter. This process of clarification is maintained until the filter-bed becomes more or less polluted with the sediment arrested therein, whereupon a current of water is forced through the filter-bed in a reverse direction and thence to the drain, which has the effect of stirring up the granular mass of the bed, grinding its particles against each other and therefore loosening the sediment, and thus quickly freeing the particles of the filter-bed from the sediment and conveying the latter to the sewer. It has been found necessary in this washing process to employ filtered water for the purpose, since the unfiltered water was likely to leave the bed in a more or less foul condition. After the completion of the washing the filtration of the water is again commenced and continued until the bed again becomes foul, when the same operation is repeated. This is a very effective method of obtaining clear water, but it of course involves the expense necessary for a sufficient amount of coagulant to collect all the suspended matter in the water undergoing treatment, and it also involves the expense of filtering the water used for washing the filters, and this expense, especially where the water is heavily charged with suspended matter, is frequently very large. It is one of the objects of my present invention to reduce the expense due to both these causes. Efforts have been made to accomplish this result heretofore by passing the water after the addition of a coagulant into a settling-basin and permitting it to deposit therein a portion of the sediment before flowing on to the filter. This process, however, presents the difficulties that a larger instead of a smaller quantity of coagulant is required in order to accomplish any result in the sedimentation-basin, and, moreover, the coagulated sediment in the settling-basin through which the water passes becomes offensive and injurious to the water.

In my present invention I propose to avoid the expense and difficulties above pointed out by an apparatus combining with the coagulo-filtration process a preliminary sedimentation of the water by passing the same through settling-basins, in which I permit it to remain for a suitable length of time before it receives its charge of coagulant and passes to the filter. In this way a considerable portion of the suspended matter is removed by the sedimentation, and the amount of coagulant required for completing the clarification of the water is very substantially reduced. I also propose to use water which has passed through the settling-basins, but has not passed through the filter or been charged with the coagulant, for washing the filter-beds. I find that this water is sufficiently pure for the purpose, and its use as compared with the use of water entirely clarified does not involve any substantial expense, since the use of settling-basins is inexpensive.

My invention further consists in apparatus for securing an automatic regulation of the amount of coagulant supplied to the water entering the filter. The most convenient and inexpensive form in which to use a coagulant is that of a solution. Where water is pumped to the filter, it is customary to use an auxiliary pump for the coagulant and to cause it to inject into the water about to be filtered a certain measured quantity for each stroke of the pump. An automatic and perfect regulation is thus secured; but where the water is supplied to the filters by gravity this, of course, cannot be done. Now the regulation of the feed of the coagulant to the flow of the water is a matter of great importance, since the flow is continually varying. Thus if, as in the case shown in the illustrations connected herewith, there be a plant of four filters those filters will be at intervals successively one at a time thrown out of operation for washing, so that at such times the number of filters in operation will be three instead of four. The amount of water passing through the filters

will therefore be reduced by twenty-five per cent., and the amount of coagulant required will be reduced in a like proportion. Moreover, as the filters become clogged their capacity falls, so that a clean filter will pass twenty per cent. more water than the same filter just before it is washed. Therefore the amount of water required by the filters is subject to a large variation, and it is desirable that the feed of the coagulant should be accurately and automatically adjusted to this variation. If the adjustment is not automatic, it is almost impossible to make it exact, and, moreover, the manual adjustment requires considerable expense and trouble. In order to meet these difficulties, my present invention has been devised, the same consisting of the introduction of a motor of any suitable form into the conduit or closed pipe conveying the water into the filter and connecting this motor with mechanism and causing it to operate the same, so as to force the coagulant into the supply-pipe. Thus the speed of operation of the mechanism feeding the coagulant will be controlled and graduated in accordance with the flow of the water through the supply-pipe. Any suitable form of motor may be used for this purpose and also any suitable form of mechanism operated thereby for forcing the coagulant into the supply-pipe. A convenient construction is that of a propeller as a motor and a pump as the forcing mechanism, as herein shown.

It is preferable that the supply in connection with which this invention is applied should flow through a closed rather than an open pipe, since in the former case the variations in rapidity of flow will affect the mechanism more accurately and closely than where the pipe is open.

In cases where the filter-chambers used are closed no further apparatus than that above mentioned will be required; but where gravity-filters are employed open at the top it will be found desirable to use an automatically-controlled valve for keeping the water in the filter-chamber at a constant height.

It should be noted that whereas the motor which is operated by the current of water in the supply-pipe is shown herein as operating directly the mechanism for forcing the coagulant into the supply-pipe such an arrangement is not necessary for the practice of my invention, since said mechanism may be operated from another source of power, provided that its operation is controlled by the motor.

My invention further consists in apparatus for facilitating and expediting the washing of the filter in sections.

In the drawings annexed hereto, Figure 1 is a plan view, on a reduced scale, of a plant embodying my invention. Fig. 2 is a cross-section of one of the filters of said plant, showing the connections thereto. Fig. 3 is a plan view of the part shown in Fig. 2. Fig. 4 is a side view of the filter. Fig. 5 is a plan view of a portion of the bottom of the same. Fig. 6 is a vertical sectional view, on an enlarged scale, of the valve and its connected parts which control the flow of water in the washing operation. Fig. 7 is a similar view showing the different positions of the valve. Fig. 8 is a sectional view of the supply-pipe, taken at the point where the connection with the coagulant-pump is made. Fig. 9 is a detail of the ratchet by which the valve above referred to is moved. Figs. 10, 11, and 12 show modifications.

Referring to said drawings, the water is pumped by the pump 1 from any suitable source of supply through pipe 2 to settling-basins 3 4 and thence to pipe 5, from which it flows through branches 6 6′ to filters 7. On its passage from the settling-basin to the filter the water receives a charge of coagulant, which is pumped from the coagulant-tank 8 by the pump 9, this pump being connected by gearing to the paddle-wheel 10, mounted in the supply-pipe and moved by the current of the water flowing therein. (See Fig. 8.) The water passes through the filters and out through branch pipe 11 (not shown in Fig. 1) to the main 12 for the filtered water.

The pipe 13 for conveying washing-water to the filters branches from pipe 5 between the settling-basins and the coagulant-feed and connects with the filtered-water-exit pipe from all the filters through branch pipes 14. The filtered water is delivered by the pump 15.

The unfiltered water is introduced to the filter-bed through perforated pipes 16. A float 17 is provided in the filter-chamber, controlling the valve-lever 18 in the supply-pipe for keeping the water in the filter at a proper level.

At the bottom of the filter, near the center, is a vertical hollow cylindrical casting 19, which has within it a chamber connecting at the bottom with the filtered-water pipe 11 and at the top with the vertical pipe 20, passing out through the sand bed. From the casting 19 radiate a number of pipes 21, provided with perforated valves 22, into which the filtered water passes on its way to the pipe 11, these valves being provided in order to prevent the escape of sand with the filtered water. Other constructions of devices for this purpose may be used, it being only essential for the purposes of this part of the invention that the pipes have some kind of perforations for admitting the water thereto. Fitted within the casting 19 is a hollow cylindrical sectional pipe 23, which is adapted to either slide up and down or to revolve in the casting. This sectional pipe may have one or more perforations, two perforations 24 24′ being shown in the present case, adapted to register with the openings into the pipes 21. It will thus be seen that when the sectional pipe 23 is lowered it will cut off two of the pipes 21, leaving free communication between the pipe 11 and the other pair of these pipes 21, as shown in Fig. 7. If the

sectional pipe 23 be turned ninety degrees, the pair of pipes 21 (shown open in Fig. 7) will be closed and the other pair will be opened. Connected to the sectional pipe 23 is a hub 25, from which rises a rod 26, which extends up through the pipe 20 and through the top of the filter. Outside of the filter it carries a horizontal rigid ratchet-plate 27 firmly upon it, above which is an arm 29, loosely mounted upon the shaft, carrying a pawl 30, and connected to it also is a hand-rod 31. By pulling forward the rod 31 and pushing back upon it the rod 26 and the sectional pipe 23 are rotated. Attached to the upper end of the rod 26 is a lever 32, fulcrumed at 33 to a support rising from a cross-piece 34. By depressing the outer end of this lever the sectional pipe 23 is elevated, and by raising the outer end of said lever it is depressed.

The flow of water through the settling-basins 3 and 4 is preferably so timed that the water remains in those basins a sufficient time to effect a partial deposit of the suspended matter contained in it, and it then flows on into the pipe 5.

The feed of the coagulant by the pump 9 will be adjusted so as to deliver precisely the amount required for the water passing through the pipe, the feed being automatically regulated by the strength of the current flowing through the same.

When the filters become clogged with sediment, they are washed by forcing a reverse flow of water through the same taken from the main after it has passed the settling-basins, which is by means of the valve, composed of the pipe-section 23 in the casting 19, directed in series to each pair of pipes 21. Thus the whole force of the washing-current is thrown upon half of the filter-bed, and thereby the washing is made more thorough and satisfactory. It is of course practicable to vary the number of pipes 21 and also the number of said pipes which undergo the washing operation at the same time, and the latter may be readily done by varying the number and location of the holes.

In Fig. 10 I have shown a modified construction of the cross-pipe to which the perforated pipes 16 are connected, it being in this case cast in one section instead of nine, as shown in Fig. 3.

In the modification shown in Fig. 11 the settling-basin is placed in an upward extension of the filter-shell, the water entering through the main supply-pipe and branch 35 and passing down into the filter through pipe 36. The construction is otherwise the same as above described.

In the modification shown in Fig. 12 the exit-pipe 11 is placed above the bottom of the filter instead of below it, for the reason that it is thus more convenient of access.

What I claim is—

1. An apparatus for water clarification having in combination a water-supply pipe, two or more settling-basins, a filter, means whereby the water may be directed into and taken from one or the other settling-basins at will, and means for introducing a coagulant into the water on its way from either of the settling-basins to the filter, substantially as described.

2. The combination of a settling-basin, a filter, means for introducing a coagulant into the water on its way from the settling-basin to the filter, a pipe connected to convey sedimented water to the bottom of the filter for washing the same with a reverse current, and means for forcing water through said pipe, substantially as described.

3. The combination of a settling-basin, a filter, means for introducing a coagulant into the water on its way from the settling-basin to the filter, a pipe or pipes, provided with perforations, under the filtering-bed, a pipe connected to convey sedimented water directly to the first-mentioned pipe for washing the same with a reverse current, and means for forcing water through said pipe, substantially as described.

4. The combination of a filter, a conduit for conveying the water thereto, a motor operated by the flow of water in the conduit, and means controlled by the motor for forcing a coagulant into the water to be filtered, substantially as described.

5. The combination of a filter, a closed supply-pipe therefor, a motor operated by the flow of water in the pipe, and means controlled by the motor for forcing the coagulant into the water to be filtered, substantially as described.

6. The combination of a filter, a conduit for supplying water thereto, in which the water is caused to flow to the filter by gravity, a motor operated by the flow of water in the conduit, and means controlled by the motor for forcing a coagulant into the water to be filtered, substantially as described.

7. The combination of a filter, a closed supply-pipe therefor, in which the water is caused to flow to the filter by gravity, a motor operated by the flow of water in the pipe, and means controlled by the motor for forcing a coagulant into the water to be filtered, substantially as described.

8. The combination of a filter, a supply-conduit therefor, a motor operated by the flow of water in the conduit, and a pump controlled by the motor for forcing a coagulant into the water to be filtered, substantially as described.

9. The combination of a filter, a closed supply-pipe therefor, a motor operated by the flow of water in the pipe, and a pump controlled by the motor for forcing a coagulant into the water to be filtered, substantially as described.

10. The combination of an open-topped filter, a supply-conduit therefor, a motor operated by the flow of water in the pipe, means controlled by the motor for forcing a coagulant into the water to be filtered, and an automatically-controlled valve for regulating

the flow of water through the supply-pipe, substantially as described.

11. The combination of a filter, a closed supply-pipe therefor, a propeller-wheel operated by the flow of water in the pipe, and means controlled by the propeller-wheel for forcing a coagulant into the water to be filtered, substantially as described.

12. A filter-washing device consisting of a chamber with a plurality of pipes, provided with perforations, leading therefrom under different portions of the bed, and means for directing a washing-current through one or more of the pipes while the other pipes are closed, substantially as described.

13. A filter-washing device consisting of a pipe-section with four pipes, provided with perforations, leading therefrom under different portions of the bed, and means for directing a washing-current through two of said pipes while the other pipes are closed, substantially as described.

14. A filter-washing device consisting of a central chamber, a plurality of pipes, provided with perforations, leading therefrom under different portions of the bed, and means for directing a washing-current through one or more of the pipes while the other pipes are closed consisting of a pipe-section fitting within said chamber and provided with one or more openings registering with the entrances to said pipes and arranged to open one or more of said pipes while the others are closed and means for moving the inner pipe-section vertically up and down and revolving the same, to control said entrances, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM M. DEUTSCH.

Witnesses:
T. F. KEHOE,
J. A. GRAVES.