J. J. FEARON.

CIRCULATING AND MIXING DEVICE.

APPLICATION FILED OCT. 15, 1912.

1,079,753.

Patented Nov. 25, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

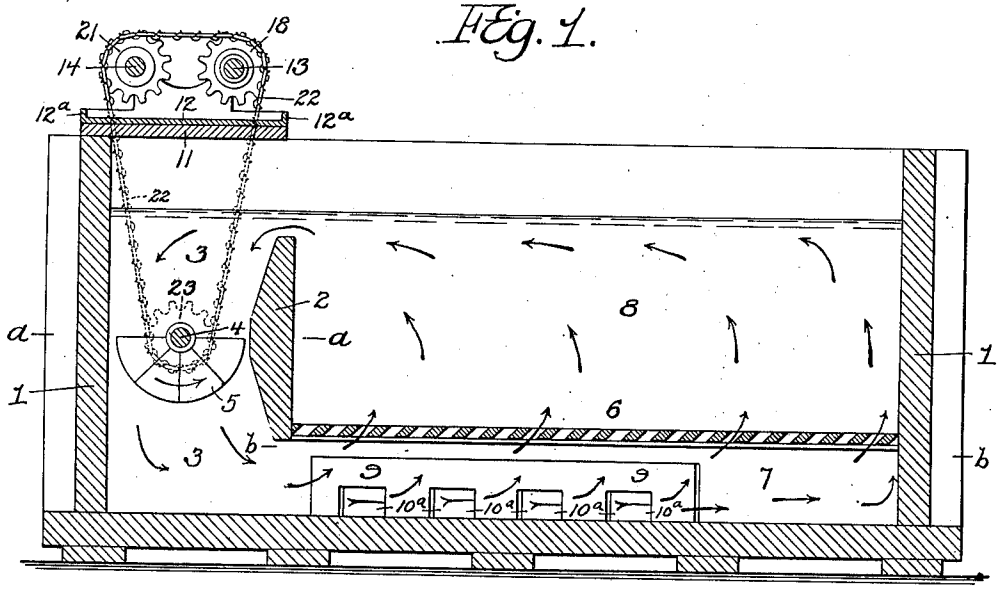
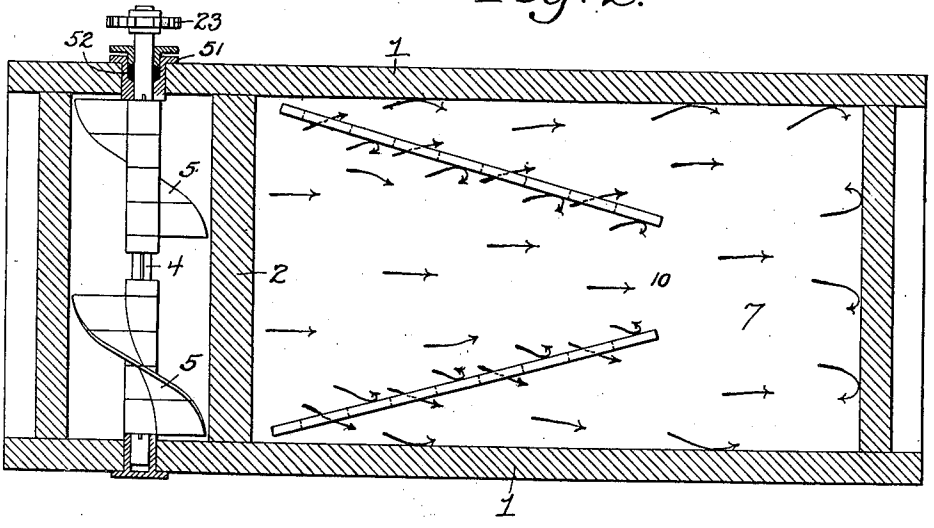


Fig. 2.



WITNESSES

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3 SHEETS—SHEET 2.

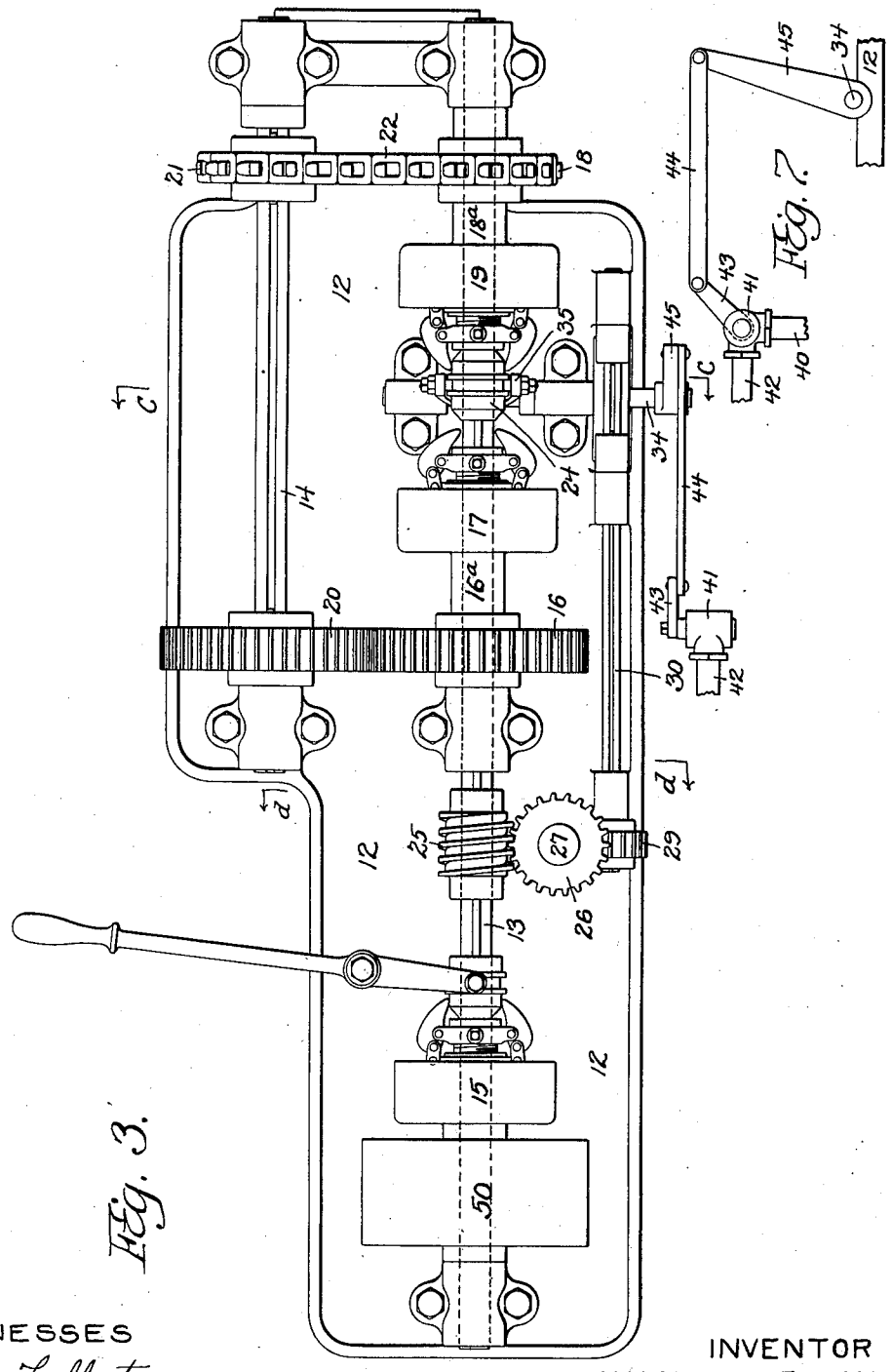


Fig. 3.

Fig. 7.

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3 SHEETS—SHEET 3.

Fig. 4.

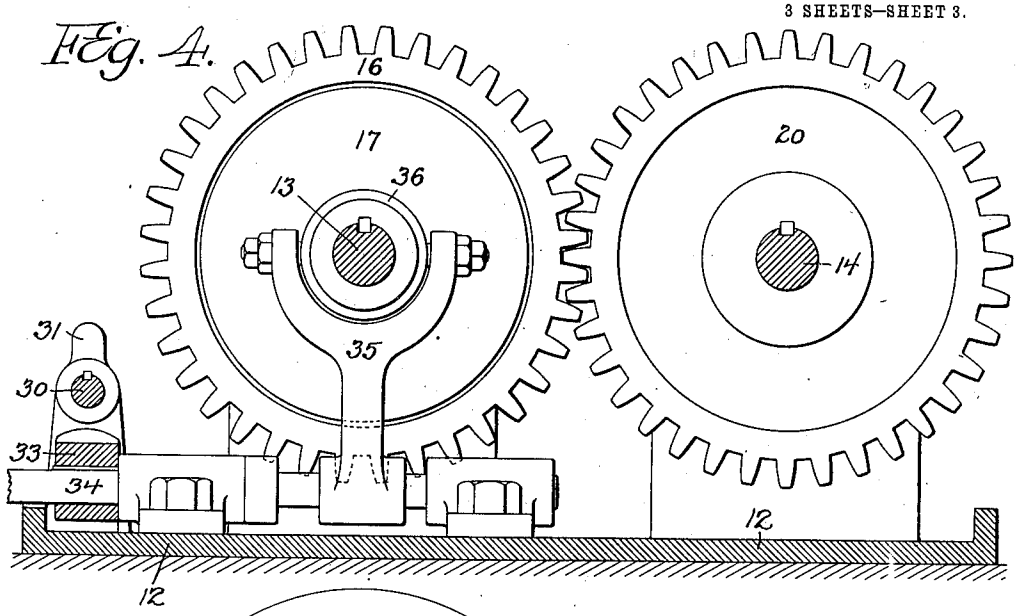


Fig. 5.

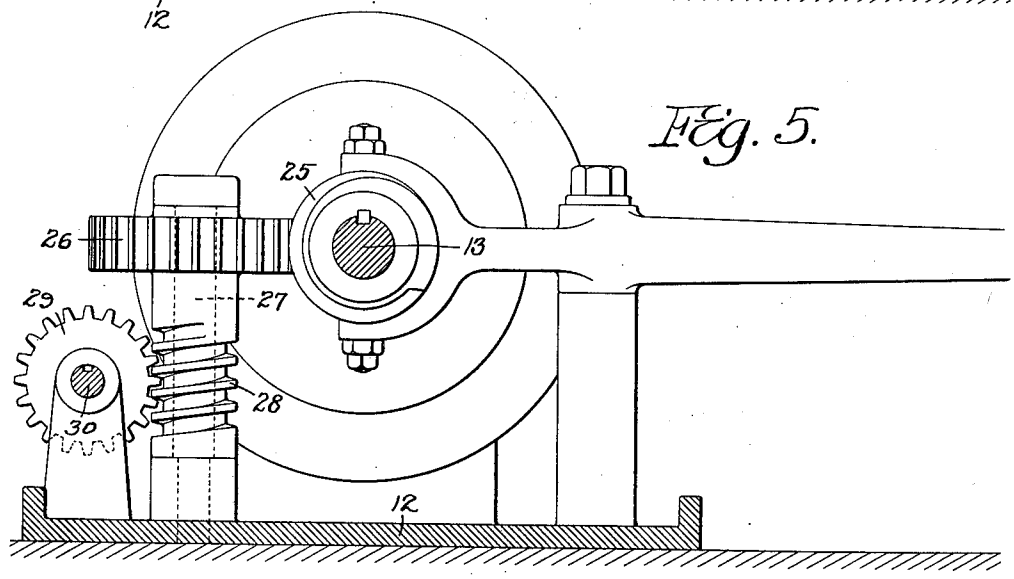
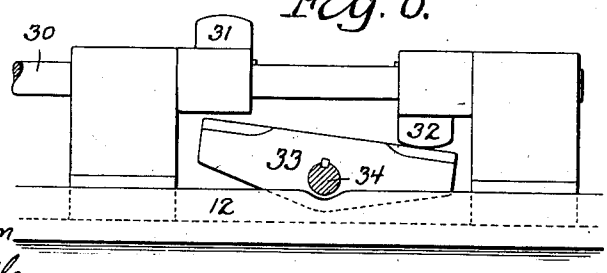


Fig. 6.



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CIRCULATING AND MIXING DEVICE.

1,079,753. Specification of Letters Patent. Patented Nov. 25, 1913.

Application filed October 15, 1912. Serial No. 725,938.

To all whom it may concern:

Be it known that I, JAMES J. FEARON, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Circulating and Mixing Devices, of which the following is a specification.

My invention consists of certain improvements in the liquid circulating and mixing device constituting the subject of my application, Serial No. 667,157, filed December 21, 1911, the objects of my present invention being to insure equable circulation and distribution of the liquid throughout the body of the tub, vat, or other vessel (hereinafter, for convenience, referred to as a "tub"); to prevent contamination of the liquid; to effect automatic change in the direction of circulation of the liquid, to accomplish this latter result without subjecting to severe strain the devices whereby the circulation of the liquid is effected, and, in the case of a dye tub, to prevent entanglement of the yarn.

In the accompanying drawings—Figure 1 is a longitudinal section of a tub provided with a liquid circulating and mixing device in accordance with my invention; Fig. 2 is a horizontal section of the same partly on the line *a*—*a*, Fig. 1, and partly on the line *b*—*b*, Fig. 1; Fig. 3 is a plan or top view of the driving and reversing mechanism for the liquid circulating device; Fig. 4 is a transverse section on the line *c*—*c*, Fig. 3; Fig. 5 is a transverse section on the line *d*—*d*, Fig. 3; Fig. 6 is a side elevation of certain elements of a clutch-operating device constituting part of said reversing mechanism, and Fig. 7 is a side elevation of a valve-operating device constituting part of my invention. Fig. 3 is on a larger scale than Figs. 1 and 2, and Figs. 4, 5 and 6 are on a still larger scale.

The tub 1, in which the liquid is contained, may be intended for different uses, such, for instance, as a dye tub, a vessel for mixing different liquids for the production of emulsions, or for any other purpose in which circulation, or circulation and agitation of the liquid is required, especially where the direction of flow of the liquid needs to be reversed at intervals.

Near one end of the tub is a transverse partition 2, which extends completely across the tub from side to side, there being, however, a space between its lower end and the bottom of the tub, and the height of the partition being, by preference, such that it terminates below the normal level of liquid in the tub. The partition 2 thus serves to form, at one end of the tub, a passage 3 leading from the top to the bottom of the tub, and that side of the partition 2 which is adjacent to said passage is reversely beveled or curved so as to reduce the width of the passage 3 at a point between the top and bottom of the same, as shown in Fig. 1.

Extending transversely of the tub, through the passage 3, at the reduced portion of the latter, is a shaft 4, upon which are mounted a pair of spirally disposed blades 5, one at each end of the passage 3, as shown in Fig. 2, these blades being of reverse pitch as also indicated in Fig. 2, and each being, by preference, composed of a number of sections, as shown. It has been found in practice that, when such a spiral blade is rotated in the passage 3, it will, when rotated in the direction indicated by the arrow in Fig. 1, cause downward flow of the liquid through said passage and when rotated in the opposite direction will cause upward flow of the liquid through the passage, consequently, by proper rotation of the blades, the liquid can be caused to flow through the passage either from the bottom to the top of the tub or from the top to the bottom of the same, and, by periodically changing the direction of rotation of the blades 5, the direction of flow can be likewise reversed. Preferably, each blade has but a half turn around the shaft and they are disposed on opposite sides of the shaft so as to balance one another and prevent injurious strains upon the shaft.

Besides the upward or downward flow of the liquid through the passage 3 there is also a lateral flow of the liquid in said passage, and this results in such agitation of the liquid within the passage as will cause intimate admixture of the component parts of the liquid body, and will prevent the settling of any particles held in mechanical suspension therein. As the shaft 4 is always submerged when the tub is being used, the bearing 51 through which the driving end of the shaft projects is provided with a stuffing box 52.

When the tub is used for dyeing purposes it is usually provided with a grated false bottom 6, between which and the bottom of the tub is a chamber 7, and when the liquid is caused to flow downwardly through the passage 3 it passes beneath the partition 2 and flows longitudinally through this chamber 7, from one end of the same to the other, until it strikes the end of the tub farthest removed from the circulating device and is deflected upwardly by reason of such contact. The upward flow of the liquid in the central portion of the tub and in that end of the tub adjacent to the circulation device is, under these circumstances, deficient, and in order to correct this objection and insure a substantially uniform upward flow throughout all portions of the treating chamber 8 of the tub, I locate in the chamber 7 a pair of deflecting plates 9, which extend diagonally inward from the sides of the tub toward the center of the same, as shown in Fig. 2, but provide, between their inner ends, a throat 10 for the longitudinal travel of liquid toward the end of the tub. Those portions of the body of liquid located at and near each side of the chamber 7 contact with the deflectors 9, and, as the latter converge, the liquid is crowded toward the center of the chamber 7 and is compelled to escape upwardly through the perforated false bottom 6. The resultant of the two forces acting upon the liquid is a flow in a forwardly and upwardly inclined course, hence the perforations in the false bottom are likewise inclined so as to permit of the flow of the liquid through them with the least resistance. The deflectors 9 are preferably provided with passages 10^a at the bottom, through which liquid can flow in the directions indicated by the arrows in Fig. 2, so as to strike the sides of the tub and be deflected upwardly thereby.

The mechanism for driving the propeller shaft 4 and reversing the direction of rotation of the same at intervals is shown in Figs. 1, 3, 4, 5 and 6, and is as follows: At the top of the tub, above the chamber 3, is a hood 11, which serves as a support for a bed plate 12, the latter being provided with suitable bearings for three shafts 13, 14 and 30, as shown in Fig. 3, and being provided also, around its edge, with an upstanding flange 12^a, which prevents escape into the tub of oil dripping from the shafts, bearings, or gearing above the plate, and therefore prevents contamination of the liquid in the tub. The shaft 13 is rotated by power applied thereto in any suitable manner, as, for instance, by means of a pulley 50 which receives a driving belt from a pulley on any convenient power shaft. It is advisable to connect this pulley to the shaft 13 through the medium of a friction clutch 15, whereby the application of power to the shaft can be cut off whenever desired.

A spur wheel 16 is secured to a sleeve 16^a which constitutes the hub of a clutch drum 17, the latter being clutched to or released from the shaft 13, as desired, by means of suitable friction or other clutch mechanism, a friction clutch being preferred and being shown in the present instance. A sprocket wheel 18 is secured to the hub 18^a of a clutch drum 19, which can be clutched to or released from the shaft 13 by mechanism similar to that employed in connection with the clutch drum 17. The spur wheel 16 is in mesh with a similar spur wheel 20, keyed or otherwise secured to the shaft 14, and a sprocket wheel 21 is likewise keyed or otherwise secured to said shaft.

A drive chain 22 engages the sprocket wheels 18 and 21 and is also in engagement with a sprocket wheel 23 on a projecting end of the shaft 4, as indicated in Figs. 1 and 2. By reason of this arrangement of gearing the shaft 13, although rotating continuously in one and the same direction, may be caused to impart rotative movement in either direction to the shaft 4, the direction of rotation being susceptible of reversal whenever desired.

The lever mechanism of both clutches 17 and 19 is operated by a single duplex cone 24, free to slide on the shaft 13 between the two clutches, the cone having such play that when the shaft is in driving engagement with one clutch the other clutch will be free from such engagement, and, when the cone 24 occupies a position midway between the two clutches, the shaft will be free from driving engagement with either clutch.

When the shaft 13 is in driving engagement with the clutch 17 power will be transmitted to the shaft 4 through the medium of the spur wheels 16 and 20, shaft 14, sprocket wheel 21, chain 22 and sprocket wheel 23, the sprocket wheel 18 being free to turn loosely on the shaft 13, as said shaft is free from driving engagement with the clutch 19. Supposing, therefore, that the direction of rotation of the shaft 13 is clockwise, the direction of rotation of the shaft 14 and consequently of the spur wheel 20, sprocket wheels 18 and 23, and shaft 4, will, under these circumstances, be counter-clockwise. If, however, the shaft 13 is in driving engagement with the clutch 19, power will be transmitted to the shaft 4 from said shaft 13 through the medium of said clutch 19, the sprocket wheel 18, chain 22, and sprocket wheel 23, and the direction of rotation of said shaft 4 will be clockwise, the shaft 14 with its sprocket wheel 21 and spur wheel 20 likewise rotating in a clockwise direction, but the spur wheel 16 running loosely in a counter-clockwise direction, as the shaft 13 is free from driving engagement with the

clutch 17. It will be evident, therefore, that change in the direction of rotation of the shaft 4 can be effected by simply reversing the position of the cone 24 and that when the latter is in mid position, the rotation of the shaft 4 will be arrested.

In order to provide for the automatic shifting of the cone 24 at the proper times and also to insure the maintenance of the cone in mid position for a limited time during each of such shifting movements I employ mechanism as follows: Secured to the shaft 13 is a worm 25 which is in mesh with a worm wheel 26 on an upright shaft 27, the latter being provided with a worm 28 which is in mesh with a worm wheel 29 on the shaft 30, the latter being parallel with and at one side of the shaft 13. Secured to the shaft 30 are a pair of tappets 31 and 32, one of these tappets projecting from the shaft in one direction and the other in the opposite direction, as indicated in Fig. 6. The tappets act upon the oppositely projecting arms of a lever 33 which is secured to a rock shaft 34 mounted in bearings on the bed plate 12 and carrying a forked lever 35 which engages a grooved collar 36 on the cone 24, as shown in Figs. 3 and 4.

When one arm of the lever 33 has been fully depressed by the tappet 31 the cone 24 will be adjusted into position to engage the clutch 17 with the shaft 13 and free the clutch 19 from engagement therewith, and when the other arm of said lever has been fully depressed by the tappet 32 these conditions will be reversed, the clutch 19 being in engagement with the shaft 13 and the clutch 17 being free from engagement therewith. The speed of rotation of the shaft 30 is very low as compared with the speed of rotation of the shaft 13 and by proper regulation of these speeds any desired amount of time may be permitted to intervene between the successive shiftings of the cone 24, a corresponding amount of time therefore intervening between the changes in the direction of flow of the liquid in the tub 1.

When either of the tappets 31 or 32 starts to act upon its respective arm of the lever 33, it will move said lever, and consequently the cone 24, so as to tend to withdraw the latter from engagement with the levers of the active clutch, but as soon as these levers reach the tapered portion of the cone they will move the latter to mid or inoperative position, this action resulting in the withdrawal of the arm of the lever 33 from contact with the tappet which started its movement. The parts will remain in this position until the continued rotation of the shaft 30 again brings the acting tappet again into contact with the arm of the lever 33 and continues the movement of the cone 24 so as to cause it to engage the levers of the opposite clutch and establish driving connection between the shaft 13 and the said clutch. A certain amount of time must therefore elapse between the release of one clutch from the shaft 13 and the engagement of the other clutch therewith, and during this time the rotation of the shaft 4 will be arrested.

Between the clockwise and counter-clockwise rotations of the shaft 4, therefore, ample opportunity is afforded for the previously flowing body of liquid in the tub 1 to expend the greater portion of its force or even to come to rest, thereby preventing the severe strains upon the circulating devices which result from attempts to force the liquid to flow in one direction while it is still flowing with full force in the opposite direction.

In Fig. 7 of the drawing, 40 represents the pipe, which in the case of a dye tub, supplies steam to the same for the purpose of heating the dye liquor. This pipe has a valve chest 41 from which projects a branch 42, the latter usually leading to the lower portion of the dye chamber where it communicates with perforated pipes suitably disposed for distributing the steam throughout the body of dye liquor, the steam usually issuing from said perforated pipes in an upward direction. When the steam is thus injected into the dye liquor while the latter is flowing upwardly in the treating chamber it has a tendency to cause agitation of the depending skeins of yarn and results in the entanglement of these skeins, and, in order to correct this objection, I provide for cutting off the flow of steam during the time that the upward flow of dye liquor is maintained and permitting flow of the steam again when the direction of flow is changed and the liquor flows downwardly in the treating chamber. For this purpose the valve in the chest 41 has an arm 43 connected by a link 44 to an arm 45 on the clutch-operating rock shaft 34, as shown in Fig. 7, whereby, when said shaft is moved so as to throw the clutch into such position as to cause operation of the circulator to cause flow of the liquid from the bottom to the top of the tub, the valve in the chest 41 will be moved so as to cut off the flow of steam through the branch 42 and when the shaft is moved so as to throw the clutch to the opposite position and thus cause operation of the circulator to cause flow from the top to the bottom of the tub, the valve will be opened and the flow of steam resumed.

While I have shown and described, as an embodiment of my invention, a combination of parts which I have found to be effective in practice and which I therefore prefer, it should be understood that my invention, in its broader aspect, is not limited to a combination of such specific parts, as modifications of the same may be readily devised by

those skilled in the art without departing from the main principles of my invention.

I claim:—

1. The combination, in a liquid circulating device, of a vessel having a treating chamber and a chamber below the same, means for causing the liquid to flow longitudinally through the lower chamber, and a deflector in said chamber disposed at an angle to the direction of flow and serving by contact with the liquid to direct a portion of the same upwardly into the treating chamber.

2. The combination, in a liquid circulating device, of a vessel having a treating chamber and a chamber below the same, means for causing the liquid to flow longitudinally through said lower chamber, and deflectors located in said chamber but providing a passage between them for the flow of liquid to the end of the chamber.

3. The combination, in a liquid circulating device, of a vessel having a treating chamber and a chamber below the same, means for causing the liquid to flow longitudinally through said lower chamber, and deflectors located in said chamber but extending only part way throughout the length of the same.

4. The combination, in a liquid circulating device, of a vessel having a treating chamber and a chamber below the same, means for causing flow of liquid longitudinally through said lower chamber, and inclined deflectors located in said chamber but extending only part way throughout the length of the same and providing a passage between them for the direct flow of liquid to the end of the chamber.

5. The combination, in a liquid circulating device, of a vessel having therein a passage leading from the upper to the lower portion thereof and contracted in width at an intermediate point, a shaft extending transversely through said contracted portion of the passage, and a spiral blade secured to said shaft.

6. The combination, in a liquid circulating device, of a vessel having therein a passage leading from the upper to the lower portion thereof and contracted in width at an intermediate point, a shaft extending transversely through said contracted portion of the passage, and spiral blades secured to said shaft, one of said blades being located at one end of the passage and having a right hand pitch and the other being located at the other end of the passage and having a left hand pitch.

7. The combination, in a liquid circulating device, of a vessel having a passage leading from the upper to the lower portion thereof and bounded in one direction by a partition presenting to the passage a reversely beveled face, a shaft extending transversely through the passage substantially in line with the apex of said reversely beveled face of the partition, and a spiral blade secured to said shaft.

8. The combination, in a liquid circulating device, of a vessel having a passage leading from the upper to the lower portion thereof and bounded in one direction by a partition presenting to the passage a reversely beveled face, a shaft extending transversely through the passage substantially in line with the apex of said reversely beveled face of the partition, and spiral blades secured to said shaft, one located at one end of the passage and having a right hand pitch, and the other located at the other end of the passage and having a left hand pitch.

9. The combination, in a liquid circulating device, of means for causing circulation of the liquid, automatic means for changing the direction of flow of said liquid at intervals, and automatic means for arresting the operation of the circulating device, at each such change, until the flowing body of liquid has substantially expended its force.

10. The combination, in a liquid circulating device, of rotary circulating devices which cause flow in a direction dependent upon the direction of rotation thereof, automatic means for reversing such direction of rotation at intervals, and automatic means for arresting rotation at each change of direction until the flowing body of liquid has substantially expended its force.

11. The combination, in a liquid circulating device, of a vessel having a passage leading from the upper to the lower portion thereof, a shaft extending transversely through said passage, and spiral blades secured to said shaft, each of said blades having a half turn around the shaft and one of them being located on one side of the shaft and at one end of the passage and the other on the other side of the shaft and at the other end of the passage.

12. The combination, in a liquid circulating device, of a vessel having a treating chamber and a chamber below the same, a partition between said chambers, said partition having openings extending through the same and disposed at an angle in respect to the vertical, means for causing the liquid to flow longitudinally through the lower chamber, and deflectors located in said lower chamber and serving to direct a portion of the liquid upwardly through the inclined passages in the partition.

13. The combination, in a liquid circulating device, of a vessel having means for causing circulation of the liquid either upwardly or downwardly therethrough at will, of a pipe for supplying steam to the liquid, a valve in said pipe and means connected

with the reversing mechanism for the circulating device whereby said valve is operated so as to cut off the flow of steam during the upward flow of the liquid and permit flow of steam during the downward flow of the liquid.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

JAMES J. FEARON.

Witnesses:
KATE A. BEADLE,
HAMILTON D. TURNER.