March 7, 1950 R. B. CARTER, JR 2,499,816

FLOCCULATION AND MIXING APPARATUS

Filed June 28, 1947

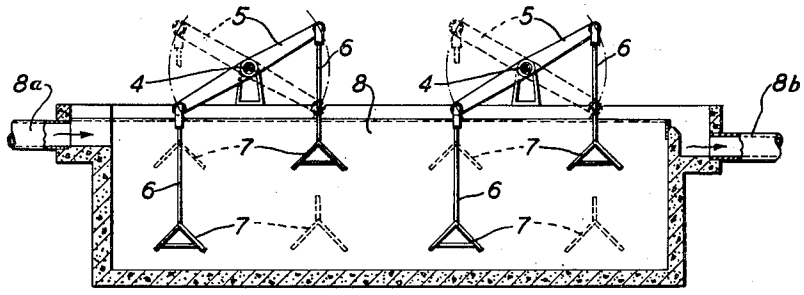


FIG. 1.

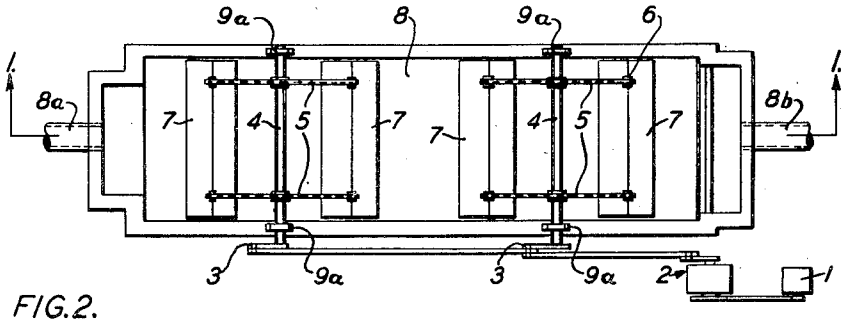


FIG. 2.

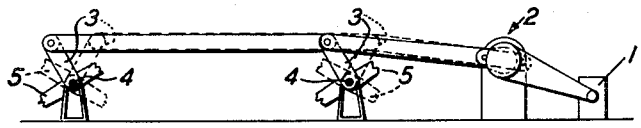


FIG. 3.

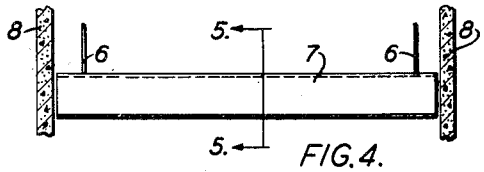


FIG. 4.

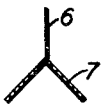


FIG. 5.

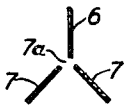


FIG. 6.

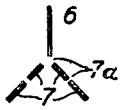


FIG. 7.

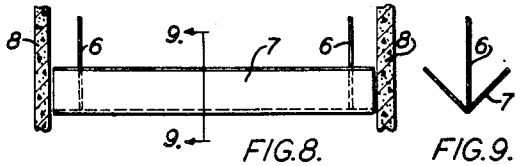


FIG. 8.

FIG. 9.

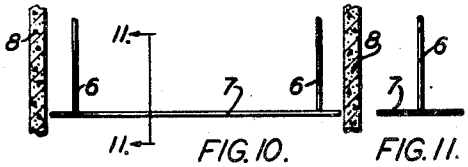


FIG. 10.

FIG. 11.

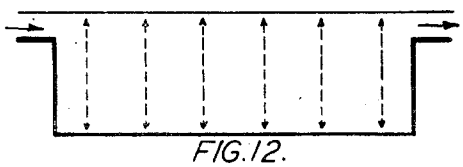


FIG. 12.

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Patented Mar. 7, 1950

2,499,816

UNITED STATES PATENT OFFICE

2,499,816

FLOCCULATION AND MIXING APPARATUS

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Application June 28, 1947, Serial No. 757,699

5 Claims. (Cl. 259—27)

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This invention relates to improvements in mixing and flocculation and apparatus for the same. The invention provides for more effective flocculation of liquids containing solids by a to and fro agitative action instead of by the usual rotative action.

Its main advantages are, first, a more complete mixing and, in flocculation, with less violence in proportion to mixing effect than any other known apparatus, and, secondly, the elimination of all under liquid bearings or other wearing parts such as shafts, chain or gear drives, etc. Next, its design ability to lend itself to complete agitative coverage of any existing tank or other vessel of any shape.

The invention consists in positive agitative means back and forth (reciprocally) thru the flow of liquid. These means are operated by means outside of the liquid. Preferably, such agitating means are moved by a pivoted beam to the ends of which agitators are supported, so that as one group of agitators goes up, the other group goes down. The agitators themselves may have various forms in section, to gently move the liquid.

The method consists in subjecting a flowing liquid to a spaced movement contrary to the natural flow of the liquid, under gentle transposition of the liquid.

The invention will be further described, embodiments thereof shown in the drawings, and the invention will be finally pointed out in the claims.

In the accompanying drawings:

Fig. 1 is a central longitudinal section of an embodiment of my invention;

Fig. 2 is a plan view of the same;

Fig. 3 is a side view of one form of actuating mechanism;

Fig. 4 is a detail front view of one of the paddles;

Fig. 5 is a vertical section taken on line 5—5 of Fig. 4;

Fig. 6 is a similar section of a modified form of the paddle.

Fig. 7 is a similar section of another modified form;

Fig. 8 is a detail front view of another form of paddle;

Fig. 9 is a vertical section taken on line 9—9 of Fig. 8;

Fig. 10 is a detail front view of another form of paddle;

Fig. 11 is a vertical section on line 11—11 of Fig. 10; and

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Fig. 12 is a diagrammatic view showing the vertical to and fro movements.

Similar characters of reference indicate corresponding parts throughout the various views.

Referring to the drawings, the mechanism shown comprises a tank or other container 8 having an inlet 8a and outlet 8b, a source of motive power 1, a driving mechanism 2, creating reciprocal motion to an arm 3, which is attached to a shaft 4. These shafts 4 extend across container 8 and are supported by bearings 9a for the shaft 4. At suitable intervals are crossbeams 5 forming what is commonly known as walking beams. Suspended from the outer ends of the walking beams 5 by means of supports 6 are paddles, plates or discs 7.

In operation, the liquid to be treated is passed through the container 8, with the liquid maintained at a prearranged level which submerges the paddles 7. The motive power 1 is started causing the arms 3 to move backward and forward and therefore the shaft 4 to turn backward and forward in partial rotation or oscillation. This in turn caused the rigidly attached walking beams 5 to rock and the paddles 7 to move up and down through the liquid causing complete and gentle agitation and mixing.

The paddles or plates 7 conform with any shaped container preventing the possibility of so called short circuiting prevalent in the prior types of rotating paddles. Short circuiting is the ability to, and the actuality of, a portion of the liquid to be treated flowing in a straight path through the container from entrance to exit without being properly mixed or agitated.

It is important that in creating efficient flocculation gentle but very complete mixing is required. Anything but very gentle will cause the formed floc to break up instead of getting larger as desired.

The nature of the reciprocating motion is such that the agitative means slows down to zero at the end of each up and down stroke and then gradually speeds up to its maximum at the center of the stroke. This eliminates any slappy action of the agitative means in or against the liquid, which would tend to break up the floc.

In Fig. 12, is shown, diagrammatically, the substantially horizontal flow of the liquid, and the double arrowed lines show the paths of the paddles in planes contrary to the general flow. This brings about a thorough intermixing enabling the formation of the flocs, without destroying their agglomerations. There need not be movements, as shown on drawings as vertical as only

approximate movements are contemplated, the essential being that such movements be of gentle nature.

Assuming the flow to be in a horizontal direction as shown and to be in the nature of horizontal laminations. The transverse vertical movements of the liquid thus transpose these assumed laminations, and assure an interchange assisting in the development of the flocs.

In Figs. 4 to 11, there are shown alternative forms of paddles or agitators.

The principle of flocculation is known to the art and need not be particularly described.

The paddles may take various forms, the essential here being a working surface at an angle to the direction of movement of the paddle. A simple form is shown in Figs. 10 and 11. Further forms are shown in Figs. 4 and 5, 6, 7 and 8. The paddles may be provided along their lengths with openings *7a*, as shown in Figs. 6 and 7 to permit the passage of the liquid, as the paddles ascend or descend.

All of the paddles shown in the drawings, have a length shorter than the width of the tank or container, so that their ends are spaced from the tank wall and free of the same.

As the walking beams may be operated by any suitable means, the walking beam actuating mechanism is illustrated separately in Fig. 3, this being also shown in plan view as part of Figure 2.

I have described several forms of my invention, but obviously various changes may be made in the details disclosed without departing from the spirit of the invention as set out in the following claims. What I claim is:

1. In an apparatus for effecting clarification of turbid liquids, having a tank with an inlet at one end and with an outlet at its longitudinal other end, the liquid to be cleared flowing from the inlet to the outlet, the combination of a plurality of paddles transverse to the flow and spaced along the flow, supporting members for said paddles, means raising the alternate supporting members, and means lowering the other supporting members while the alternate supporting members are ascending, said paddles extending across substantially the entire width of the flow but short of said width having their ends spaced from the tank wall and free of the same, said paddles being at an angle to said supporting members.

2. In an apparatus for effecting clarification of turbid liquids, having a tank with an inlet at one end and with an outlet at its longitudinal other end, the liquid to be cleared flowing from the inlet to the outlet, the combination of a plurality of paddles transverse to the flow and spaced along the flow, supporting members for said paddles, means raising the alternate supporting members, and means lowering the other supporting members while the alternate supporting members are ascending, said paddles extending across substantially the entire width of the flow but short of said width having their ends spaced from the tank wall and free of the same, said paddles being at an angle to said supporting members, said angle being a right angle.

3. In an apparatus for effecting clarification of turbid liquids, having a tank with an inlet at one end and with an outlet at its longitudinal other end, the liquid to be cleared flowing from the inlet to the outlet, the combination of a plurality of paddles transverse to the flow and spaced along the flow, supporting members for said paddles, means raising the alternate supporting members, and means lowering the other supporting members while the alternate supporting members are ascending, said paddles extending across substantially the entire width of the flow but short of said width having their ends spaced from the tank wall and free of the same, and said paddles being at an angle to said supporting members, said angle being an acute angle.

4. In an apparatus for effecting clarification of turbid liquids, having a tank with an inlet at one end and with an outlet at its longitudinal other end, the liquid to be cleared flowing from the inlet to the outlet, the combination of a plurality of paddles transverse to the flow and spaced along the flow, supporting members for said paddles, means raising the alternate supporting members, and means lowering the other supporting members while the alternate supporting members are ascending, said paddles extending across substantially the entire width of the flow but short of said width having their ends spaced from the tank wall and free of the same, said paddles being at an angle to said supporting members, said angle being an obtuse angle.

5. In an apparatus for effecting clarification of turbid liquids, a tank with an inlet at one end and with an outlet at its longitudinal other end, the liquid to be cleared flowing from the inlet to the outlet, a plurality of paddles spaced along the length of the tank, each extending across substantially the entire width of the tank but short of the side walls thereof, and means raising and lowering the spaced paddles in alternation, vertically through the flow.

RALPH B. CARTER, JR.

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The following references are of record in the file of this patent:

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Disclaimer

2,499,816.—*Ralph B. Carter, Jr.*, Maywood, N. J. FLOCCULATION AND MIXING APPARATUS. Patent dated Mar. 7, 1950. Disclaimer filed Sept. 5, 1951, by the inventor, the assignee, *Frederick E. Stuart* agreeing and consenting, to the extent set forth.

Hereby enters this disclaimer to claims 1, 3, 4, and 5 of said patent, and of the subject matter of claim 2, except as claim 2 is limited by the following words, to wit: "said angle being a right angle."

[*Official Gazette October 9, 1951.*]