Aug. 26, 1941. W. C. WEBER ET AL 2,253,543

LIQUID CLARIFICATION

Filed Aug. 30, 1938 2 Sheets-Sheet 1

Fig. 1.

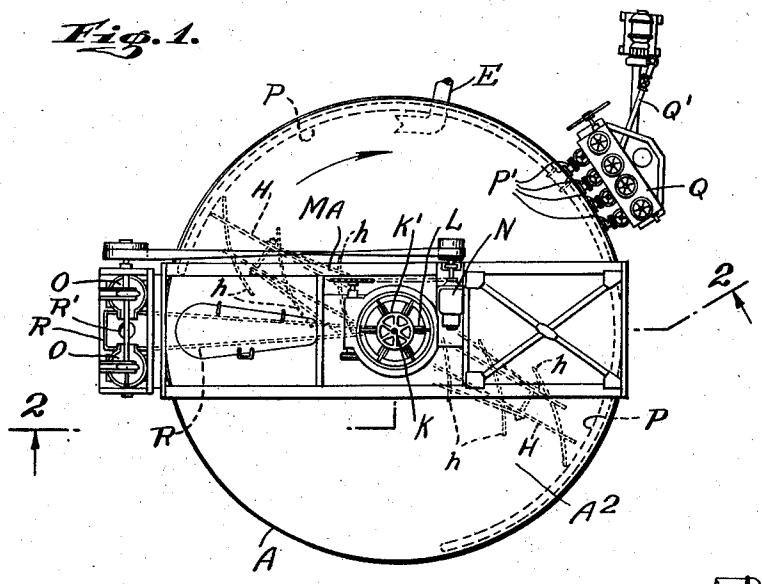



Fig. 2.

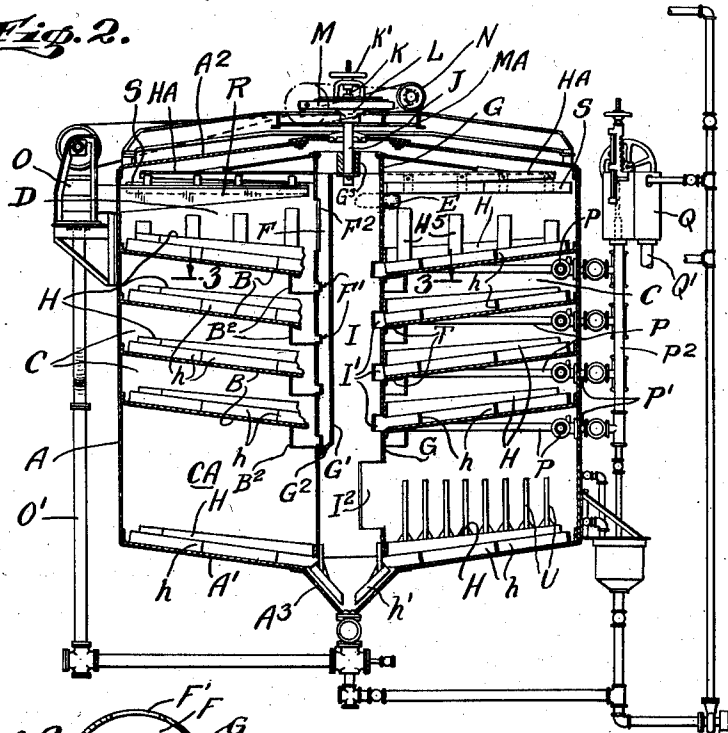
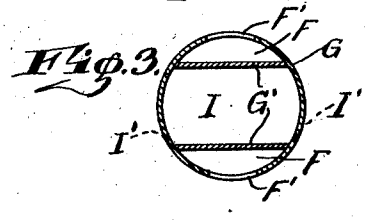



Fig. 3.




INVENTORS
WILLIAM E. GEISSLER
WILLIAM C. WEBER
BY
John E. Hubbell
ATTORNEY

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Fig. 4.

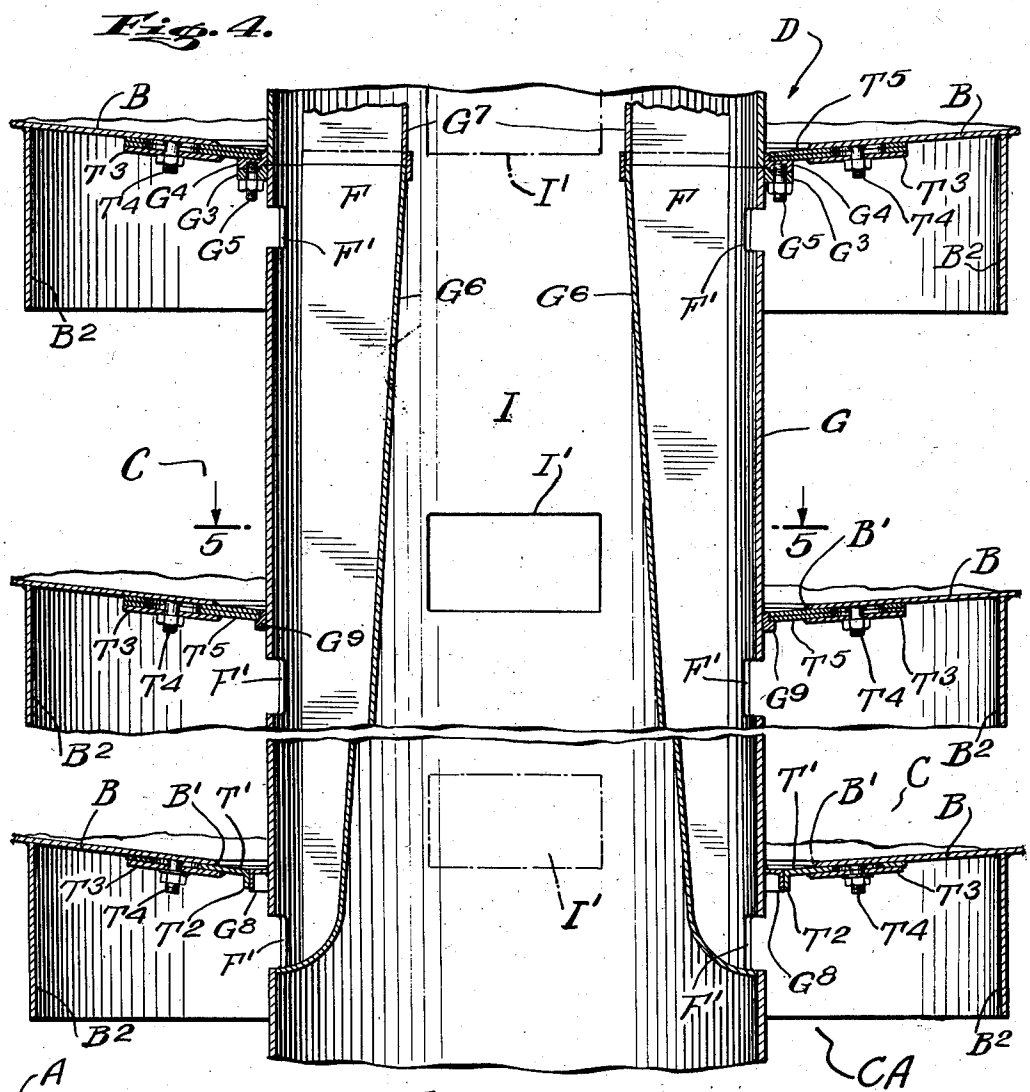
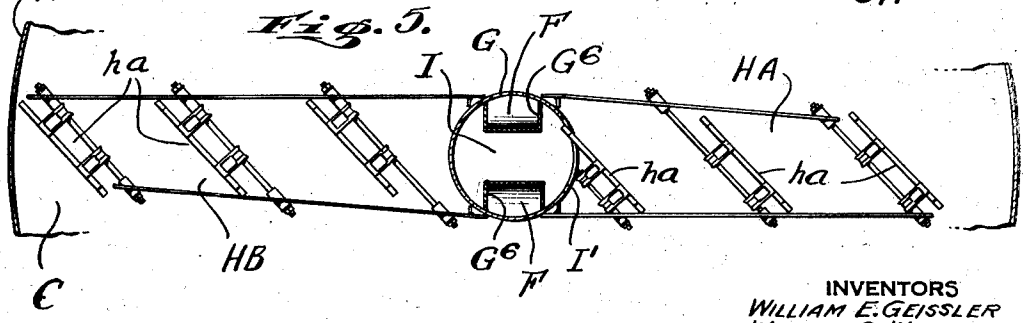



Fig. 5.




INVENTORS
WILLIAM E. GEISSLER
WILLIAM C. WEBER
BY
John E. Lovell
ATTORNEY

LIQUID CLARIFICATION OR PURIFICATION,

Examiner

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Patented Aug. 26, 1941

2,253,543

# UNITED STATES PATENT OFFICE

2,253,543

## LIQUID CLARIFICATION

William C. Weber, Westport, Conn., and William E. Geissler, Ossining, N. Y., assignors to Petree & Dorr Engineers, Inc., New York, N. Y., a corporation of Cuba

Application August 30, 1938, Serial No. 227,464

11 Claims. (Cl. 210—55)

The invention relates to tray clarifiers or thickeners, for the sedimentation of solids suspended in liquids and the removal of the sedimented solids. More particularly the invention is designed for use in the clarification of juices to be treated incident to the making of cane and beet sugar, although it has other uses.

In accordance with the present invention, the liquid to be clarified is conditioned, preparatory to sedimentation, by subjecting it to a flocculating action adapted to produce relatively large floc aggregates, and the primary object of the invention is to provide a practical method of moving the flocculated liquid into the different superposed clarifier compartments of the tray clarifier in such manner as to avoid appreciable disintegration or disruption of the floc aggregates. A more specific object, of primary practical importance, is to provide for such non-disruptive movement of the flocculated liquid into the clarifying compartments, while at the same time providing for the removal from the compartments of settled solids in the general manner heretofore developed and made standard practice in the use of tray clarifiers.

In accordance with such standard practice, solids collecting on the trays forming the bottom walls of the different clarifying compartments are worked to the center of each compartment and passed downwardly out of the latter through a central opening in its bottom wall, by a rotating structure comprising a vertical body or shaft portion extending through the central openings in the bottom walls of the compartments, and supporting one or more scraper arms with attached scraper means in each clarifying compartment.

A clarifier constructed in accordance with the present invention for the attainment of the above mentioned objects comprises a rotating structure which is not only adapted to serve the above mentioned solids removing purpose, but is provided for the purposes of the present invention with vertically disposed passages or channels in its shaft or body portion, which forms a flow-path for the down flow of settled solids from the clarifying compartments, and a separate flow-path for the downflow of flocculated liquid to said compartments, from a flocculating and conditioning chamber directly above the clarifying compartments. Each of said flow-paths may comprise one or a plurality of vertical passages, but in any case the cross-sectional area of the flow path for the passage of conditioned liquid to the clarifying compartments should be large enough, relative to the volume of flow therethrough, to avoid the disintegrating or disruptive action on floc aggregates which is an inevitable result of a somewhat higher velocity of flow. While the maximum safe flow velocity of the conditioned liquid passing to the clarifying compartments will be different in different cases, in general the linear velocity of flow should be of the order of one foot per second, and a fraction only of the velocity which would be required to prevent solids from settling out of the liquids from accumulating in and clogging the flow-path if the latter were appreciably longer and included a portion or portions generally horizontal rather than vertical.

For a full appreciation of the advantages obtained by passing the conditioned liquid into the clarifying compartment in the manner just described, account should be taken of the character and manner of producing relatively large floc aggregates. When hot, limed sugar juice, for example, is subject to agitation in a conditioning chamber, small suspended solid particles collide with one another and coalesce or are coagmented as a result of cohesion and adhesion into larger floc aggregates and are thereby rendered settleable. For the optimum practical sedimentation results the collisions of the suspended particles must be as numerous as is practically possible, and the collisions must be strong enough to effect integration and coagmentation but not strong enough to disintegrate the flocs formed. In practice, the desired conditioning action is effected by creating currents in the liquid which may be initiated by various methods. For the purposes of the present invention, such currents may be induced by the jet action of the liquid fed into the conditioning chamber, which is desirably supplemented in some cases by the action of paddles, supported by the above mentioned rotating structure and moved through the conditioning chamber along circular paths.

In a clarifier constructed in accordance with the present invention, the conditioning chamber above the clarifying compartment may readily have the dimensions and form suitable for the subjection of the liquid therein to the agitation needed for the colonization or integration of the smaller suspended particles into flocs, properly conditioned for settleability. To obtain full advantage from the settleability standpoint of the conditioning action, it is necessary to transfer the liquid from the conditioning chamber to the clarifying compartment in such manner as to avoid significant disintegration or disruption of the flocs, which, even when well conditioned, are still fragile and easily broken, and when broken are difficult to reflocculate. Substantial floc disintegration is an inevitable result of subjecting the liquid to pumping action, and objectionable floc disintegration is practically inevitable as a result of friction and eddy currents, when the liquid is moved through piping with the velocity of at least a few feet per second, required to prevent the piping, if

not substantially vertical, from becoming clogged by accumulations of solids settling out of the liquid. With the present invention, the liquid flows or drifts from the conditioning chamber to each adjacent clarifying compartment to replace clarified liquid and settled solids withdrawn from the compartment, at a rate slow enough to reduce floc disintegration in the short vertically disposed flow-path to a relatively minute and unobjectionable amount, and slow enough to avoid flow disturbances in the compartment.

To facilitate a suitable, quiet movement of the liquid to be clarified from the rotating structure into the different clarifying compartments and to minimize its agitation or contamination of said liquid by the movement of the solids being removed from the compartments into the rotating structure, the latter is advantageously in the form of a cylindrical shell or drum and formed with one or more ports opening directly into the upper portion of each clarifying compartment from the conditioned liquid flow-path in the rotating structure, and with one or more ports opening from the lower portion of the compartment directly into the flow-path in said structure for the settled solids. In practice, said rotating shell or drum is advantageously made of rolled metal sheet material, and the walls of the flow-paths therein are formed in part by the shell and in part by internal partition plate parts, welded at their edges to the shell, and is of a diameter large enough to insure flow paths of ample cross section and to permit the passage of a workman through the shell for construction or repair purposes.

With the quiet introduction of the conditioned liquid into each clarifying compartment and its distribution therein without contamination by the movement of settled solids out of the compartment, it becomes practically possible to take full advantage of the fact that the primary sedimentation action is directly dependent upon the horizontal area of the sedimentation chamber and is substantially independent of the chamber depth or the time required for gravitational movement from the top to the bottom of the compartment. In consequence, the use of the present invention not only permits of a reduction in the vertical dimensions of the different clarifying compartments, but permits of a desirable increase in the number of superposed clarifying compartments which it is practically feasible to include in a single clarifying unit or tank structure.

In a clarifier constructed in accordance with the present invention, the lowermost compartment of the clarifying tank serves the double purpose of a clarifying compartment, and of a thickening compartment in which solids separated from liquid being clarified in that compartment and solids passing into that compartment from the upper clarifying compartments, may concentrate or thicken, to the end of reducing the liquid in the liquid and solids mixture removed from the clarifier, and ordinarily subjected to a filtration or other liquid and solids treatments, particularly in the clarification of sugar juices. The thickening action, unlike the primary sedimentation action, is a time action, and the lowermost compartment is advantageously of substantially greater depth than the upper compartments. To further the thickening action movable arms or picket-like vertically disposed members are provided in the lower compartment being ordinarily connected at their lower ends to one or more of the scraper arms in that chamber. As these uprising arms or pickets move slowly through the thickening solids, the latter streamline to each side of each picket and clear liquid passes into the space immediately behind the arm or picket. The liquid thus liberated from the solids is free to pass up into the upper portion of the compartment to be withdrawn therefrom with the liquid directly clarified therein. The use of such pickets augments and speeds up the thickening action, by facilitating the liberation of liquid, entrapped, so to speak, in the sponge like mass, or matrix, of thickening solids in the lower portion of the thickening chamber. The use of the special thickening provisions just described, makes it practically feasible to withdraw solids from the upper clarifying compartments in a less concentrated condition than would be otherwise desirable, and this makes possible a further reduction in the vertical dimensions of the last mentioned compartments.

The various features of novelty which characterize the present invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and the specific objects obtained with its use, reference should be had to the accompanying drawings and descriptive matter, in which are illustrated and described various forms of apparatus adapted for use in the practice of the invention.

Of the drawings:

Fig. 1 is a somewhat diagrammatic plan view of an improved clarifier unit of one form;

Fig. 2 is a vertical section on the broken line 2—2 of Fig. 1;

Fig. 3 is a partial section on the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary elevation partly in section, illustrating a modification of the central shaft portion of the apparatus shown in Figs. 1 to 3;

Fig. 5 is a section on the line 5—5 of Fig. 4.

The clarifier A shown in Figs. 1 to 3 comprises a cylindrical tank body with bottom and top walls A′ and $A^2$, which are preferably conical, with the concave side of the bottom wall A′, and the convex side of the top wall $A^2$ uppermost. The space within the tank is divided into a plurality of superposed settling or clarifying compartments C, a lower clarifying and thickening compartment CA, and a top feed and conditioning chamber or compartment D, by partitions or trays B, each formed with a central opening B′. Each of the trays B, as shown, is conical, with its concave side uppermost, and extends to, and has its peripheral edges connected to the tank body A. As shown, the compartments C, of which three are included in the clarifier shown, are all alike, each being relatively shallow and of substantially less vertical depth than the bottom compartment CA, from which all of the solids settling out of the liquid are finally discharged.

The liquid to be clarified is passed into the feed chamber D of the clarifier A through a supply pipe E, which terminates in a discharge portion alongside the cylindrical wall A, so directed as to tend to set up a movement of the liquid in the chamber D about the tank axis. From the feed chamber D the liquid passes to the adjacent compartments through feed passages F, vertically disposed in a vertical hollow shaft or rotatable drum G, and having vertically distributed outlet ports

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F' opening to the different compartments C and CA. The shaft extends through the aligned central tray openings B' in the trays B, and supports scraper arms H carrying scrapers *h*. The latter, as the shaft G rotates, work the settled solids, commonly called "mud," collecting on each tray B, through a corresponding port or ports I', opening into vertical channels I in the shaft G. Similarly arms H and scrapers *h* and *h'* work mud accumulating on the bottom wall A' of the tank into the tank mud outlet $A^3$, shown as comprising a central conical depression in said bottom wall.

As shown in Fig. 3, the shaft G is a steel drum, and two longitudinally extending, side by side partition plates G' within the drum and welded at their edges to the drum, unite with the latter to form two feed passages F and so-called "mud well" or solids passage I. The two feed passages which are at opposite sides of, and displaced from the axis of the drum, are segment shaped in cross section, and as shown, each passage communicates with each of the compartments C and CA, through a corresponding port F opening through the peripheral wall of the drum into the upper portion of the compartment. To diffuse the entering feed, each tray B is formed with an annular depending flange $B^2$, positioned to form an annular feed receiving space adjacent and surrounding the shaft G in the upper portion of each of the compartments C and CA. Each such space is open at its underside to the corresponding compartment, and receives liquid to be clarified therein from the corresponding port or ports F'. As shown in Fig. 2, each feed passage F has its open upper end above the normal liquid level in the feed compartment D, and receives liquid therefrom through a vertically elongated port $F^2$ in the peripheral wall of the shaft G. The lower end of each passage F is closed by an inclined bottom portion $G^2$ of the corresponding partition plate G'.

The single mud channel I shown in Figs. 2 and 3, extends diametrically across the hollow shaft or drum G, and communicates with each of the clarifying compartments C, through two corresponding diametrically opposed ports I' in the shaft wall, each at a level immediately above that of the opening B' in the bottom wall B of the compartment.

Advantageously the mixture of solids and liquid, or mud, passing down through the channel I, is allowed to spread out in the thickening compartment CA, and the shaft G need not extend appreciably below the bottom of the feed channels F, except to avoid the necessity for supporting a mud scraper arm or arms at the bottom of the compartment CA. As shown in Fig. 2, the shaft G extends nearly to the bottom of the compartment CA, but is formed with large, vertically elongated, mud outlet ports $I^2$.

The scraper arms H and scrapers *h* may be constructed in any usual or suitable manner, but in general, there should be at least as many scraper arms H in each compartment C as there are mud outlet ports I' receiving mud from that compartment, and the scrapers should be arranged so that mud is worked toward, and directly into, each of the ports I'.

The shaft G may be supported and rotated in any suitable manner. In the form of construction shown in Figs. 1 and 2, the shaft G is suspended and rotated by means of a solid shaft J having its lower end secured to the upper end of the drum G through a crosshead $G^3$, and having its upper end connected through a vertical adjusting screw K and nut member K' to a rotatable gear member L. The latter is mounted for rotation about the axis of the shaft G in a suitable bearing structure M mounted on a supporting bridge or frame work MA above the clarifier tank. The bearing structure M may comprise ball bearings supporting the member L, and the latter may be rotated through suitable speed reducing means, by an electric motor N which also drives the mud pumps O connected in the usual manner by piping O' to the mud outlet portion $A^3$ of the bottom tank wall.

The means shown in Figs. 1 and 2 for withdrawing clarified liquid from the upper portion of said compartment C and CA, are of a known type in general use, comprising a horizontal apertured pipe P which extends for a considerable angular distance about the axis of the compartment, adjacent its periphery. Each pipe P is connected by a pipe section P', passing through the wall of the tank A, to a corresponding standpipe $P^2$. The various standpipes $P^2$, one for each of the compartments C and CA, open at their upper ends into a clarified liquid receiving compartment Q, from which the clarified juice is passed to the evaporators, or to other apparatus, through a pipe Q'. The amounts of liquid withdrawn from the different compartments C may be regulated in a known manner by the vertical adjustment of telescopic upper end portions of the standpipes $P^2$, whereby the standpipe overflow levels are varied.

Scum or floating impurities on the liquid in the feed compartment D are discharged from the latter through a foam canal or trough R extending radially through the vertical wall of the tank A, and opening into a mud outlet pipe R', which may also receive the discharge from the pumps O. Horizontal skimming blades S linked to, and suspended from arms HA carried by the shaft G, sweep the scum or floating impurities into the foam canal B. The latter also serves as an overflow trough, preventing an excessive accidental increase in the height of liquid level in the compartment D. As shown, each of the scraper arms H in the conditioning chamber D supports uprising arms or paddles $H^5$, arranged at different distances from the center of the tank.

As the shaft G is rotated very slowly, ordinarily at a rate of the order of three to six revolutions per hour, and as the scraping arms H and scrapers *h* may be symmetrically disposed about the axis of the shaft G, the latter ordinarily tends to rotate continuously about an axis substantially coincident with the geometrical axis of the shaft. However, because of the character of the tank structure and the thermal and mechanical stresses to which it is subjected, the various tray openings B' may not always be in exact vertical register, and are advantageously made appreciably larger in diameter than the shaft drum G. Leakage along the shaft from one tank compartment into another, is prevented or suitably restricted by means of packing means T supported by the trays B, and substantially closing the annular spaces between the shaft G and the wall of the openings B'. Desirable special packing member forms are shown in Fig. 4, and hereinafter described.

Advantageously, in many cases, vertically disposed, uprising arms U are carried by one or more of the scraper arms H in the bottom compartment CA. As shown in Fig. 2, such arms, which may be angle bar sections, are welded or riveted to one only of the scraper arms H. As previously stated, the movement of such arms

through the mixture of liquid and flocculated material in the lower thickening portion of the compartment CA, facilitates the liberation of liquid from said mixture, and thus contributes to the thickening of the solid discharge through the outlet pipe O'. While the thickening arms are desirably used in some cases, their use is not essential to the substantial attainment of the characteristic advantages of the improved provisions for feeding liquid to, and withdrawing mud from the different clarifying compartments. To avoid adherence of mud on the arms, it may sometimes be advantageous to provide stationary parts in the compartment CA to scrape mud off the moving arms O and their supporting arms H.

The general mode of operation of the apparatus shown in Figs. 1–3 should be apparent to those skilled in the art from what has already been said. The tangentially directed inlet E, is preferably arranged to introduce liquid to be clarified into the conditioning compartment D in a stream or jet, opposite in direction to the movement of the paddles $H^5$. The paddles and the jet subject the liquid in the chamber D to a current producing, or agitation, effect conducive to the formation of relatively large and strong floc aggregates. From the chamber D, the conditioned liquid slowly flows or drifts through the downflow pathway formed by the two feed passages F and the lateral ports F' directly into the different clarifying compartments, and as previously explained, with a velocity of flow through the short vertical pathway sufficiently low to avoid the breaking up of floc aggregates which would result from a higher flow velocity. Each feed passage F is in substantially direct communication with each clarifying compartment through the corresponding port F', since the portion of the path of flow into each compartment formed by the corresponding port F' is too short to permit of any significant accumulation therein of solids settling out of the liquid. The said velocity of flow is so low as to make pressure variations, due to the variations in the velocity of the flow, insignificantly small, so that they do not produce flow disturbances in the clarifiers, or prevent the rate at which liquid passes to each clarifier from being directly dependent upon the rate at which clarified liquid is withdrawn from the compartment. The last mentioned rate, as previously described, depends upon the relative adjustment of the overflow levels of the different standpipes $P^2$.

The settled solids worked through the ports I' in the shell of the shaft G, pass through the mud well passage I to the lower compartment CA, without interference with the feed of, or contaminating, the liquid supplied to the different clarifying compartments through the ports F'. In the compartment CA, the solids have time and opportunity to become concentrated or thickened, and the thickening action is augmented, as previously described, by the action of the pickets or thickening arms U, when the latter are employed.

In some cases it may be advantageous to form the central shaft G of two or more superposed sections, as shown in Fig. 4. The lower shaft section shown in Fig. 4, is provided at its upper end with a flange $G^3$, and the upper section is provided at its lower end with a flange $G^4$. Each of said flanges may be formed by a ring of metal welded to the corresponding shaft section, and the two flanges $G^3$ and $G^4$ are connected by bolts $G^5$. The portion of each feed channel F in the lower shaft section shown in Fig. 4, is formed by welding the edges of a metal plate $G^6$, bent into the form of a trough, to the inner wall of the shaft section, and the portion of each feed channel F in the upper shaft section shown, is similarly formed by welding the edges of a metal plate $G^7$ bent into trough form, to the inner side of the upper shaft section. The two sides of each trough shaped part $G^6$ and $G^7$ are parallel, which facilitates the shaping of those parts so that, as shown, each feed channel F may increase in horizontal cross section from its lower end uppermost, as is desirable to equalize the flow velocities at the different levels.

As shown in Fig. 4, the means provided to prevent leakage through the annular space between the shaft G and the lowermost tray B, comprises a packing member T' in the form of a dished metal disc, having a central aperture surrounded by a depending flange portion $T^2$ of a diameter to fit snugly about the adjacent portion of the shaft G. The latter, as shown, is reinforced by a metal ring or collar $G^8$, welded to the shaft section and having its peripheral edge surrounded by the flange $T^2$. The peripheral edge portion of the member T' extends under the portion of the lower tray B adjacent its aperture B', and is clamped against the tray by an annular clamping member $T^3$ and clamping bolts $T^4$. By loosening the latter, the member T' may be adjusted into axial symmetry with the suspended central shaft. The member T' and shaft collar $G^8$ form a metal to metal bearing for the central shaft, effective to prevent lateral displacement of the lower end of the shaft.

As shown in Fig. 4, leakage through each of the annular spaces between the shaft G and the margins of the apertures B' in the upper trays B, is prevented by an apertured disc-like packing member $T^5$, of rubber or other flexible packing material, which is adjustably clamped to the corresponding tray B by an annular clamping member $T^3$ and clamping bolts $T^4$, similar to those used with the member T'. As shown, the inner edge of the uppermost member $T^5$ overlaps a shoulder provided for the purpose on the shaft collar part $G^4$, and each lower member $T^5$ overlaps a shoulder formed on a special collar part $G^9$ surrounding the shaft G at the proper level.

In the particular arrangement shown in Figs. 4 and 5, the shaft G is formed with a single mud inlet I' to the mud channel I from each of the compartments C and D, and is provided in each of said compartments with a short scraper arm HA and a long scraper arm HB. The scrapers *ha* connected to the long arm HB work solids settling on an outer zone portion of the subjacent tray B, to an inner zone portion of the tray, and the scrapers *ha* connected to the short arm HA, work solids settling on, and moved onto an inner zone portion of the subjacent tray B, toward the shaft G and into the corresponding mud outlet I' into which a scraper *ha* carried by the short arm may extend, as indicated in Fig. 5.

As will be apparent to those skilled in the art, various changes may be made in the form of the apparatus disclosed without departing from the spirit of the invention, as set forth in the appended claims. Thus, for example, the fundamental principles of the invention disclosed and claimed herein are utilized in apparatus which is disclosed in the co-pending, concurrently filed, application for patent of Miguel Arango, Serial

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No. 227,481. The last mentioned apparatus is characterized primarily by the inclusion of clarifying juice takeoff provisions in the rotating element of the clarifier. Said provisions provide standpipes and a clarified juice receiving chamber corresponding generally to the previously mentioned parts $P^2$ and Q, but located in a hollow rotating, scraper arm supporting shaft, said shaft including passages forming feed and mud pathways like those included in the shaft G hereof, but said co-pending application discloses variations in shaft form, and in shaft supporting and rotating means, which may be used in, and in connection with, the shaft G disclosed herein.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In the clarification of liquids in a clarifier comprising a conditioning chamber and a plurality of superposed clarifying compartments beneath said conditioning chamber, the method which consists in passing liquid to be clarified into said conditioning chamber and subjecting the liquid therein to a conditioning treatment producing relatively large floc aggregates, passing the conditioned liquid from said chamber to the clarifier compartments along a flow path extending downward from the conditioning chamber to the lowermost compartment and in substantially direct communication with each of the intermediate compartments, moving settled solids into the lowermost clarifying compartment from the clarifying compartments above it through a vertical flow path separated from the first mentioned flow path by an intermediate impervious barrier, withdrawing clarified liquid from the different clarifying compartments along flow paths separate from the previously mentioned flow paths, and withdrawing settled solids from the lowermost compartment.

2. A tray clarifier comprising in combination a plurality of superposed sedimentation compartments, a feed chamber above said compartments, means for passing liquid to be clarified into said chamber, a rotating structure comprising a vertical body portion centrally disposed in said clarifier and means in each of said compartments and chamber for moving settled solids in its lower portion to the center thereof, said body portion being formed with vertical passages and lateral ports in communication therewith to provide a feed flow path for the down flow of liquid from said chamber to each of the different compartments, and a solids flow path, separated from the first mentioned flow path and adapted to discharge into the lowermost compartment settled solids received from each of the other compartments and from said chamber, means for withdrawing clarified liquid from the different clarifying compartments, and means for passing settled solids out of the clarifier from the lowermost compartment thereof.

3. A tray clarifier as specified in claim 2, comprising means in said feed chamber for subjecting the liquid therein to a mechanical flocculating action.

4. A tray clarifier as specified in claim 2, comprising flocculating blades in said top chamber which are supported and rotated by said rotating structure.

5. A tray clarifier as specified in claim 2, including rotatable means in the lowermost clarifier compartment for thickening settled solids accumulating therein.

6. A tray clarifier as specified in claim 2, including vertical solids thickening elements in the lowermost compartment supported and rotated by said rotating structure.

7. A tray clarifier as specified in claim 2, in which the body portion of said rotating structure is of cylindrical form and extends through central openings in the partition walls separating the clarifying compartments from one another and from said chamber, and in which said walls support annular packing means for preventing leakage flow through the joints between said body portion and the margin of the respective openings.

8. A tray clarifier as specified in claim 2, in which the body portion of said rotating structure passes through central openings in the partition walls separating the clarifying compartments from one another and from said chamber, and comprising a circumferential flange adjacent such opening, and in which each of annular packing members supported by said walls cooperates with an adjacent one of said flanges to prevent leakage through the joint between said flange and the margin of the corresponding opening.

9. The method as specified in claim 1, further characterized by so continuously passing the liquid to be clarified into the conditioning chamber that the body of liquid in said chamber is thereby caused to continuously move in one direction and by the movement in the opposite direction through the liquid of mechanical liquid stirring means.

10. A tray clarifier comprising in combination, a plurality of superposed sedimentation compartments, each having an outlet for settled solids, a feed chamber above said compartments, means for passing liquid to be clarified into said chamber, means in said feed chamber for subjecting the liquid therein to a mechanical flocculating action, means for passing flocculated liquid from said feed chamber to each of said compartments comprising a substantially vertical conduit opening directly to said feed chamber at an upper level and opening directly to said compartments at a lower level, means providing a settled solids flow path, separated from said conduit, for the downflow into the lowermost compartment of solids from the solids outlet of each compartment above said lowermost compartment, and mechanical means in each of said compartments for moving solids settling out of the liquid in the compartment to the solids outlet of the compartment.

11. A tray clarifier comprising in combination a plurality of superposed sedimentation compartments, a rotating structure comprising a chambered vertical body portion centrally disposed in said clarifier, and extending through said compartments and providing a feed flow path for the downflow of liquid to each of the different compartments and having lateral feed outlets through which said flow path is in direct communication with each of said compartments, means including solids outlets from the different compartments, separate from said flow path, for discharging solids settling in said compartments, means in each of said compartments for moving solids settled therein to the corresponding solids outlet, and means for withdrawing clarified liquid from the different clarifying compartments.

WILLIAM C. WEBER.
WILLIAM E. GEISSLER.