United States Patent

Weisser

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[54] FLOOD CELL APPARATUS

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[52] **U.S. Cl.** **134/68,** 134/108, 134/111, 209/156, 209/173

[51] **Int. Cl.** **B08b 3/02**

[58] **Field of Search**.....134/60, 61, 65, 67, 68, 133; 15/3.14, 3.15; 209/156, 173, 461; 99/239, 240

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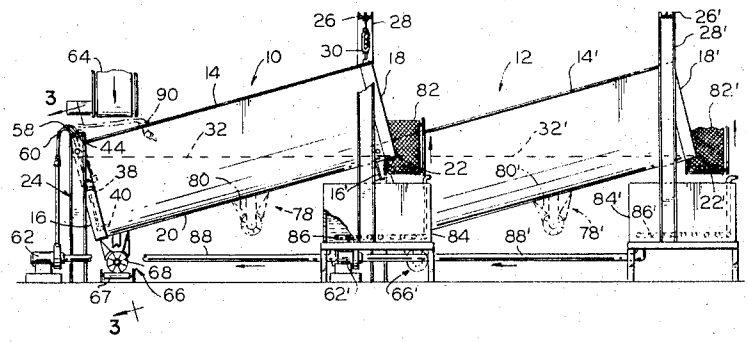
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[57] **ABSTRACT**

A flood cell apparatus for conveying and processing materials, e.g. for washing, conveying, and processing vegetables and the like, comprises an inclined tank having a rounded bottom and a closed first or inlet end. The second or outlet end of the tank is open and upraised with respect to the first end for defining a flood level over which liquid introduced into the tank leaves the tank. Plural adjustable headers provided with nozzles direct streams of water under pressure from the inlet end of the tank toward the outlet end. Vegetables or the like are introduced into the tank and are impelled toward the outlet end while the turbulence of water cleans the vegetables. Waste material moves down the tank toward the inlet end where a waste outlet valve is provided. Successive tanks may be employed for heating and cooling operations or the like.

8 Claims, 7 Drawing Figures



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FIG. 1

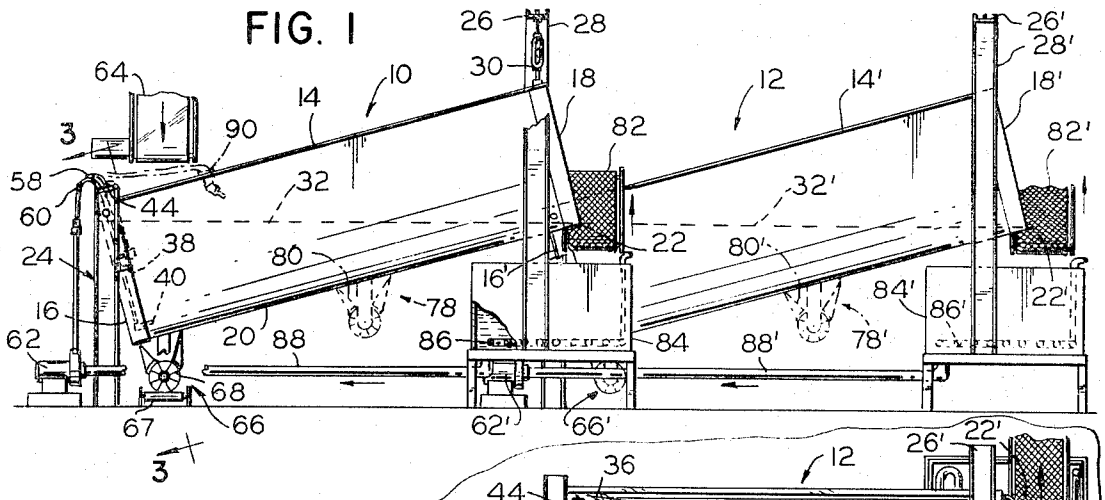


FIG. 2

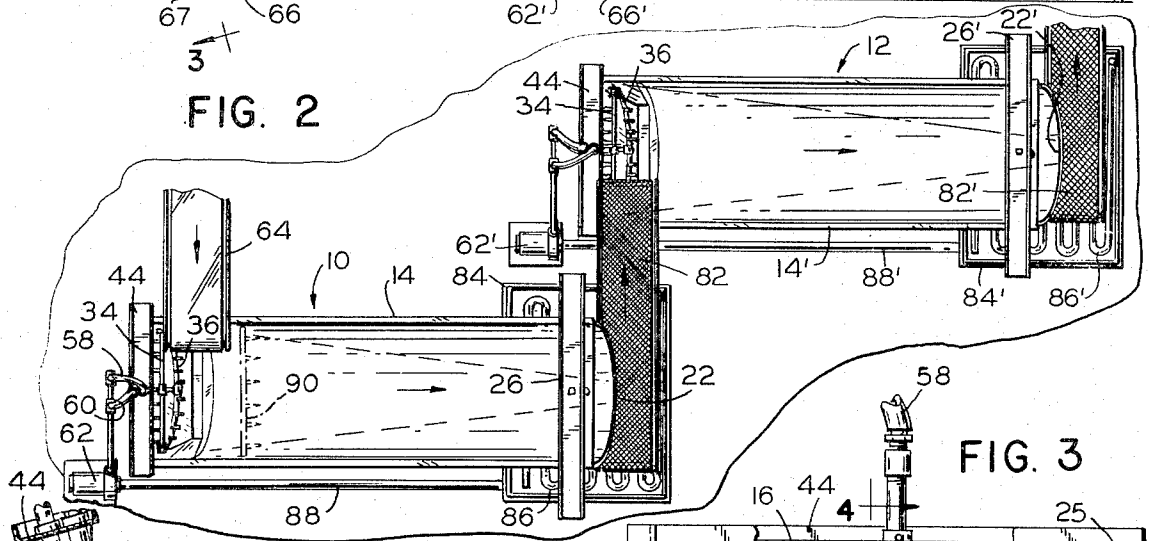


FIG. 3

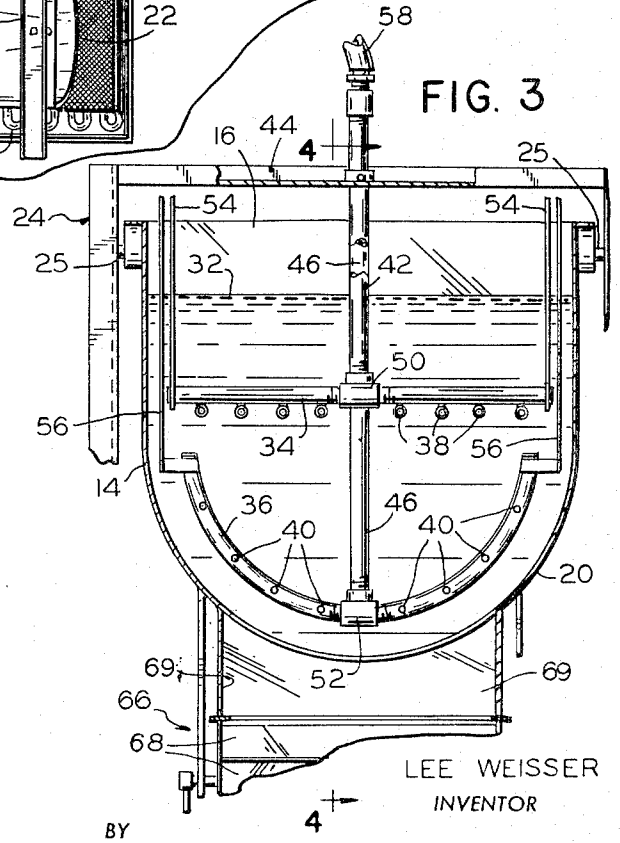
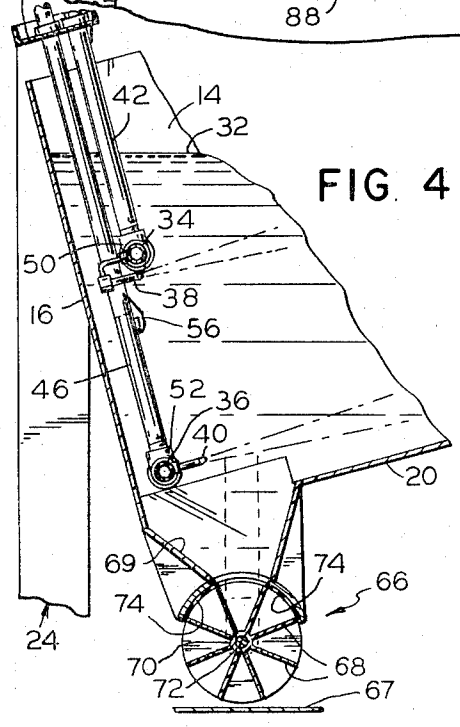


FIG. 4



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FIG. 5

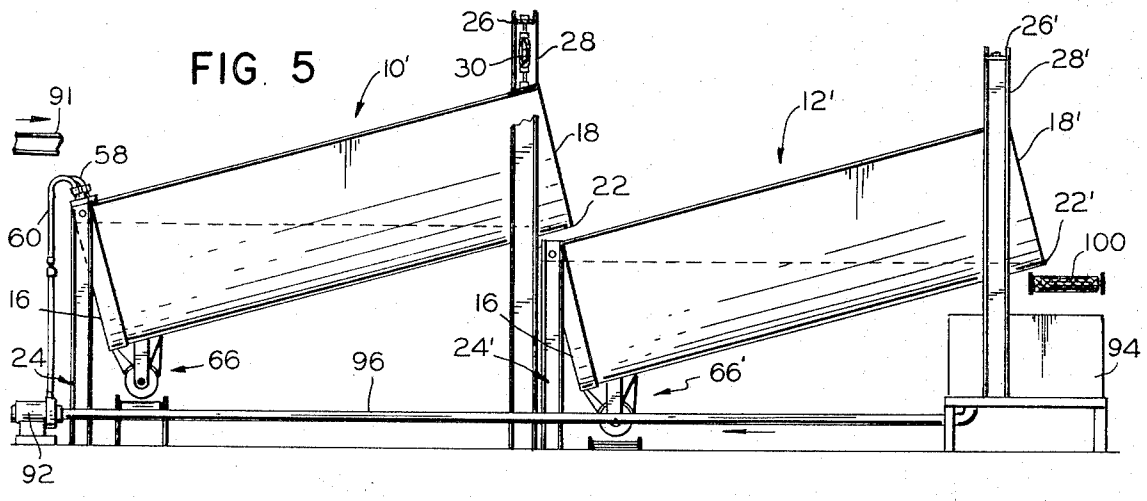


FIG. 6

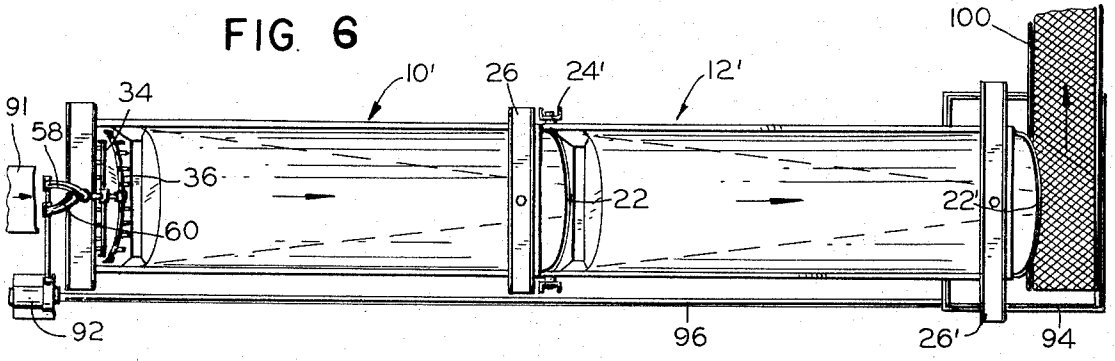
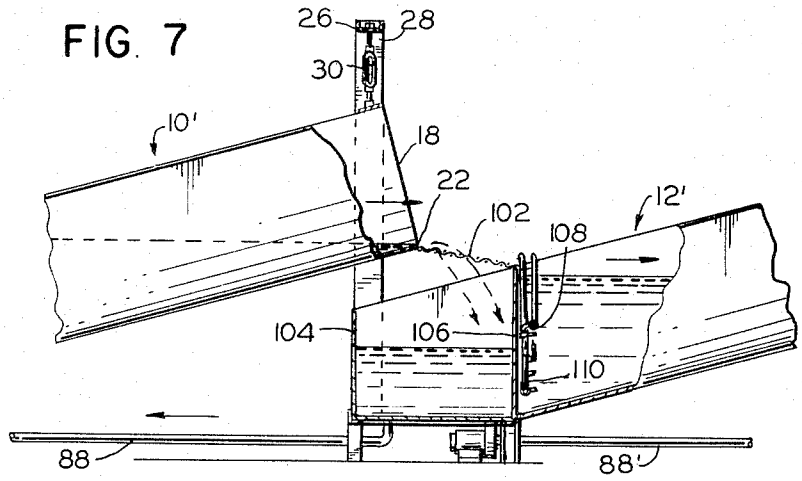


FIG. 7



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FLOOD CELL APPARATUS

BACKGROUND OF THE INVENTION

Apparatus for washing vegetables preparatory to packing the same has been difficult to maintain, clean, and operate. A typical vegetable washer comprises a fairly large rectangular tank for containing the washing liquid, e.g. water, into which the vegetables are deposited. A conveyor extends down into the tank for removing the vegetables therefrom. The present invention avoids the utilization of conveying means under the level of the washing liquid and provides a substantially continuous automatic clean-out. Controlled flow of vegetable movement and separation are achieved as well as numerous other advantages.

SUMMARY OF THE INVENTION

According to the present invention, a flood cell apparatus is provided comprising an elongated tank having an inlet end and an outlet end, wherein said tank is adapted to receive materials, e.g. food items and the like, for conveying and processing. The tank is inclined upwardly from a lower level at the inlet end of the tank to a higher level toward the outlet end of the tank, with the outlet end defining an overflow level of reduced cross section. Means provide a stream of liquid under pressure directed from the inlet end of the tank toward the outlet end, producing a liquid level over the aforementioned overflow level. Materials of a given specific gravity deposited into the tank are impelled by the force of the liquid over the outlet end. During movement, these materials, in the case of food items, are turbulently washed. Heavier materials, such as waste and dirt, remain in the inclined tank where such materials may be removed proximate the lower inlet end thereof.

With apparatus according to the present invention, a selected flow of materials is controlled by adjustment of the liquid flow and pressure, and by adjustment of the angular disposition of the tank, in relation to the specific gravity of the materials processed. Separation and washing can be adapted to materials of different specific gravities.

It is accordingly an object of the present invention to provide an improved apparatus for washing food articles, which apparatus avoids immersed conveyor means and the like.

It is a further object of the present invention to provide an improved apparatus for washing food items, wherein controlled flow is achieved, and evacuation of waste materials is facilitated.

It is another object of the present invention to provide an improved apparatus for controlling the separation of materials.

It is a further object of the present invention to provide an improved apparatus for separating and/or washing materials, wherein said apparatus is low in cost, having few moving parts, and is easily maintained.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. The invention, however, both as to organization and method of operation, together with further advantages and objects thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings wherein like reference characters refer to like elements.

DRAWINGS

FIG. 1 is a longitudinal cross-sectional view of flood cell apparatus according to the present invention;

FIG. 2 is a plan view of the FIG. 1 flood cell apparatus;

FIG. 3 is a transverse cross-sectional view taken at 3—3 in FIG. 1;

FIG. 4 is a partial longitudinal cross-sectional view taken at 4—4 in FIG. 3;

FIG. 5 is a side view of an alternative flood cell apparatus in accordance with the present invention;

FIG. 6 is a plan view of the FIG. 5 apparatus; and

FIG. 7 is a partial side view, partially in cross section of yet another flood cell apparatus according to the present invention.

DETAILED DESCRIPTION

Referring to FIGS. 1 through 4, illustrating a first flood cell apparatus according to the present invention, such apparatus includes two individual flood cells indicated generally at 10 and 12, wherein flood cell 10 provides the material input to flood cell 12. Referring particularly to flood cell 10, this cell comprises an elongated tank 14 having an inlet end 16 and an outlet end 18. The tank is suitably formed of fourteen to sixteen gauge sheet steel. The bottom 20 of said tank is inclined upwardly from a lower level at the inlet end to a higher level at the outlet end such that heavier material would have a natural tendency to move downwardly to the left. As can be seen in FIG. 3, the flood cell has a width decreasing toward the bottom of the tank, whereby a reduced cross section liquid stream at the outlet end of the tank is defined. This reduction in stream cross section can alternatively be achieved by the inclination of the tank even without the decreasing tank width.

However, the tank is advantageously trough-shaped with the bottom 20 of the tank having a substantially semicircular configuration, such that the width of the tank decreases from top to bottom. A tank in a given instance was 36 inches wide with the radius of the bottom being 18 inches. The straight sides above the curved bottom rose another 18 inches. The inlet end 16 of the tank trough is closed, while outlet end 18 is open for defining the tank liquid outlet. The tank bottom centerline is lower at the outlet end than the highest point of inlet end 16, whereby the overflow of liquid or the flood level will occur at flood point 22 in FIG. 1. The tank 14 is pivotally supported at 25 between upright members of frame 24 at the inlet end of the tank, while the outlet end of the tank is suspended from horizontal beam 26 of frame 28 with turnbuckle 30. Thus, the inclination of tank 14 is easily adjusted. In a particular constructed embodiment comprising a tank 8 feet long, the angle of inclination averaged 13° to 15°. Larger tanks may be constructed having a length of 15 to 20 feet or longer, in which case the angle of inclination will tend to be smaller. A quiescent liquid level in tank 14 is illustrated at 32. It is seen this level is even with overflow level flood point 22. However, during usual operation, a rapid flow of liquid is provided such that the flow of liquid rises above level 32 causing a flow above flood point 22. As a consequence of the decreasing cross-sectional area of liquid in the tank, as the liquid approaches closer to the outlet end, the flow

velocity of the liquid increases toward the outlet end. Although a turnbuckle is employed, it is apparent that an adjustable jack or jacks can be utilized under the outlet end of the tank if so desired for adjusting tank angle.

Liquid is supplied in the flood cell through a first or upper header 34 and a second or lower header 36. Header 34 is provided with a plurality of exit nozzles 38 while header 36 is similarly provided with a plurality of exit nozzles 40, in each case directed downstream toward the outlet end of the flood cell. Header 34 is supported from downwardly extending pipe 42 which in turn is supported by cross member 44 of frame 24. Header 36 is attached to a downwardly extending pipe 46 supported from the same cross member. Both pipes 42 and 46 are rotatable with respect to cross member 44, and headers 34 and 36 are also rotatable about the horizontal axes of pipe couplings 50 and 52, respectively. Handles 54 and 56, joined to either end of the headers and extending above liquid level 32, may be employed for manipulating the headers and directing the flow of liquid from nozzles 38 and 40. Also, nozzles 38 and 40 are desirably individually adjustable. By backward and forward movement of handles 54 and 56, the flow of liquid from nozzles 38 and 40 can be adjusted either predominately upwardly toward liquid surface 32 or predominately downwardly toward tank bottom 20. Also, since the headers are rotatable about the axes of pipes 42 and 46, the lateral direction of liquid flow is easily controllable. In the embodiment, headers 34 and 36 are both illustrated as disposed below the liquid level 32, but it is understood that in a given instance, it may be desired to position header 34, for example, above liquid level 32. Header 36, near the bottom of the tank, is conveniently substantially semicircular in configuration to match tank bottom 20.

Pipes 42 and 46 are provided with connections 58 and 60 for delivering liquid from pump 62. The liquid will generally be water, and it is delivered under a pressure of 20 or 25 pounds or greater through nozzles 38 and 40. The flow of water may be between about 200 and 800 gallons per minute. As hereinbefore indicated, this flow will cause the liquid level to raise above level 32 and produce appreciable turbulence.

Material to be separated is deposited in the flood cell from belt conveyor 64. Typically, this material comprises vegetables such as cauliflower, broccoli, beans, tomatoes, or the like. The vegetables are washed in the flood cell according to the present invention. The angle of the flood cell is adjusted by means of turnbuckle 30, and the water pressure is adjusted by controlling pump 62, with means not shown, so that material of a given specific gravity will be impelled over the outlet end of the flood cell, i.e. over flood point 22. In the turbulent stream, the vegetables are subjected to a vigorous washing action, and may tend to drop back down along the bottom 20 of the flood cell, but will in due course be impelled over flood point 22. A scrubbing action tends to take place along the tank bottom as materials pass toward the outlet end of the tank. Dirt and unwanted materials will move downwardly to the left along bottom 20. For the purpose of removing such materials, an evacuation chamber valve 66 is provided.

At the lower inlet portion of the tank, a lower indentation or funnel portion 69 is located into which dirt, foreign articles and the like descend along tank bottom 20. Funnel portion 69 terminates in evacuation chamber valve 66 which comprises a plurality of vanes 68 attached to hub 70 rotatable on shaft 72. Pairs of these vanes are angularly spaced to match the lower extremity of funnel portion 69. On either side of the lower opening of funnel portion 69 are disposed sealing skirts 74. It will be seen that hub 70 carrying vanes 68 can be rotated without producing a constant flow of liquid through valve 66. The chamber defined between two vanes is filled, and then when hub 70 is rotated, the chamber defined between these two vanes is closed by a sealing skirt 74. Then, upon further rotation of hub 70, the contents of such chamber are emptied. A conveyor 67 may be provided for removing waste. The evacuation chamber valve can be periodically rotated through the angular difference corresponding to the angular difference between two vanes for providing clean-out. Another substantially similar valve 78 may be located at the lower extremity of a funnel-shaped depression 80 positioned half way along the flood cell if so desired, this construction being illustrated by dashed lines in FIG. 1. This configuration may be used for providing additional separation of items having intermediate specific gravities.

Material impelled over flood point 22 is deposited upon outlet conveyor 82 which is a sieve-type belt conveyor comprising a continuous mesh belt for moving the material upwardly and over the inlet end 16' of flood cell 12. The liquid from flood cell 10 passes through this conveyor into recirculation tank 84 comprising a rectangular tank within which is located tubing 86 for altering the temperature of the liquid in tank 84. For instance, hot water or steam is passed within tubing 86 for raising the temperature of liquid in the tank to an appropriate level for blanching the vegetables passing through flood cell 10. The liquid passes out of tank 84 through pipe 88 to pump 62 by means of which it is returned under pressure to flood cell 10 via headers 34 and 36.

Flood cell 12, in this instance, is substantially identical to flood cell 10, but is offset laterally, with the outlet conveyor 82 from flood cell 10 providing the input of the materials of flood cell 12. Flood cell 12 accomplishes additional washing, separation, and treatment of the materials. However, flood cell 12 may perform a partially different function. Assuming flood cell 10 is utilized for washing and blanching the vegetables, flood cell 12 may then be employed for lowering the temperature of the vegetables, as well as for additional washing thereof. The liquid in flood cell 12 may even comprise a refrigerant, of a type harmless to human beings, by means of which vegetables are at least partially frozen. It is noted the means for accomplishing liquid flow in flood cell 12 are completely separate from the liquid circuit for flood cell 10, with coils 86' in tank 84' suitably functioning to lower the temperature of the liquid passing through tank 84' into cell 12. However, substantially similar elements in the case of flood cell unit 12 are referred to by primed reference numerals, and accomplish substantially similar mechanical functions. Sieve conveyor 82' may lead to yet another flood cell, or may convey the materials passing over flood point 22' to a waiting receptacle.

Although a pair of flood cells are illustrated in the embodiment of FIGS. 1 through 4, it will be readily appreciated that only one flood cell, or alternatively, a greater number than two may be employed according to the purposes of the user. Obviously, greater washing action can be accomplished with more than one flood cell, e.g. when the particular product or vegetable is difficult to clean. However, for other products, one flood cell may be sufficient.

It is important to note that the incline of the tank together with the pressure of the liquid from headers 34 and 36 should be adjusted in accordance with the particular material inasmuch as different materials exhibit different specific gravities. It is desired to convey the end product over flood point 22 while retaining unwanted items within the tank for clean-out via valve 66. It is also frequently desired that the end product remain in the turbulent liquid within the tank for a short period of time in order that the turbulent action may be efficient. Adjustments of incline and liquid pressure are accomplished to suit the particular results of controlled flow and controlled separation desired in a given case. The curvature of the bottom 20 of the tank also influences the separation action of the flood cell, but this factor will normally be constant. The pressure and angle of inclination is correlated with a given radius of tank bottom to provide the desired effect. As hereinbefore mentioned, the tank bottom curvature results in a decreased stream width toward the outlet end of the tank as can be seen in the plan view of FIG. 2, and therefore in a relatively higher velocity of liquid flow toward flood point 22. This higher velocity urges materials within the tank over flood point 22 as they move or circulate in the direction thereof, as long as their specific gravity is not greater than some desired value. As can be seen, conveying is accomplished within the tank without moving parts inside such tank.

In some instances, the nozzles 38 are turned angularly in a first direction, while nozzles 40 are turned angularly in a second direction. Thus, nozzles 38 may be aimed downstream but turned somewhat toward the left-hand side of the tank while nozzles 40 are aimed downstream but somewhat more toward the right-hand side of the tank. As a result, a counter whirlpool action may take place in the tank for enhancing the turbulence therein. Various patterns of flow are possible through adjustment of the headers and the nozzles carried thereby. A controlled turbulence is achieved by this adjustment and the other adjustments described above.

In addition to the sprays of liquid from headers 34 and 36, it is sometimes desirable to provide an additional spray or sprays of liquid along and over the top of the tank, e.g. to enhance turbulence of the liquid. For this purpose, an additional adjustable header 90 may be located along the tank and provided with a plurality of nozzles directed downstream towards the outlet end of the tank. The additional spray causes additional turbulence and washing action. The header is, of course, provided with adjustable nozzles.

Another embodiment of the present invention is illustrated in FIGS. 5 and 6 wherein flood cells 10′ and 12′, substantially similar to flood cells 10 and 12 as hereinbefore described, are disposed in line rather than offset with respect to one another. Moreover, rather than employing intermediate conveying means between the flood cells, the outlet end of flood cell 10′ is disposed over the inlet end of flood cell 12′ and the same liquid passes through both cells. That is, the liquid entering flood cell 10′ at headers 34 and 36 subsequently leaves the outlet end 18′ of flood cell 12′ over flood point 22′, passing through sieve conveyor 100 and into a tank 94. Liquid leaves tank 94 by way of pipe 96 through which it is returned to pump 92 delivering such liquid under pressure to headers 34 and 36.

Materials are introduced into flood cell 10′ of FIG. 5 via chute 91 and are subjected to turbulent washing action in each flood cell before finally passing on to conveyor 100 by means of which such materials are delivered to a waiting receptacle. Flood cells 10′ and 12′ are provided with evacuation valves 66 and 66′, respectively, for removing undesired materials having greater specific gravity. Other component parts associated with the flood cells operate substantially similarly to those hereinbefore described in connection with flood cells 10 and 12, and are referred to employing the same reference numerals.

A further embodiment of the present invention is illustrated in FIG. 7 wherein flood cells 10′ and 12′ are also disposed in line. Here, the liquid circuits for two flood cells are separated. A perforated chute 102 extends from flood point 22 on flood cell 10′ to the top of inlet end 106 of flood cell 12′. The liquid from flood cell 10′ flows through the perforations in chute 102 into a tank 104 which may be provided with internal coils or the like (not shown) for changing the temperature of the liquid. This liquid is then transferred to the inlet pump for flood cell 10′ via pipe 88 as hereinbefore described in connection with the embodiment of FIGS. 1 through 4.

The inlet end 106 of flood cell 12′ is disposed substantially vertically, and may coincide with one wall of tank 104, thereby avoiding undesired spillage of liquid from flood cell 10′ into flood cell 12′. Headers 108 and 110, appropriately provided with nozzles, are located proximate the inlet end of flood cell 12′ and function in a substantially similar manner to headers 34 and 36, respectively, described in connection with the previous embodiments. The remaining elements of the FIG. 7 apparatus, in part referred to by similar reference numerals, are substantially similar to those hereinbefore described for a pair of flood cells.

The arrangement of FIG. 7 avoids a mechanical conveyor between flood cells, thereby avoiding moving mechanical components substantially altogether, while maintaining a separate fluid circuit for each flood cell for successive blanching and cooling operations or the like. Also, the linear arrangement of the flood cells in FIG. 7 tends to be less space consuming than the offset configuration illustrated for the embodiment of FIGS. 1 through 4. The use of the perforate conveyor of the earlier embodiment does, however, have the relative advantage of separating more foreign matter from the desired materials as the conveyor moves, before deposition of such materials in the second flood cell.

While the washing, conveying, and processing of vegetables has been described as a particular example of the operation of the flood cell apparatus according to the present invention, such apparatus can be used

for conveying, separating, washing, or processing other materials of differing specific gravities. Other uses will occur to those skilled in the art.

While I have shown and described preferred embodiments of my invention, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from my invention in its broader aspects. I therefore intend the appended claims to cover all such changes as fall within the true spirit and scope of my invention.

I claim:

1. A flood cell apparatus comprising:

a tank having an inlet end and an outlet end, wherein said tank is adapted to receive materials proximate said inlet end for conveying and processing and for discharge thereof proximate said outlet end, said outlet end defining the overflow level of said tank,

means for positioning said tank at a predetermined angle including adjustable means for supporting the outlet end of said tank so that the angular disposition of said tank may be adjusted,

the bottom of said tank being inclined upwardly from a lower level at the inlet end of said tank to a higher level toward the outlet end of said tank, and said tank having a width decreasing from the top thereof toward the bottom of said tank to define a reduced cross section of said tank below a given level proximate said overflow level,

and means for providing a stream of liquid under pressure from the direction of the inlet end of said tank generally toward the outlet end of said tank and providing sufficient liquid for producing a flow of liquid in said tank over said overflow level, the velocity of liquid flow increasing along said tank toward said outlet end as a consequence of said reduced cross section thereof,

said stream of liquid forcing materials under a first specific gravity over said outlet end in accordance with the inclination of the bottom of said tank and the pressure of said stream of liquid, while materials of predetermined greater specific gravity are impeded by the inclined bottom of said tank and tend to move toward the inlet end thereof,

said tank having evacuation means at its lower inlet end for receiving said materials of predetermined greater specific gravity.

2. A flood cell apparatus comprising:

a tank having an inlet end and an outlet end, wherein said tank is adapted to receive materials proximate said inlet end for conveying and processing and for discharge thereof proximate said outlet end, said outlet end defining the overflow level of said tank,

the bottom of said tank being inclined upwardly from a lower level at the inlet end of said tank to a higher level toward the outlet end of said tank, and said tank having a width decreasing from the top thereof toward the bottom of said tank to define a reduced cross section of said tank below a given level proximate said overflow level,

means for providing a stream of liquid under pressure from the direction of the inlet end of said tank generally toward the outlet end of said tank and providing sufficient liquid for producing a flow of liquid in said tank over said overflow level, the velocity of liquid flow increasing along said tank toward said outlet end as a consequence of said reduced cross section thereof,

said stream of liquid forcing materials under a first specific gravity over said outlet end in accordance with the inclination of the bottom of said tank and the pressure of said stream of liquid, while materials of predetermined greater specific gravity are impeded by the inclined bottom of said tank and tend to move toward the inlet end thereof,

said tank having evacuation means at its lower inlet end for receiving said materials of predetermined greater specific gravity,

and an additional tank of a substantially similar nature having its inlet end positioned for receiving materials forced over the outlet end of said first tank for additionally conveying and processing same.

3. The apparatus according to claim 2 wherein the first mentioned tank and the additional tank are substantially in line, with the materials and liquid from the first mentioned tank flowing directly into the second mentioned tank.

4. The apparatus according to claim 2 wherein said tanks are spaced with a perforated chute disposed between the outlet end of said first mentioned tank and the inlet end of the additional tank for conveying downwardly into the second mentioned tank materials forced over the outlet end of the first mentioned tank, and means under said chute for collecting the liquid from said first mentioned tank.

5. A flood cell apparatus comprising:

an elongated tank having a trough-shaped curved bottom such that the width of said tank decreases toward the centerline of said bottom, said tank having a closed inlet end and an open outlet end,

adjustable means for positioning said tank at a predetermined angle so that the open outlet end of said tank is upraised with respect to the closed inlet end thereof, but with the outlet end at its lower extremity being no higher than the closed inlet end to define an overflow outlet of said tank at said outlet end,

header means for providing a stream of liquid under pressure directed within said tank toward said outlet end and away from said inlet end such that materials introduced in said tank are impelled by the flow of liquid over the outlet end of said tank according to the specific gravity of said materials, the pressure of said liquid, the inclination of said tank, and the curvature of the bottom of said tank,

and evacuation means at the lower portion of the tank proximate the inlet end of said tank for removing materials which are not forced over said outlet end.

6. The apparatus according to claim 5 wherein said evacuation means comprises a rotatable evacuation chamber valve.

7. The apparatus according to claim 5 wherein said tank is provided with a depression therealong between said inlet and said outlet end, and further including an additional evacuation means communicating with said depression.

8. A flood cell apparatus comprising:

a tank having an inlet end and an outlet end, wherein said tank is adapted to receive materials proximate

said inlet end for conveying and processing and for discharge thereof proximate said outlet end, said outlet end defining the overflow level of said tank,

the bottom of said tank being inclined upwardly from a lower level at the inlet end of said tank to a higher level toward the outlet end of said tank to define a reduced cross section of said tank below a given level proximate said overflow level,

and means for providing a stream of liquid under pressure from the direction of the inlet end of said tank generally toward the outlet end of said tank and providing sufficient liquid for producing a flow of liquid in said tank over said overflow level, the velocity of liquid flow increasing along said tank toward said outlet end as a consequence of said reduced cross section thereof,

said stream of liquid forcing materials under a first specific gravity over said outlet end in accordance with the inclination of the bottom of said tank and the pressure of said stream of liquid, while materials of predetermined greater specific gravity are impeded by the inclined bottom of said tank and tend to move toward the inlet end thereof,

the apparatus being further provided with an additional tank of a substantially similar nature having its inlet end positioned for receiving materials forced over the outlet end of said first tank for additionally conveying and processing same, and including upwardly inclined conveyor means between the outlet end of the first mentioned tank and the inlet end of said additional tank.

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