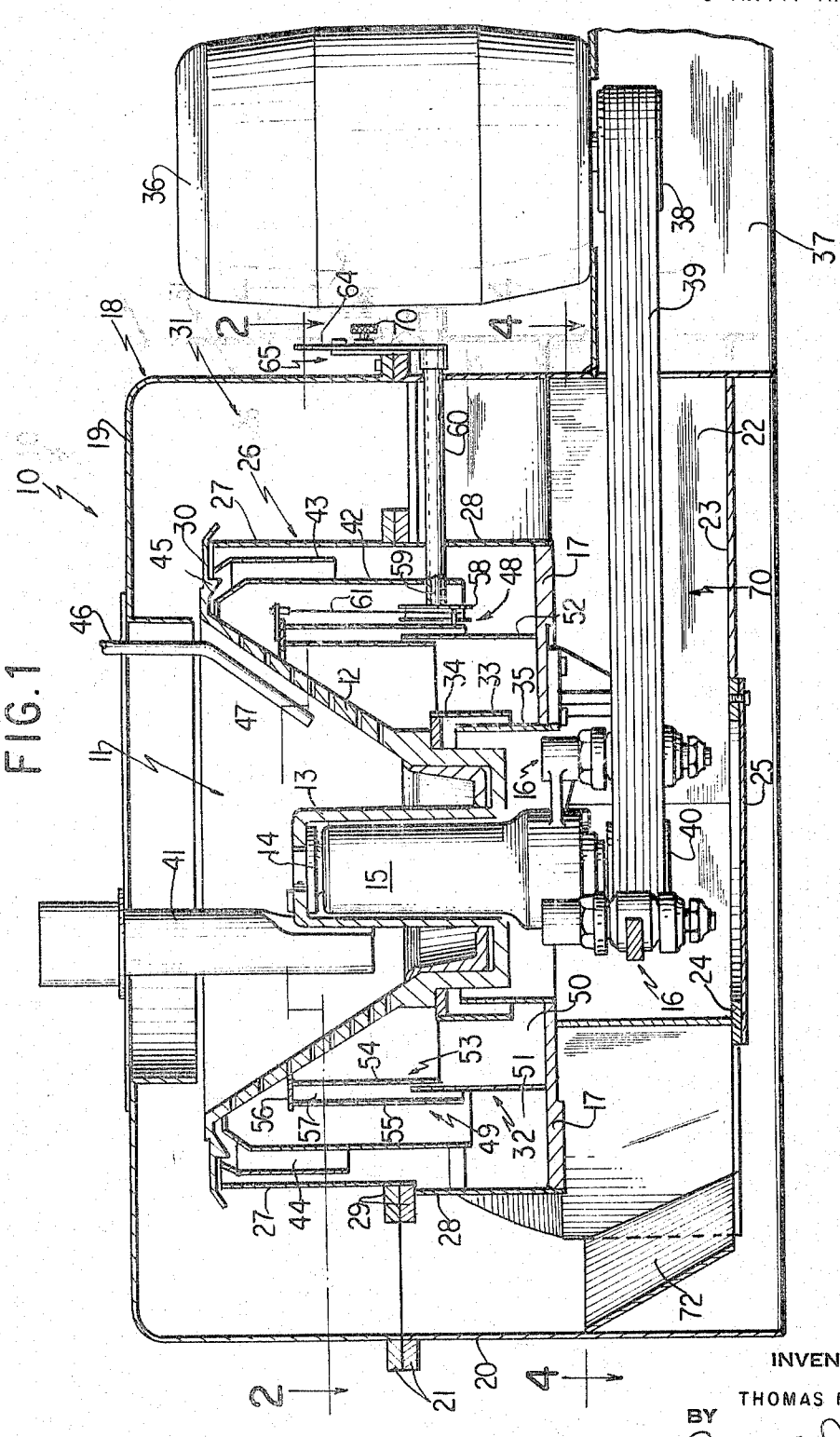
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CONTINUOUS CENTRIFUGAL WITH ADJUSTABLE LIQUIDS SEPARATOR

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FIG. 1

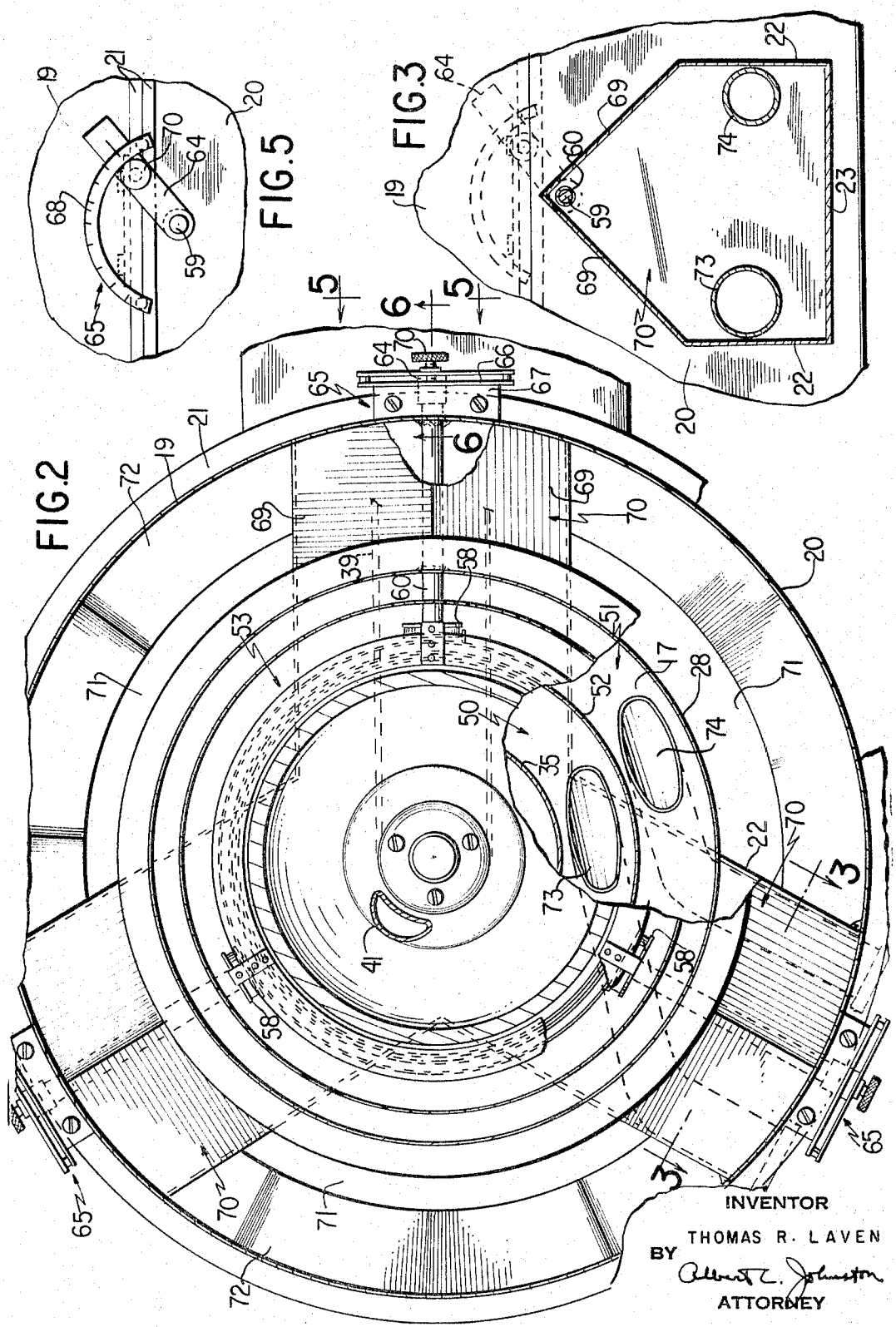


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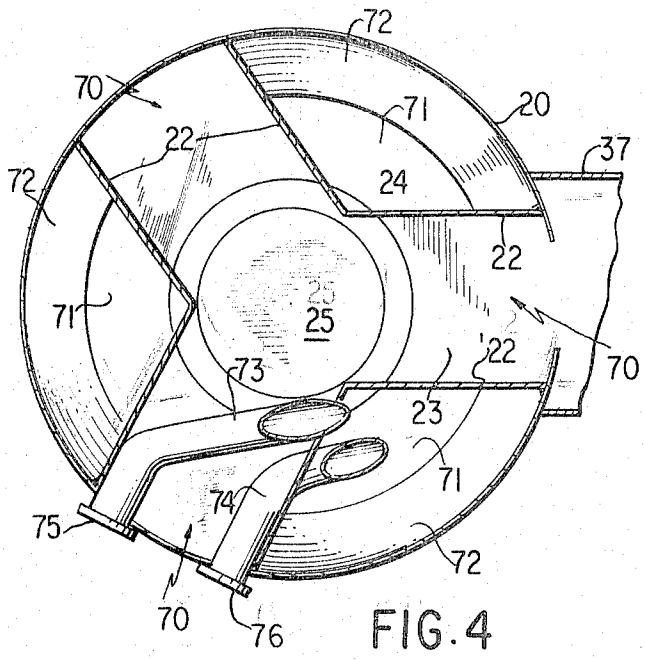


FIG. 4

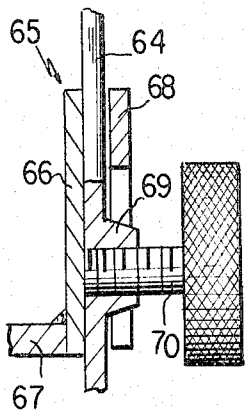


FIG. 6

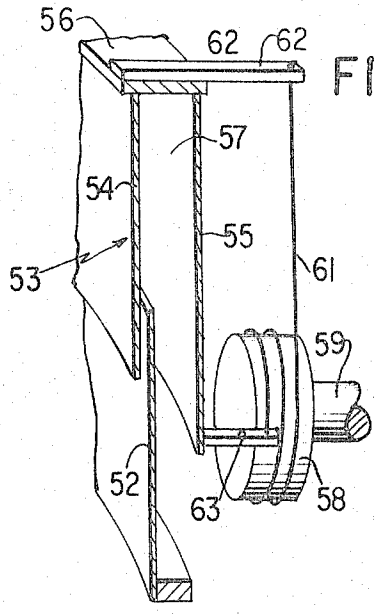


FIG. 7

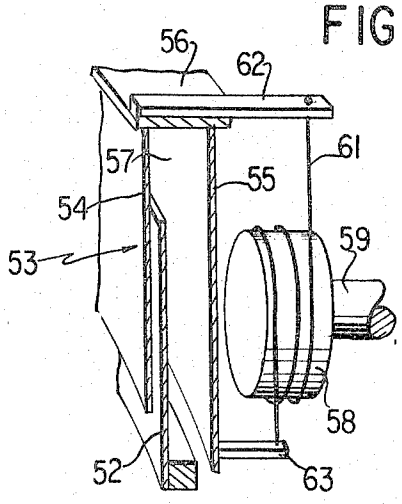


FIG. 8

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CONTINUOUS CENTRIFUGAL WITH ADJUSTABLE LIQUIDS SEPARATOR

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Filed Oct. 30, 1964, Ser. No. 407,645
6 Claims. (Cl. 210—369)

This invention relates generally to continuous centrifugals, and is particularly directed to improvements in continuous centrifugals for the separation of solids and liquids, for example, the separation of sugar crystals from syrups during the manufacturing of sugar.

Continuous centrifugals have been provided, particularly for the separation of sugar crystals from syrups in the manufacturing of sugar, which include a rotated frusto-conical basket having a perforate circumferential wall and into which a mixture of liquids and solids, for example, massecuite, is fed adjacent the small diameter end of the basket for continuous travel toward the large diameter end under the influence of centrifugal force. A cylindrical casing wall concentrically surrounds the basket and has one end proximate to the large diameter end of the basket to define a liquids receiving chamber around the basket, and an outer curb wall is spaced from the casing wall to define therebetween a chamber for receiving solids discharged over the large diameter end of the basket. When the foregoing centrifugal is used in the manufacture of sugar, wash water is sprayed against the material travelling along the perforate wall toward the large diameter end of the basket so that the liquids passing through the perforate wall adjacent the small diameter end of the basket consist essentially of green syrup, and the liquids passing through the perforate wall adjacent the large diameter end of the basket consists essentially of wash syrup.

It is an object of this invention to provide a continuous centrifugal of the described character with an adjustable separator for selectively separating liquids driven centrifugally through respective portions of the perforate wall of the basket, for example, for separating the green syrup from the wash syrup during the manufacture of sugar.

Another object is to provide an adjustable separator for a continuous centrifugal of the described character which separator is simple in construction and operates reliably even under the adverse conditions normally encountered within the centrifugal.

In accordance with this invention, a cylindrical partition is arranged concentrically within the liquids receiving chamber to divide the latter into radially inner and outer compartments, and such partition has a fixed section located between the casing wall and the small diameter end portion of the basket and a movable section in telescopic relation with the fixed section so that adjusting the axial position of the movable section relative to the fixed section varies the effective extent of the partition from the small diameter end toward the large diameter end of the basket and thereby changes the relative extents along the perforate wall of the portions of the latter through which liquids pass into the inner and outer compartments, respectively, from which the separated liquids are drained by fixed conduits extending from the inner and outer compartments at the opposite sides of the fixed section of the partition; and a mechanism connected with the movable cylindrical section at locations spaced angularly thereabout holds that section at a given axial position and has elements extending to the exterior of the curb wall of the machine for operation to adjust the axial position of the movable section whenever desired. This mechanism includes pulleys which are rotatably supported in the outer compartment of the liquids receiving chamber at locations spaced apart uniformly around the cylindrical partition, and a cable is wrapped on each pulley and has its opposite ends secured to the movable section of the partition at vertically spaced locations so as to effect the axial positioning of the movable section in response to turning of the pulleys, for example, by manipulation of levers located at the exterior of the curb wall and connected to the pulleys by shafts extending thereto.

The movable section of the partition preferably is made up of inner and outer concentric, spaced apart shells which are joined together at their upper ends to define an annular space opening downwardly therebetween and receiving the fixed section of the partition, thereby to deter splashing or other transfer of liquids between the inner and outer compartments through gaps or clearances between the fixed and movable sections of the partition.

While specific reference is made herein to the use of the invention in the manufacture of sugar, it will be evident that centrifugal machines embodying the invention have various other industrial uses as in the manufacture of finely divided chemicals or wherever finely divided solids are to be separated centrifugally from a liquid and washed free of adherent liquid in the course of the separation.

The above, and other objects, features and advantages of the invention, will be apparent in the following detailed description of an illustrative embodiment thereof which is to be read in connection with the accompanying drawings forming a part thereof, and wherein:

FIG. 1 is a vertical, axial sectional view of a continuous centrifugal having an adjustable liquids separator in accordance with this invention;

FIG. 2 is a horizontal sectional view taken along the line 2—2 on FIG. 1;

FIG. 3 is a fragmentary sectional view taken along the line 3—3 on FIG. 2;

FIG. 4 is a horizontal sectional view taken along the line 4—4 on FIG. 1, but on a reduced scale;

FIG. 5 is a detail view showing the actuating means by which the liquids separator is adjusted, and as seen in the direction of the arrows 5—5 on FIG. 2;

FIG. 6 is an enlarged detail sectional view taken along the line 6—6 on FIG. 2;

FIG. 7 is a fragmentary perspective view illustrating the means by which the partition of the separator is adjusted, with the movable section of the partition shown in its uppermost or extended position; and

FIG. 8 is a view similar to that of FIG. 7, but showing the movable section in its lowermost or retracted position.

Referring to the drawings in detail, and initially to FIGS. 1 and 2 thereof, it will be seen that the present invention is there shown embodied in a continuous centrifugal 10 having its basket 11 rotated about a vertical axis. The basket 11 has a circumferential wall 12 which is generally of frusto-conical configuration with its largest

diameter at the top. The wall 12 is of perforate construction, for example, as disclosed in the co-pending application for U.S. Letters Patent identified as Serial No. 356,763, filed April 2, 1964, and through which liquids can pass under the influence of centrifugal force. A central hub 13 projects upwardly from the bottom of basket 11 and is secured on the upper end of a vertical shaft 14 which is journalled in bearings within a housing 15. The lower end of housing 15 is carried by suspensions 16 which are, in turn, supported by an annular horizontal plate 17, for example, as disclosed in the co-pending application for U.S. Letters Patent identified as Serial No. 368,615 filed May 19, 1964.

The centrifugal 10 has an outer curb wall structure 18 that includes an upper section or cover 19 and a base section 20 secured together at mating flanges 21. The annular plate 17 is welded or otherwise secured to the top edges of pairs of vertical, parallel spaced apart plates 22 which extend radially inward from the lower section 20 of the curb wall and which are equally angularly spaced apart, as shown particularly on FIG. 4. The lower edges of each pair of plates 22 are joined by a horizontal web or bottom plate 23 (FIGS. 1, 3 and 4), and the radially inner ends of all of the plates 22 are further joined to a ring 24 (FIGS. 1 and 4) defining an access opening under the suspensions 16 which is normally closed by a cover plate 25.

A cylindrical casing wall 26 is made up of upper and lower sections 27 and 28 joined together at mating flanges 29, and the lower section 28 extends upwardly from, and is welded or otherwise secured to the outer periphery of annular plate 17. The upper end edge of casing wall 26 extends closely proximate to a rim structure 30 at the upper or large diameter end of basket 11 so that an annular solids receiving chamber 31 is defined between curb wall 18 and casing wall 26 and an annular liquids receiving chamber 32 is defined above annular plate 17 between casing wall 26 and the circumferential wall 12 of the basket.

The lower or small diameter end of basket 11 has a cylindrical skirt 33 depending therefrom and spaced radially outward from the adjacent relatively small diameter end portion of the side wall of the basket to define an annular, downwardly opening space 34, and an upstanding cylindrical wall 35 extends along the inner periphery of annular plate 17 and projects upwardly into the annular space 34 to define the inner margin of liquids receiving chamber 32 adjacent the bottom of the latter.

Rotation of the basket 11 may be effected by a motor 36 mounted on a base 37 which projects radially outward from lower curb wall section 20 substantially in line with one of the pairs of plates 22, as shown on FIG. 4. The shaft of motor 36 drives a pulley 38 which is engaged by belts 39 passing between the plates 22 which are substantially in line with the base 37 and running around a pulley 40 secured to the lower end of shaft 14 below bearing housing 15.

The mixture of solids and liquids to be separated by the centrifugal 10 is fed into basket 11 through an infeed pipe 41 (FIGS. 1 and 2) which extends downwardly into the basket and opens adjacent the lower or small diameter end of the latter. During rotation of basket 11 centrifugal force acts on the mixture continuously fed to the basket adjacent the small diameter end of the latter to cause movement of the mixture along circumferential wall 12 of the basket in the direction toward the large diameter end of the latter, that is, in the upward direction. As the mixture moves upwardly along wall 12, centrifugal force causes the liquid constituents of the mixture to pass radially outward through perforate wall 12 into liquids receiving chamber 32, and the solids from which the liquids have been extracted pass radially outward over rim structure 30 at the large diameter end of the basket into the solids receiving chamber 31. In order to avoid passage of liquids from chamber 32 into solids

receiving chamber 31 through the necessary gap or clearance between rim structure 30 of the rotated basket and the fixed or stationary casing 26, cylindrical, concentric baffles 42 and 43 are supported from the upper section 27 of casing 26, as by radial webs 44, and have inwardly bent upper edges between which there extends an annular rib 45 depending from the underside of rim structure 30 to form a serpentine seal.

When the liquid constituents of the mixture tend to adhere to the solids, the adhering liquids can be removed from the solids as the latter travel upwardly along wall 12 of basket 11 by wash water supplied through a pipe 46 extending downwardly into the basket and terminating in a perforated manifold 47 extending parallel to the perforate wall for spraying water against the solids. When the mixture fed to basket 11 through infeed pipe 41 is massecuite, that is, a mixture of sugar crystals and syrups, the liquids passing through the lower portion of perforate wall 12 into chamber 32 are essentially green syrup, and the liquids passing through the upper portion of perforate wall 12 are wash syrup, that is, the wash water sprayed against the sugar crystals from manifold 47 and the vestiges of the syrup removed from the sugar crystals by such wash water.

In accordance with this invention, the above described centrifugal 10 is provided with an adjustable separator 48 which is operative to separate the green syrup or other liquids passing through a predetermined lower portion of perforate wall 12 from the wash syrup or other liquids passing through the remaining upper portion of the basket wall. The adjustable separator 48 includes a cylindrical partition 49 arranged concentrically within the liquids receiving chamber 32 to divide the latter into radially inner and outer compartments 50 and 51, respectively. The partition 49 is made up of a fixed cylindrical section 52 extending upwardly from annular plate 17 substantially midway between the lower section 28 of casing wall 26 and the small diameter or lower end portion of basket 11, and a movable cylindrical section 53 which is in telescopic relation to the fixed section 52. The movable section 53 of the partition is preferably made up of inner and outer concentric, spaced apart shells 54 and 55 which are joined together at their upper ends by a ring 56 to define an annular space 57 opening downwardly between shells 54 and 55 and receiving the fixed section 52 of the partitition. The extension of fixed partition section 52 into space 57 forms a serpentine seal for preventing splashing or other transfer of liquids between the inner and outer compartments 50 and 51 through the necessary gaps or clearances between the fixed and movable sections of partition 49.

In order to effect vertical or axial movement of section 53 relative to fixed section 52, a number of pulleys 58, for example, three pulleys as shown on FIG. 2, are spaced apart equally around the partition 48 and are mounted on the inner ends of shafts 59. The shafts 59 are journalled in tubes 60 extending radially, with respect to the axis of basket 11, through casing wall 26 and curb wall 18 and being secured to such walls as by welding. The several tubes 60 are positioned above and centered with respect to the pairs of plates 22. A steel cable 61 is wrapped on each pulley 58 and, as shown particularly on FIGS. 7 and 8, the opposite ends of each cable 61 are respectively secured to brackets 62 and 63 extending outwardly from movable partition section 53 at vertically spaced apart locations, for example, at the ring 56 forming the top of section 53 and at the bottom edge of the outer shell 55. It will be apparent that, when shafts 59 and pulleys 58 are turned in one direction or the other, the wrap of cables 61 on the pulleys will cause either upward or downward movement of partition section 53 relative to the axes of rotation of the pulleys, and hence relative to fixed partition section 52.

In order to permit turning of pulleys 58 from the outside of curb wall 18, the outer ends of shafts 59 project

from tubes 60 and are each secured to a lever or handle 64 (FIGS. 1, 2, 3, 5 and 6).

Secured to the mating flanges 21 of curb wall sections 19 and 20 above the outer ends of shafts 59 are quadrant brackets 65. Each quadrant bracket includes an inner sector plate 66 projecting upwardly from a mounting flange 67 and an arcuate guide 68 secured, at its ends, to sector plate 66 so as to be spaced outwardly from the latter and permit the slidable extension of the related lever 64 therebetween. Each lever 64 has a boss 69 (FIG. 6) formed intermediate its ends and having a tapped hole receiving a set screw 70 with a knurled head. It will be apparent that the set screw 70 can be tightened to bear against the sector plate 65 and thereby lock the lever 64 in any desired position within the quadrant bracket 65. Further, when set screw 70 is loosened, lever 64 can be angularly displaced within the related quadrant bracket to similarly turn the related shaft 59 and pulley 58 for effecting vertical displacement of movable partition section 53. As shown on FIG. 5, the arcuate guide 68 of the quadrant bracket may be provided with a scale which is calibrated to cooperate with an index on the lever 64 for indicating the vertical position of movable partition section 53 relative to fixed section 52.

As shown particularly on FIGS. 2 and 3, sloping plates 69 converge upwardly from the top edges of each pair of plates 22 between curb wall 18 and casing wall 26 and come together above the tube 60 which is centered with respect to that pair of plates 22. Thus, each pair of plates 22, the web 23 extending between the bottom edges thereof, the annular plate 17 extending over the inner portions of the plates 22 and the converging plates 69 extending from the outer portions of the plates 22 cooperate to define a tunnel-like structure 70 extending radially inward from the curb wall and opening at the center of the centrifugal under the basket. The solids are discharged downwardly from chamber 31 through the gaps 71 defined between the tunnel-like structures 70, and an inwardly inclined deflector 72 (FIGS. 1, 2 and 4) extends from curb wall 18 within each gap 71 to direct the discharged solids towards the center under the centrifugal.

The liquids collected in compartments 50 and 51 are respectively discharged from such compartments through ducts 73 and 74 (FIGS. 2 and 4) which open through annular plate 17 at the inner and outer sides, respectively, of fixed partition section 52, and which extend downwardly from annular plate 17 and then outwardly through one of the tunnel-like structures 70. The outer ends of discharge ducts 73 and 74 project through curb wall 18 and have flanges 75 and 76 (FIG. 4) for connection to suitable piping.

It will be seen that the tubes 60 housing shafts 59 of pulleys 58, the drive belts 39 for rotating the basket 11, and the liquid discharge ducts 73 and 74 are all housed in the tunnel-like structures 70 so as to avoid interference with the downward discharge of solids from the outer chamber 31.

During operation of centrifugal 10, liquids passing outwardly through the lower portion of perforate wall 12 below the level of the top edge of partition 49 and being centrifugally propelled away from wall 12 are intercepted by the partition and collected in the inner compartment 50, while liquids passing through the upper portion of perforate wall 12 above the level of the top edge of partition 49 are collected in the outer compartment 51. Thus, partition 49 is effective to separate the liquids discharged radially through the lower and upper portions of perforate wall 12 and such separated liquids are then drained from the respective compartments 50 and 51 through the discharge ducts 73 and 74, respectively. The portions of the wall 12 through which liquids pass into the compartments 50 and 51, respectively, can be changed, even during operation of the centrifugal, merely by suitably turning the handles or levers 64 so as to raise or lower movable section 53 of partition 49 and thereby alter the level of the top edge of the partition. Thus, when centrifugal 10 is employed during the manufacture of sugar for separating the sugar crystals from the syrups contained in massecuite fed into the basket 11 through infeed pipe 41, the movable section 53 of partition 49 can be adjusted to ensure that the liquids collected in compartment 50 consist essentially of green syrup, and that the liquids collected in the outer compartment 51 consist essentially of the wash syrup.

Since adjustment of the separator 48 merely involves raising and lowering the level of the upper edge of partition 49 disposed between the concentric radially inner and outer compartments 50 and 51 having fixed bottoms defined by the plate 17, such adjustment can be easily accomplished by simple mechanisms, as shown, and does not require movement of the discharge ducts 73 and 74 opening through plate 17.

Although an illustrative embodiment of this invention has been described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to that precise embodiment, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a continuous centrifugal including a basket rotatable on a vertical axis and having a perforate, frustoconical circumferential wall increasing in diameter toward the upper end of the basket, means for feeding a mixture of solids and liquid into the basket for travel upwardly along the perforate wall under the influence of centrifugal force, a cylindrical casing wall concentrically surrounding the basket and having its upper end proximate to the upper end of the basket to define a liquids receiving chamber around the basket, and an outer curb wall spaced from said casing wall to define therebetween a chamber for receiving solids which are discharged over said upper end of the basket; a separator for selectively separating liquids driven centrifugally through lower and upper portions of said perforate wall of the basket comprising a cylindrical partition extending upwardly, and arranged concentrically within said liquids receiving chamber to divide the latter into radially inner and outer compartments which receive the liquids passing through the portions of said perforate wall respectively below and above an upper edge of said partition, said partition having a fixed section between said casing wall and the lower end portion of the basket and a movable section in telescopic relation with said fixed section and defining said upper edge of the partition, means for adjusting the vertical position of said movable section relative to said fixed section to vary the height of said upper edge and thereby change the portions of said perforate wall through which liquids drain into said inner and outer compartments, respectively, and conduits extending from said inner and outer compartments at the bottom of the latter for draining liquids from the respective compartments, said means for adjusting the vertical position of said movable section including pulleys rotatably supported at locations spaced apart around said partition, a cable wrapped on each of said pulleys and having its opposite ends secured to said movable section at vertically spaced locations on the latter, and means for controlling the rotational positions of said pulleys.

2. A continuous centrifugal as in claim 1, each said pulley being mounted at the inner end of a shaft extending outward therefrom to the exterior of said curb wall, said means for controlling the rotational positions of said pulleys including a manually actuable lever on the outer end of each said shaft, and releasable clamping means for holding each lever in angularly adjusted position.

3. A continuous centrifugal as in claim 2; further comprising angularly spaced tunnels extending radially inward across said solids receiving chamber and under said

liquids receiving chamber, said shaft of each said pulley extending through a respective one of said tunnels.

4. A continuous centrifugal as in claim 1; further comprising angularly spaced tunnels extending radially inward from said curb wall across said solids receiving chamber and under said liquids receiving chamber; said means for adjusting the vertical position of said movable section being actuable from the exterior of said curb wall and extending through said tunnels to said movable section.

5. A continuous centrifugal as in claim 4; wherein said conduits extend from said compartments through one of said tunnels to the exterior of said curb wall.

6. A continuous centrifugal as in claim 4; further comprising drive means for the basket extending through one of said tunnels from the exterior of said curb wall.

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