June 11, 1963 B. JAFFE ET AL 3,093,149

DISC WASHING MACHINE

Filed May 2, 1961 4 Sheets-Sheet 1

FIG. 1

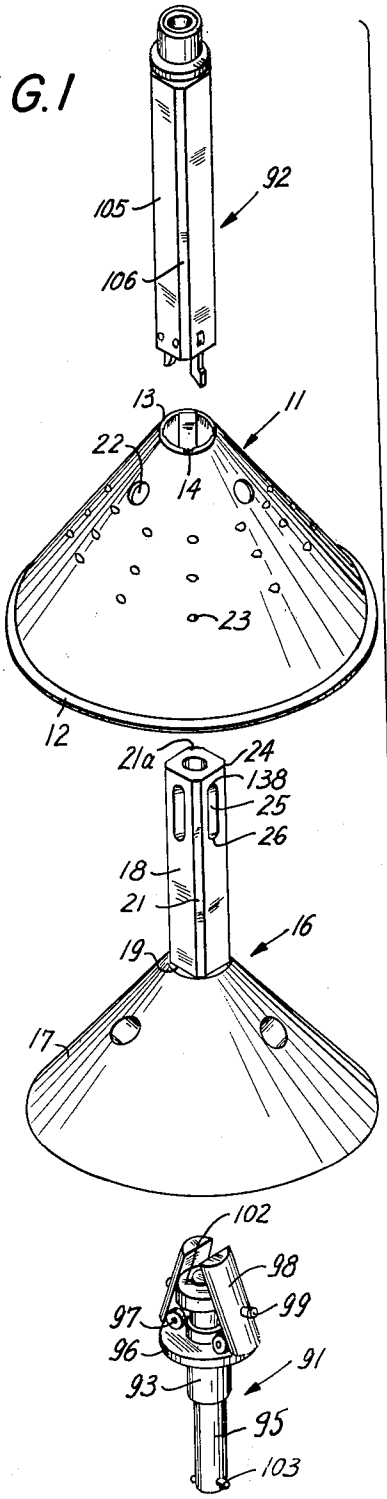


FIG. 2

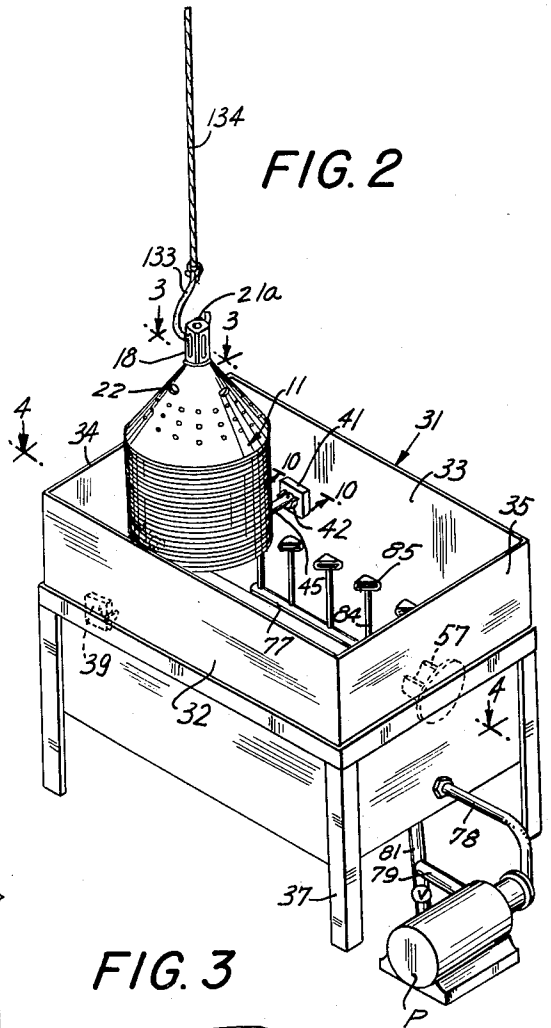
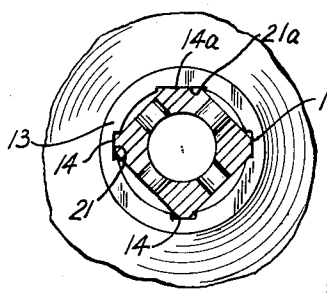


FIG. 3



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DISC WASHING MACHINE

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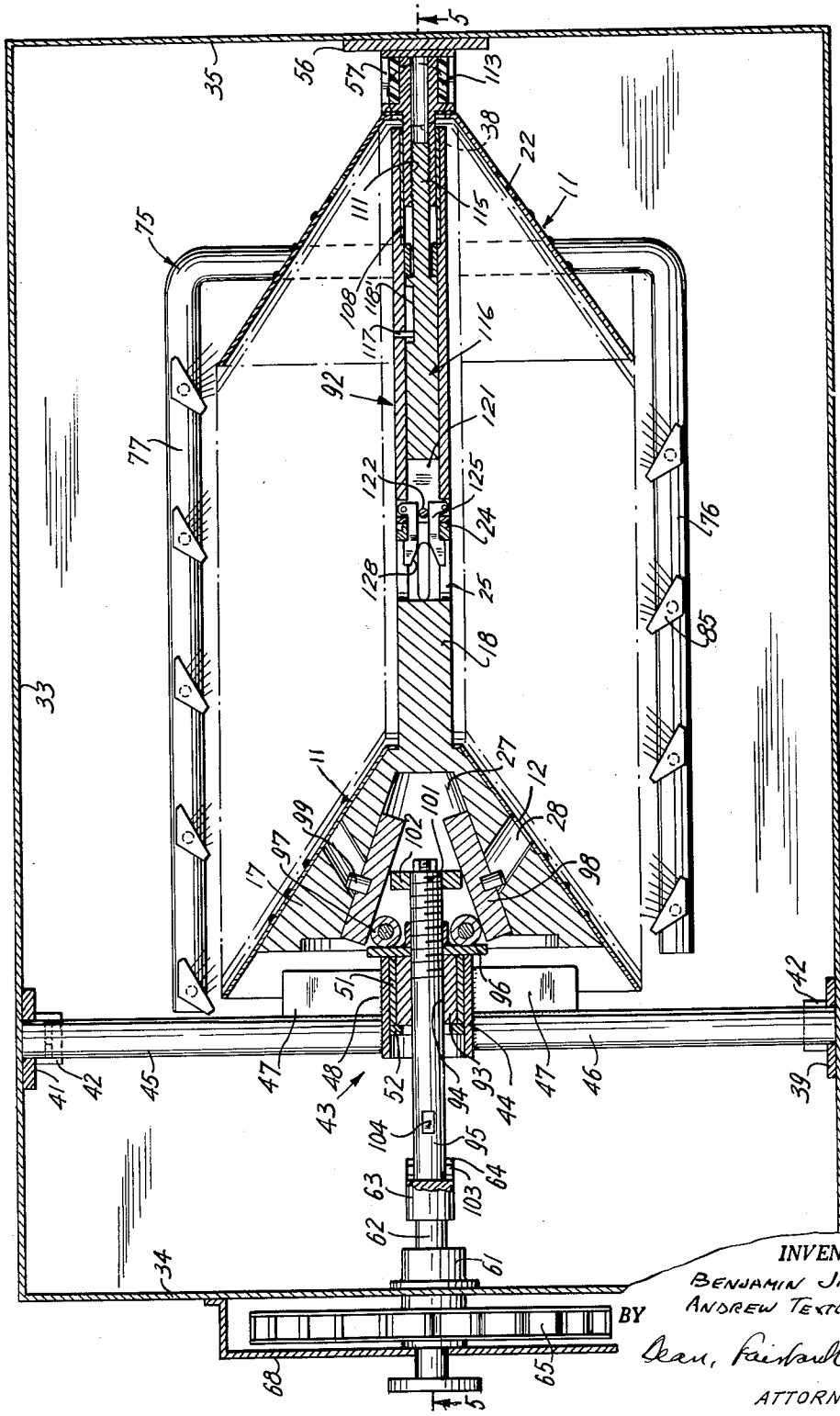


FIG. 4

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June 11, 1963 B. JAFFE ET AL 3,093,149

DISC WASHING MACHINE

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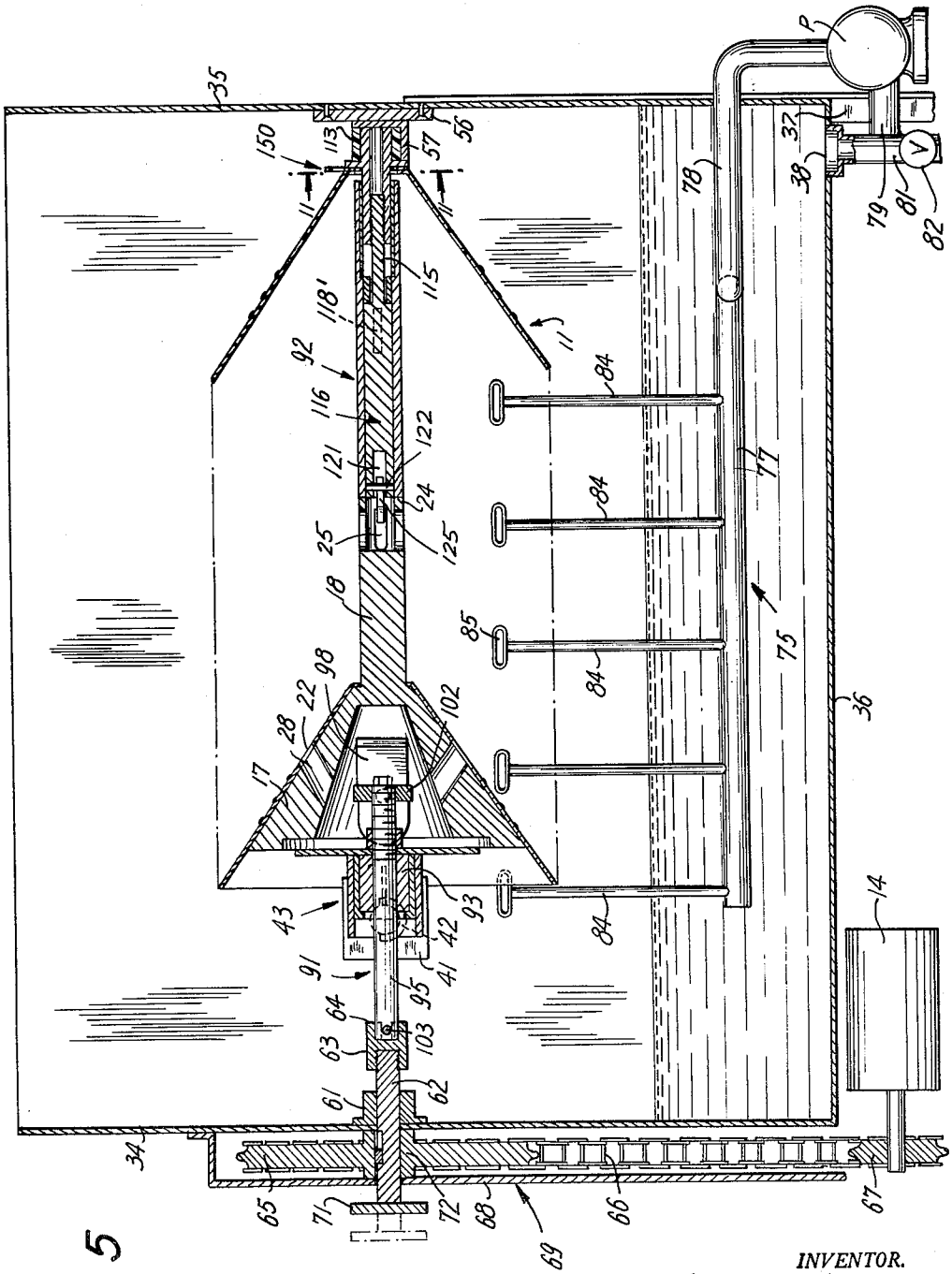


FIG. 5

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DISC WASHING MACHINE

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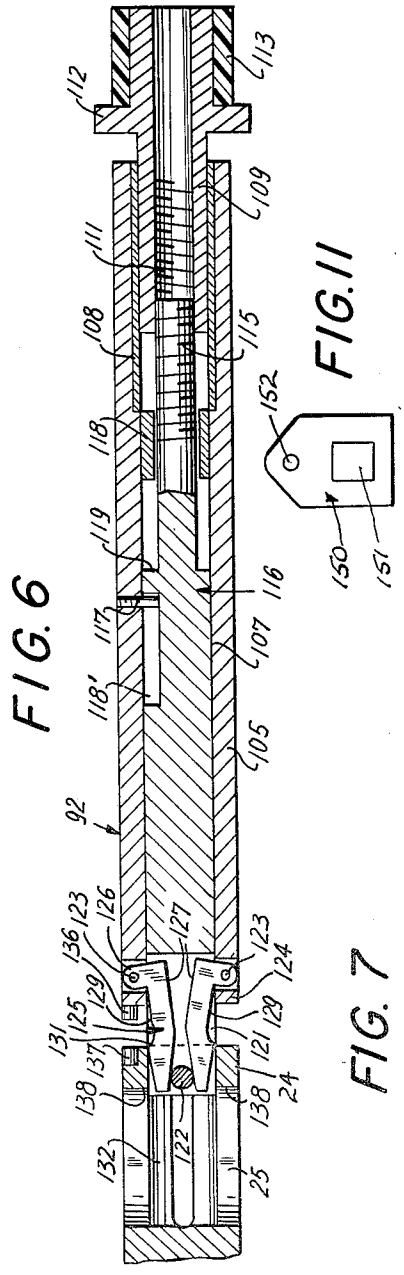


FIG. 6

FIG. 11

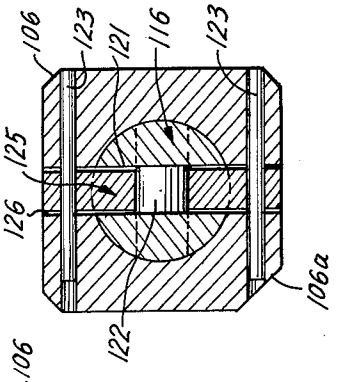


FIG. 9

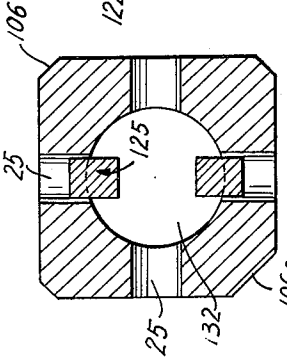


FIG. 8

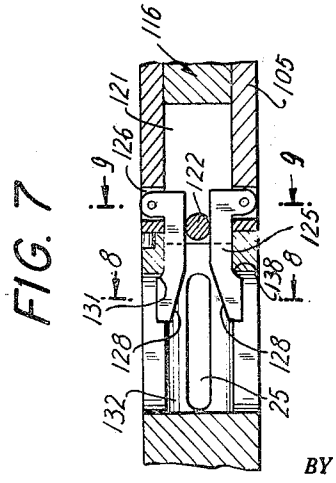


FIG. 7

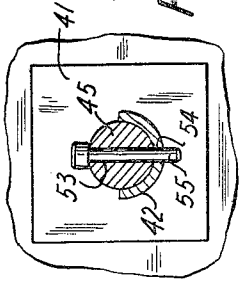


FIG. 10

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United States Patent Office 3,093,149 Patented June 11, 1963

3,093,149

DISC WASHING MACHINE

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Filed May 2, 1961, Ser. No. 107,188
9 Claims. (Cl. 134—149)

This invention relates to the art of washing machines, more particularly of the type to wash the discs used in centrifugal type milk separators.

As conducive to an understanding of the invention, it is noted that centrifugal separators, such as the type used in the milk industry and put out by the DeLaval Separator Company under their Model No. 425, for example, utilize a large number of frusto-conical members, generally called discs in the trade. These discs, which number over 125 in the Model 425 separator, above mentioned, are mounted in nested position on a disc carrier which comprises a frusto-conical base having an axial spindle extending upwardly therefrom and which extends through an axial opening in the smaller diameter end of each of the discs.

The discs are clamped together with but a slight clearance therebetween and in conventional operation of the separator, the milk is forced through aligned openings in the base of the carrier and the wall of the discs, the latter being rapidly rotated to hurl any foreign bodies or solid matters outwardly toward the wall of the chamber in which the discs are rotating. Because of the close tolerances between the juxtaposed nested discs, material that is too heavy or too large to be thrown out laterally, sticks between the discs and eventually will clog the latter. As a result, the equipment must periodically be stopped and the discs removed for cleaning.

Where the discs are removed one by one from the disc carrier and then are scrubbed by hand to remove impurities, in view of the relatively large number of discs, such operation is time-consuming and requires the constant efforts of a workman which therefore is a relatively expensive operation.

It is accordingly among the objects of the invention to provide an equipment for washing the multiplicity of discs of a centrifugal separator without need for removing the discs from their carrier and without need for manual scrubbing of the individual discs, which washing equipment is dependable in operation and will thoroughly clean the discs and is not likely to cause damage to the individual discs resulting from their removal from the carrier on which they are normally mounted.

According to the invention these objects are accomplished by the arrangement and combination of elements hereinafter described and more particularly recited in the claims.

In the accompanying drawings in which are shown one of various possible embodiments of the several features of the invention:

FIG. 1 is an exploded perspective view of the disc carrier and the extension units,

FIG. 2 is a perspective view of the washing tank,

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2,

FIG. 4 is a sectional view taken along line 4—4 of FIG. 2 showing the equipment in operating position,

FIG. 5 is a sectional view taken along line 5—5 of FIG. 4,

FIG. 6 is a longitudinal sectional view of one of the extension units on a greatly enlarged scale,

FIG. 7 is a fragmentary detail view similar to FIG. 6 showing the locking mechanism of the extension unit,

FIG. 8 is a sectional view taken along line 8—8 of FIG. 7,

FIG. 9 is a view similar to FIG. 8 taken along line 9—9 of FIG. 7,

FIG. 10 is a sectional view taken along line 10—10 of FIG. 2, and

FIG. 11 is a view taken along line 11—11 of FIG. 5.

Referring now to the drawings, the washing equipment which is the subject of the present invention is designed to wash conventional discs 11 of the type shown in FIG. 1, for example.

Thus, the discs are of sheet metal such as stainless steel and are substantially frusto-conical as shown, having a peripheral flange 12 at the wider diameter end thereof. The smaller diameter end of the disc 11 has an inwardly extending flange 13 with a plurality of notches 14 therein, one of said notches, illustratively the notch 14*a*, being of greater width than the other notches, to serve as a keying conformation to insure that all of the discs will be properly aligned as hereinafter described.

The disc carrier 16 shown in FIGS. 1 and 3 comprises a substantially frusto-conical base 17 which has an axial stem or spindle 18 rising from the smaller diameter end 19 of the base. As shown in FIG. 1, the stem 18 is substantially square in cross section having beveled corners 21 designed to coact with the recesses 14 in flange 13, one of said beveled corners 21*a* being of greater width than the others and designed to coact with the larger recess 14*a* in flange 13. Thus, when the discs are positioned on the stem, all of the openings 22 in the discs will be in proper alignment and the plurality of flat rivet heads 23 extending outwardly from the surface of each disc, serve to space the nested juxtaposed discs from each other by a relatively small clearance to permit discharge of milk therebetween.

The upper end 24 of the stem 18 desirably has slots 25 extending therethrough at right angles to each other and the discs are designed to be positioned on the disc carrier substantially up to the level of the lower end 26 of said slots.

The base 17 of the disc carrier has an axial recess 27 therein and a relatively large wall thickness, said wall having a plurality of bores 28 extending therethrough. As is clearly shown in FIG. 3, the bores extend at an acute angle toward the end 24 of the stem 18, with respect to the axis of the disc carrier, and four equidistantly spaced bores are illustratively provided, said bores 28 being aligned with the openings 22 in the discs when the latter are positioned on the stem 18 of the disc carrier.

The discs are washed in a tank 31 shown in FIGS. 2 4, and 5, which preferably is of stainless steel. The tank has parallel side and end walls 32, 33 and 34, 35 and a floor 36. The tank is suitably supported on upright legs 37 and the floor of the tank desirably inclines downwardly slightly from end wall 34 to end wall 35 so that liquid in the tank may be discharged through a port 38 in the floor adjacent end wall 35.

Secured to each of the side walls 32, 33 of the tank, substantially midway between the top and bottom thereof and closer to end wall 34 than the end wall 35 are bearing blocks 39 and 41, each of which mounts a substantially U-shaped or arcuate bracket 42 which serves as a bearing, said brackets being transversely aligned and in the same horizontal plane.

The brackets 42 serve as the pivotal mount for a transfer unit 43 which, as shown in FIG. 4, comprises a central hub 44, illustratively a sleeve which has extending outwardly therefrom, at right angles to the axis of the hub and secured to the latter as by welding, two longitudinally aligned shafts 45 and 46. To reinforce the unit a pair of rigid plates 47 are welded as at 48 to the hub 44 and to the shafts 45, 46 respectively. The hub has affixed therein a bushing 51 and an inwardly extending

annular flange **52**, the inner periphery of which has a diameter less than the diameter of the bushing **51**.

The ends of the shafts **45**, **46** are designed to rest in the U-shaped brackets **42** and the end of shaft **45** has a diametric bore **53** therethrough (FIG. 10) adapted to be aligned with a vertical bore **54** in the associated bracket **42** so that when a pin **55** is inserted through said aligned bores, the hub **44** will be retained in vertical position for the purpose hereinafter to be described.

Affixed to the end wall **35** of the tank centrally located thereon and positioned substantially midway between the top and bottom thereof is a block **56** which mounts a U-shaped bearing bracket **57**. The bracket **57** is arcuate and has its axis longitudinally aligned with the axis of the hub **44** of the transfer unit when such hub is pivoted through an angle of 90° so that its longitudinal axis is in horizontal position.

The end wall **34** of the tank has secured thereto substantially midway between the bottom and top thereof and centrally located thereon, a hub **61** through which extends a shaft **62**, the latter being longitudinally aligned with the longitudinal axis of hub **44** when the latter is in horizontal position.

Secured to the inner end of the shaft **62** is a coupling sleeve **63** which has diametrically opposed notches **64** in the free end thereof, the purpose of which will be hereinatfer described.

The end of shaft **62** extending through the wall **34** of the tank, mounts a sprocket wheel **65** connects by a sprocket chain **66** to a sprocket wheel **67** driven by motor M. The shaft **62** also extends through the wall **68** of a housing **69** and mounts a knob **71** at its outer end. The shafts **62** is keyed to sprocket wheel **65** so that it may slide through the hub **72** thereof, said wheel being restrained from axial movement by the walls **34** and **68**. Thus, the shaft **62** may be moved inwardly and outwardly for the purpose hereinafter set forth.

Mounted on the floor of the tank is a spray system **75** which includes two pipes, **76**, **77**, extending parallel to the side walls **32** and **33** and inwardly spaced therefrom and terminating in a feed pipe **78** which extends through the end wall **35** of the tank below the bearing **57** and is connected to the outlet of a pump P, the inlet of which is connected by line **79** to drain port **38**.

Desirably, a discharge line **81** having a valve **82** therein is connected to line **79** so that the tank can be emptied after the cleaning operation is completed.

Rising vertically from each of the parallel pipes **76** and **77** and spaced therealong are vertical pipes **84**, the upper ends of each of which mounts a spray nozzle **85**. As is clearly shown, the spray nozzles on the respective parallel pipes **76**, **77** are directed inwardly at an angle and the vertical pipes **84** on each of the parallel pipes **76** and **77** are staggered with respect to each other for maximum uniform distribution of water from the spray nozzles.

Adapted to be operatively connected to the disc carrier **16** to permit mounting thereof with the discs thereon in the tank, are extension units **91** and **92**.

Referring to FIGS. 1 and 4, the extension unit **91** comprises a hub **93** having a threaded bore **94** adapted to receive the correspondingly threaded portion of a shaft **95**. Secured to one end of the hub as by welding, is a disc **96**, illustratively of greater diameter than that of the hub and having an axial opening through which the shaft extends. Secured to the surface of the disc on the side thereof remote from the hub are diametrically aligned hinge brackets **97**, each of which pivotally mounts one end of a locking arm **98**, the free ends of the latter being movable toward and away from the shift **95** and each mounting on its outer surface a locking pin **99**.

The end **101** of the shaft **95** between the arms **98** has secured thereto a disc **102** which, when the shaft **95** is rotated to move the disc **102** away from disc **96**, will react against the inner sides of the arms **98** tending to urge them apart on their pivotal mounts. The other end

of the shaft **95** has a pin **103** extending diametrically therethrough and designed to be accommodated in the diametric slots **64** in sleeve **63** of shaft **62**. In addition, the end of shaft **95** adjacent the pin **103** has flats **104** thereon to permit rotation of the shaft **95** by a suitable tool for the purpose hereinafter to be described.

The extension unit **92** (FIG. 6) comprises a shaft **105** which is substantially rectangular in cross section, having beveled corners **106**, one of said beveled corners **106***a* being greater in width than the others. More particularly, the cross sectional configuration of the extension shaft **105** is substantially identical to that of the stem **18** of the disc carrier **16**. The shaft **105** has an axial bore **107** extending longitudinally therethrough. One end of the bore **107** mounts a fixed bushing **108** in which is rotatably mounted a sleeve **109** having an internally threaded portion **11** at its inner end. The outer end of the sleeve **109** extends beyond the bore **107** and mounts a disc **112** inwardly spaced from such outer end as shown. The portion of the sleeve **109** between the disc **112** and the outer end of the sleeve has secured thereto a collar **113** of suitable rigid plastic.

The threaded end of the sleeve **109** is designed to accommodate the correspondingly threaded, reduced diameter end **115** of a rod **116** which extends through the bore **107**. The rod **116** is so mounted that it is restrained from rotation, yet it is free to move longitudinally depending upon the direction of rotation of the sleeve **109**. This may be accomplished by means of a pin **117** extending through the wall of the shaft **105** into a longitudinal slot **118** in the rod **116**.

The inward movement of rod **116** is limited by a collar **118** affixed in the bore **107** of shaft **105** and against which abuts the shoulder **119** defined by the reduced diameter portion **115**.

As shown in FIG. 6, the outer end of rod **116** is bifurcated as at **121** and a pin **122** extends through the outer extremity of the bifurcated portion.

Pivotally mounted as at **123** to the end **124** of the shaft **105** on axes extending parallel to the axis of the pin **122** and straddling the latter, are locking fingers **125** which are identical as shown and which are positioned in slots **126** in the end **124** of shaft **105**. The locking fingers have substantially straight surfaces **127** along their inner edges and then are beveled away from each other as at **128**. The outer edge of each of the fingers has an elongated notch **129** defining a curved locking edge **31** at the end thereof remote from the pivot **123**, the function of which will be hereinafter described. As is clearly shown in FIG. 6, when the rod **116** is in its retracted position, the locking fingers **125** will be free to pivot inwardly so that the maximum width of the extensions thereof is less than the diameter of the axial bore **132** in the upper end of the stem **18** into which slots **25** extend, so that such fingers are free to enter such bore as shown.

In order that the discs may be washed, after the separator is opened, the disc carrier **16** may be removed by attaching the hook end **133** of a cable **134** or the like through the slots **25** in the upper end of the stem **18** and vertically lifting the disc carrier **16** with the discs thereon. Thereupon, the extension unit **91** is connected to the base **17** of the disc carrier **16**. This is accomplished as shown in FIG. 4 by positioning the arms **98** of the extension unit **91** in the axial recess **27** in the base **17** of the disc carrier so that the pins **99** are substantially aligned with a pair of bores **28** as is shown. Thereupon, the shaft **95** is roated in direction to move the cam disc **102** against the pivoted arms **98** to urge the latter outwardly and such rotation is continued until the pins **99** enter the bores **28** and the arms **98** are securely retained against the wall surface of recess **27** so that the shaft **95** will be rigidly connected to the disc carrier **16**.

Thereupon, by means of the cable **134** which is still connected to the upper end of the stem **18** of the disc carrier **16**, the disc carrier **16** with the disc **11** thereon and

with the extension unit **91** affixed thereto as previously described, is positioned directly over the hub **44** of the transfer unit **43** in the tank **31** which at this time is emptied of any liquid. The disc carrier and associated extension unit **91** is then lowered so that the shaft **95** enters the hub passing through the bushing **51** and the bore of flange **52** until the hub **93** rests on such flange. While this operation is carried on the pin **55** extends through the end of the shaft **45** and the aligned opening in bearing **42** so that the hub of the transfer unit will be retained in vertical position.

Thereupon, the hook **133** of the cable **134** is removed from the upper end of the stem **18** of the disc carrier **16**, the latter still remaining in vertical position by reason of the vertical position of the hub **44** of the transfer unit.

The extension unit **92** is then connected to the upper end of the stem. This is accomplished by first rotating the sleeve **109** so that the rod **116** is retracted to move the pin **122** thereof outwardly so that the fingers **125** will be free to move toward each other as shown in FIG. 6. Thereupon, the shaft **105** is positioned over the upper end of stem **18** with the keying pin **136** in notch **137** so that the larger width beveled edge **106***a* is in alignment with the corresponding beveled edge of the stem **18**. With the free ends of the locking fingers **125** pushed together they will be of narrow enough width so that they may freely enter the bore **132** at the upper end of the stem **18**. Thereupon, the sleeve **109** is rotated to move rod **116** inwardly to the position shown in FIG. 7 thereby first causing the pin **122** to engage the beveled surfaces **128** of the locking fingers **125** to cam the latter outwardly so that they enter the slots **25** in the upper end of the stem **18** of the disc carrier **16**, i.e., they enter opposed slots. The length of the locking fingers **125** and the length of the slots **25** are so arranged that when the locking fingers are moved outwardly, the curved locking edge **131** thereof will engage the upper ends **138** of the slots securely to retain the extension unit **92** and the stem **18** of the disc carrier **16** together in properly aligned position.

With the drive shaft **62** in retracted position, the pin **55** is removed and the transfer member **43** is then pivoted so that the disc carrier with its affixed extension units **91**, **92** are in horizontal position with the collar **113** resting in bearing **57** and with the free end of shaft **95** in axial alignment with the drive shaft **62**. As the disc carrier and associated discs are relatively heavy, in order to rotate the latter in a clockwise direction on shafts **45** and **46** from the position shown in FIG. 2, a plate **150** is provided which, as shown in FIG. 11, has a central aperture **151** corresponding substantially in configuration to the cross section of the shaft **105** so that the latter may pass through such central aperture, said plate **150** being positioned on shaft **105** before it is affixed to the stem **18** as previously described. The plate **150** has an opening **152** at one end adapted to receive the hook **133** which is positioned in the opening **152** when the disc carrier is in vertical position. Thereupon, by releasing tension on the cable **134** after the pin **55** holding the hub **44** in vertical position is removed and pushing on the disc carrier, the latter may be rotated slowly to its horizontal position.

At this time the shaft **62** is moved inwardly so that the ends of pin **103** will enter the diametrically opposed slots **64** in sleeve **63**.

Thereupon, the hook **133** is removed and the plate **150** is moved to the right hand end of the shaft **105** abutting against disc **112**. The discs **11** are then distributed so that they extend the entire length of the stem **18** as well as the shaft **105** thereby materially increasing the spacing between such discs **11** so that the surfaces thereof are accessible to the water sprayed by the nozzles **85** in the manner hereinafter to be described.

At this time the drive motor M driving the sprocket wheel **65** is energized to cause rotation of the disc carrier, the discs thereon and the associated extension units. Such rotation desirably is at a relatively low speed, illustratively, one-third of a revolution every five minutes.

The cleaning tank **31** is filled with water of sufficient depth so that the discs are completely submerged and a suitable cleaning solution is added. The pump P controlling flow of water through the pipe system and the spray nozzles is then started. Since the suction end of the pump is connected to the bottom of the tank, a circulating action will be provided and the force of the spray emitted from the spray nozzles **85** will force the liquid between and around the discs **11** so as to effect a thorough cleaning thereof. This washing action is continued for approximately 45 minutes to one hour without need for any supervision whatsoever.

At this time the pump P is stopped and tank **31** is emptied by opening valve **82** and refilled with clear warm water and the operation is repeated for say 15 minutes, i.e., the pump P will again circulate the water from the tank and force such water through the spray nozzles.

Thereupon, the pump P is stopped and the tank is again emptied by opening the valve **82**. The shaft **62** is again retracted to release shaft **95**. The hook **133** is again connected to the opening **152** in plate **150** and the disc carrier **16** is pivoted to vertical position and retained in such position by means of pin **55** which is positioned through aligned openings **53** and **54**. The vertical positioning of the disc carrier **16** will cause the discs **11** automatically to restack themselves on the stem **18** of the disc carrier **16** in their normal operating position without any manual operation whatsoever to accomplish such stacking, except for the pivoting of the entire assembly as above described.

At this time the extension unit **92** is removed from the stem of the disc carrier by rotating the sleeve **109** in direction to move the rod **116** outwardly so that pin **122** will be between the beveled surface **128** of locking fingers **125** and no longer reacts against the fingers. Hence, by merely pulling on the extension unit **92** the curved surfaces **131** of the fingers **125** will move by the ends **138** of the slots **25** in the stem **18** for complete disengagement of the extension unit and the stem.

The hook **133** is then positioned in the slots **25** and the disc carrier **16** with the discs thereon is lifted vertically out of the hub **44** of the transfer member **43**. Thereupon, the extension unit **91** is removed by applying a tool to the flats **104** on shaft **95** thereof and rotating such shaft in direction to move the cam disc **102** inwardly and away from the pivoted arms **98** so that the latter will be free to move inwardly so that the pins **99** thereof will come out of the bores **28** in the base **17** of the disc carrier **16**. Thereupon, the disc carrier **16** and associated discs may be replaced in the centrifugal separator and the latter then can be operated in conventional manner.

With the relatively simple equipment above described, it is apparent that a set of discs may be washed with a minimum amount of working time that an attendant must devote to such operation. Thus, the attendant would only have to spend relatively few minutes, say about ten minutes, of actual working time with respect to the cleaning of each set of discs and consequently can wash a number of units in the time it normally took such attendant to wash the discs of one unit, thereby effecting great economy and reducing the cost of the finished product.

As many changes could be made in the above equipment and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. Equipment for washing the frusto-conical discs of a centrifugal separator of the type in which the discs are mounted in nested relationship on the stem of a disc carrier, said equipment comprising a first rigid extension unit, means releasably to connect said extension unit to the free end of the stem to extend longitudinally thereof, whereby the discs on said stem may be spread over substantially the length of said extension unit to separate said discs, a tank, means to support said disc carrier and connected extension unit in said tank in substantially horizontal position, means to rotate said disc carrier and connected extension unit and means to force liquid between said spaced discs to clean the latter.

2. The combination set forth in claim 1 in which means are provided to restrain rotary movement of said discs on said first extension unit yet permit longitudinal movement of said discs therealong.

3. The combination set forth in claim 1 in which the cross sectional configuration of said extension unit is substantially identical to that of the stem, said discs, said stem and said first extension unit having complementary configurations to restrain rotation of he discs with respect to the stem and said extension unit yet permit longitudinal movement of said discs therealong.

4. The combination set forth in claim 1 in which said extension unit comprises a shaft having a longitudinal bore therethrough, a rod in said bore, said rod being threaded at one end, a sleeve in said bore having an internally threaded bore accommodating the threaded end of said rod, said sleeve extending beyond said shaft, means to restrain rotation of said rod yet permit longitudinal movement thereof when the sleeve is rotated, a pair of locking fingers each pivotally mounted at one end to the shaft at the end thereof remote from the sleeve, means carried by the rod to cam said fingers away from each other when said sleeve is rotated in direction to move said rod inwardly, the free end of the stem having a locking conformation adapted to be engaged by said fingers releasably to connect the extension unit to said stem.

5. The combination set forth in claim 1 in which a second rigid extension unit is provided, means releasably to connect one end of said second extension unit to the disc carrier to extend longitudinally thereof in direction opposed to the first extension unit and the means to support said disc carrier comprises a transfer unit adjacent one end of said tank and having a hub, means mounting said transfer unit for pivotal movement of the hub thereof between vertical and horizontal position, said hub having an axial bore through which said second extension unit extends, and a bracket mounted in said tank adjacent the other end thereof and longitudinally aligned with the bore of said hub when the latter is in horizontal position and adapted to receive the free end of the first extension unit.

6. The combination set forth in claim 5 in which the bore in said hub and the bracket define rotary bearings for the second extension unit and the free end of the first extension unit respectively, and means to rotate said disc carrier.

7. The combination set forth in claim 5 in which the bore in said hub and the bracket define rotary bearings for the second extension unit and the free end of the first extension unit, means to rotate said disc carrier, the means to clean said disc comprises a plurality of spray nozzles in said tank arranged in rows on each side thereof and adapted to straddle the discs when the disc carrier is in horizontal position, and means to force liquid through said nozzles toward said discs.

8. The combination set forth in claim 5 in which the bore in said hub and the bracket define rotary bearings for the second extension unit and the free end of the first extension unit respectively, a shaft is slidably mounted in the end of the tank adjacent the transfer unit and is axially aligned with the bore of said hub when the latter is in horizontal position, complementary means on the inner end of the shaft and the free end of the second extension unit for releasable connection thereof and means to rotate said shaft.

9. The combination set forth in claim 5 in which the disc carrier is of the type having a frusto-conical base from which the stem extends, said base having an axial recess defining a wall having a plurality of bores therethrough, said second extension unit comprises a hub having a bore having a threaded portion, a shaft extending through said bore and having a threaded portion coacting with the threaded portion of the bore of said hub, a pair of opposed locking arms each pivotally mounted at one end on an axis extending at right angles to the longintudal axis of said shaft, the free ends of said arms being movable toward and away from said shaft, a cam dis mounted on said shaft between said arms and a locking pin extending outwardly from each of said arms and adapted to enter to a pair of bores in said disc carrier base when the arms are moved outwardly.

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