Oct. 25, 1960 N. D. COOP 2,957,332

WASHING, MIXING AND LIKE MACHINERY

Filed Dec. 24, 1957 3 Sheets-Sheet 1

FIG.1

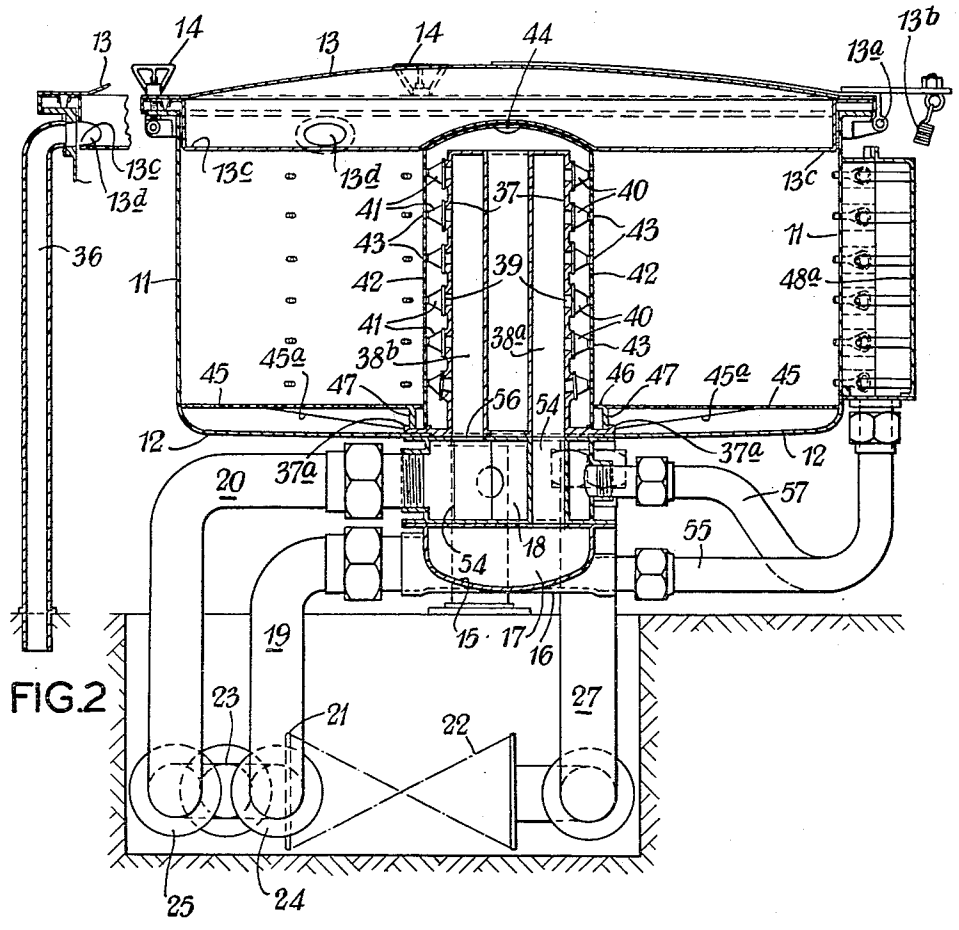


FIG.2

INVENTOR
Norman Dennis Coop
BY
Johnson and Kline
ATTORNEYS

WASHING, MIXING AND LIKE MACHINERY

Filed Dec. 24, 1957 3 Sheets-Sheet 2

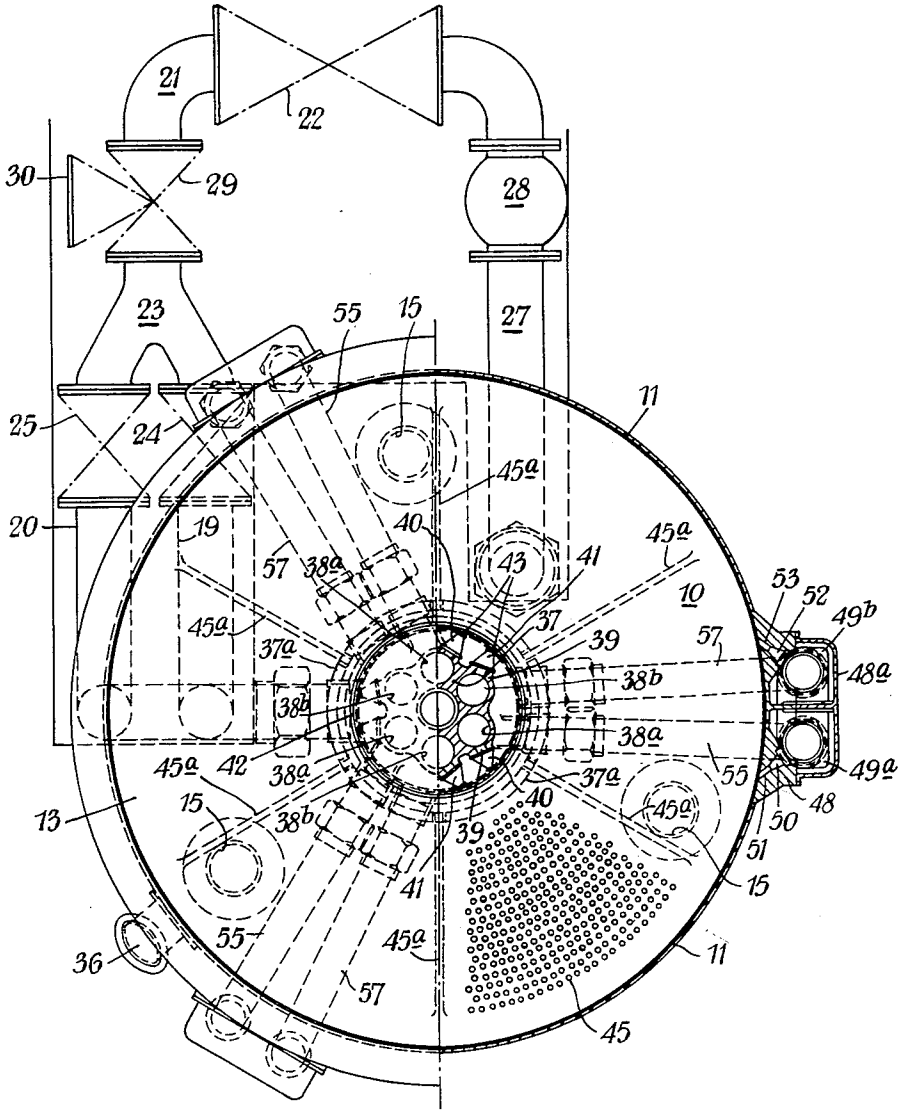


FIG.3

INVENTOR
Norman Dennis Coop
BY
Johnson and Kline
ATTORNEYS

Oct. 25, 1960 N. D. COOP 2,957,332

WASHING, MIXING AND LIKE MACHINERY

Filed Dec. 24, 1957 3 Sheets-Sheet 3

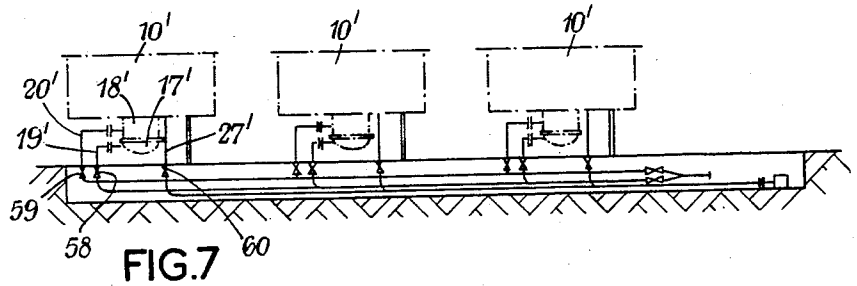


FIG.7

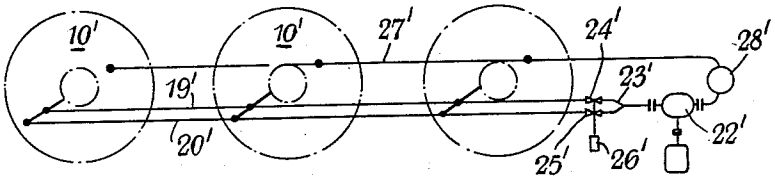


FIG.8

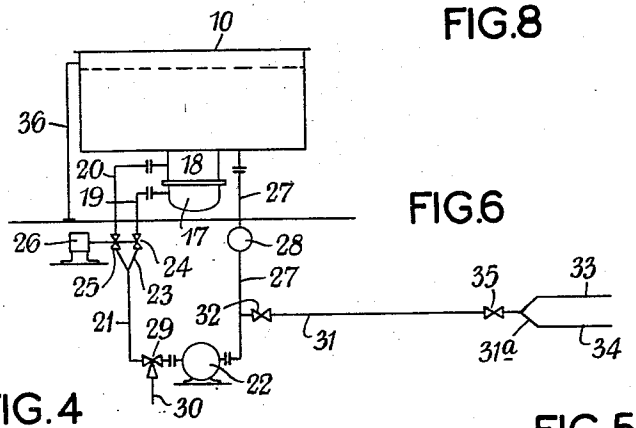
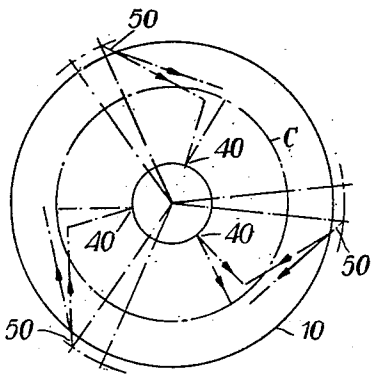
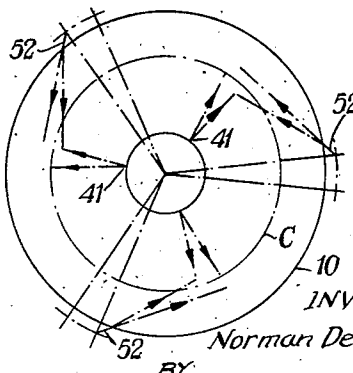


FIG.6

FIG.4

FIG.5





INVENTOR
Norman Dennis Coop
BY
Johnson and Kline
ATTORNEYS

United States Patent Office 2,957,332 Patented Oct. 25, 1960

2,957,332

WASHING, MIXING AND LIKE MACHINERY

Norman Dennis Coop, 21 Worcester Road, Blackpool, England

Filed Dec. 24, 1957, Ser. No. 705,047

3 Claims. (Cl. 68—190)

This invention of improvements in or relating to washing and mixing machinery, and like machinery refers primarily to washing machines for laundering textile articles or fabrics but may also be adapted for use as a means for homogenizing miscible liquids, or mixing solids with liquids, by hydraulic jets for the textile or chemical industries.

Washing machines or mixing machinery as at present constructed usually embody mechanical impellers, agitators or beaters for creating the necessary turbulence in the liquid which require a not inconsiderable power in driving and, further, in the case of laundering machines, the mechanical impellers or the like are liable to damage fabrics or articles being laundered, particularly if they are of a flimsy nature and also the mechanical impellers or the like cause undesirable wear and tear on other articles in general.

The present invention has for its object the provision of machinery of the type referred to in which the use of mechanical impellers, agitators or beaters for creating the requisite turbulence is entirely eliminated, the means by which the required turbulence or agitation is obtained comprising hydraulic pressure jets so placed in opposed pairs and so adapted to operate as to act on the liquid in a manner to imitate the turbulence set up by the blades of one or more oscillating or reversing impellers.

According to a further feature of the invention, machinery for use in laundering or mixing operations includes a cylindrical tank having inlet and outlet connections and being furnished with pairs superposed and opposed jets arranged in spaced relation circumferentially and centrally of said tank, an electric motor, hydraulic pump, jet timing mechanism, outlet and return pipes to jets on the delivery side of the pump with a three-way valve intercalated in the circuit operable to permit the tank to be emptied by the pump, and means for supplying hot or cold water to the tank, and also means for supplying steam thereto.

In an advantageous embodiment the tank has an open top and a flat bottom having a sump with an outlet for drainage purposes, and located centrally on the tank is a vertical column having a multiplicity of vertical chambers arranged in pairs and each in communication with the interior of the tank by means of vertically superposed nozzles, forming jets. The tank is furnished around its circumference with pairs of chambers arranged opposite to the pairs of chambers in the central column, and each circumferential chamber is furnished with nozzles directed inwards and forming jets, the wall of the respective chambers next to the interior of the tank having perforations registering with the respective jets in the said chambers.

For convenience in the following description the jet-forming nozzles will hereinafter be referred to as jets.

The jets are set at an angle to a tank radius passing through the jet and in pairs of an outwardly and inwardly directed jet adapted to converge on an imaginary circle dividing the annulus between the tank and the jet column into two equal areas. Thus, a jet on the inside vertical

surface of the tank has its co-operating jet on the central jet column, the two jets being adapted to operate simultaneously in the same clockwise or anti-clockwise direction.

In the following description the term "pair" comprises one internally and one externally directed jet on adjacent tank radii and on the same horizontal plane, both operating in a clockwise or anti-clockwise direction. The term "set" comprises two opposed pairs of jets, each pair being on adjacent tank radii, and the lines joining the jets of each pair being at an angle approximately equal to the angles between the blades of the impeller whose turbulent action it is desired to imitate.

To imitate the turbulent action of an oscillating impeller blade a minimum of four jets is necessary.

It is to be understood that imitation of turbulence resulting from two or more contra oscillating or contra reversing impeller blades on adjacent levels may be arranged for, the jets being superposed one above the other.

While jets on one level are operating clockwise, the jets on the adjacent level are operating counter-clockwise.

Increased turbulence may be obtained if instead of one jet, the number of jets is multiplied throughout the depth of the tank liquid, the jets being arranged in a vertical plane, as in imitation of a three-deep-bladed impeller.

The turbulent action of an equispaced three-bladed impeller oscillating through an angle of 120° may be matched by providing three sets of jets, the turbulence being imitated by operating first the right-hand pairs of the set of jets simultaneously, and then the left-hand pairs of the sets of jets simultaneously. Similar action may be taken with four, or more, equispaced bladed oscillating impellers. Also, the desired turbulence from two, three or more contra oscillating or contra reversing impellers at adjacent levels may be imitated.

The period of duration of the jets determines whether turbulence produced is in imitation of that produced by a partial revolution oscillation, or a full revolution oscillation of the impeller. A short jet duration will cause the liquid to be pushed part way round the tank in one direction and then back, while a longer duration of jet will cause the liquid to be pushed all the way round the tank in one direction and then back. With a still, longer duration of jet the liquid is pushed around the tank a number of times and as the jets operate alternately in one direction and then in the opposite direction, the liquid is pushed in the opposite direction an equal number of times.

In the last described case the turbulence created is in imitation of the turbulence resulting from an impeller being rotated first in a clockwise and then in a counter-clockwise direction.

Such action is advantageous in connection with a mixing operation as well as a washing operation.

Further, by arranging for angular setting of the jets in a vertical plane, the axial thrust of a propeller type of impeller may be imitated which is advantageous in mixing operations.

All the jets are suitably masked to prevent clothes fouling them.

The liquid is drained through the outlet of the sump in the tank body already alluded to.

The operations for washing and mixing for chemical and textile industries are similar to those described for laundering purposes.

It is to be understood that all jet velocities, and the number, position and angles of the jets are designed to obtain maximum turbulence, and that, hydraulic pump pressure, and jet timing mechanism are designed to provide the desired effective speeds and pressures.

Description will now be given of a practical construction of washing machine according to the invention, reference being made to the accompanying drawings, in which

Fig. 1 is a vertical sectional elevation of a washing machine;

Figure 2 is a fragmentary sectional view of a detail part of Figure 1;

Figure 3 is a plan, partly sectional, of the machine shown in Figure 1, with the cover removed;

Figures 4 and 5 are diagrammatic views illustrating the action of the machine, as later described;

Figure 6 is a diagrammatic layout of a single washing machine, and

Figures 7 and 8 show in side elevation and plan a diagrammatic layout of a battery of three machines.

The same reference characters indicate corresponding parts in the several figures of the drawings, but are distinguished in one case by the addition of an exponent.

Referring particularly to Figures 1, 2, 3 and 6 of the drawings, **10** indicates a tank of cylindrical construction, with a vertical wall **11** and a flat bottom **12**, and with an open flanged top furnished with a lid **13** hinged to the tank **10** as indicated at **13***a* and counterbalanced by spring means indicated at **13***b*, the lid being adapted to be secured in closed position by fasteners, indicated at **14**, see Figure 1. The tank **10** is supported on pillars **15**, e.g. three spaced around the base, as indicated in Figure 3. Secured to the underside of the tank **10** is a chest **16** comprising a lower chamber **17** and an upper chamber **18**. The lower chamber **17** is furnished with a delivery pipe **19**, and the upper chamber **18** with a delivery pipe **20**, the pipes **19** and **20** being connected to the delivery pipe **21** of a pump **22** by means of a breeches pipe **23**. A valve **24** is intercalated between the pipe **19** and the breeches pipe **23** and a further valve **25** is intercalated between the pipe **20** and the breeches pipe **23**, see Figs. 3 and 6. The valves **24** and **25** are in operative connection with an electric motor indicated diagrammatically at **26** in Figure 6. **27** indicates a suction pipe connecting the lower part of the tank **10** to the suction side of the pump **22**, a standard filter being intercalated in the suction pipe line **27**, as indicated at **28** in Figs. 3 and 6. A three-way valve **29** is intercalated in the delivery pipe line **21**, the valve **29** being also in connection with a drain pipe indicated at **30**, in Figs. 3 and 6. **31** indicates a main supply pipe connected with the suction side of the pump **22**, the main supply pipe **31** being connected to a cold water supply pipe **33** and a hot water supply pipe **34**, by way of a mixing valve **35**, see Figure 6. **36** indicates an overflow pipe, indicated diagrammatically in Fig. 6 and in detail in Fig. 2.

Located centrally within the tank **10** is a vertical column **37** formed with six cylindrical chambers arranged in pairs **38***a* and **38***b*, as shown in Figure 3, and each formed with a vertical row of ports **39**, in each of which is secured a nozzle, hereinafter referred to as a jet, the said jets projecting radially with respect to the cylindrical chambers.

The jets in the chambers **38***a* are indicated by the reference numeral **40**, while the jets in the chambers **38***b* are indicated by the reference numeral **41**.

42 indicates a cylindrical shroud which fits over the central column **37** and the jets **40**, **41**, the wall of the shroud being formed with apertures **43** registering with the jets **40** and **41**, see Figs. 1 and 3.

The top of the shroud **42** is domed and provided with a central recess and lifting bar **44**.

45 indicates a perforated plate having a central aperture **46** and a circular flange **47**, the plate **45** being adapted to fit around the shroud **42** and to be supported in spaced relation with the bottom **12** of the tank **10** by the flange **47** whereby to form a false bottom to the tank. The plate **45** is held against rotation relatively to the shroud **42** by ribs **45***a* on the underside of the plate engaging in slots formed in the periphery of the basal flange **37***a* of the central vertical column **37**, see Figs. 1 and 3.

Located on the outer wall of the tank **10** and spaced around the tank are three casings, there being a casing opposite to each pair of central chambers **38***a*, **38***b*.

Each casing is formed by a block **48** in conjunction with a removable cover **48***a* having a central division wall, whereby when the cover is screwed into position there is provided two chambers **49***a* and **49***b*.

The chamber **49***a* is furnished with a vertical row of jets **50** at an angle to the tank radius at that point screwed into corresponding ports **51** in the inner wall of said chamber. The chamber **49***b* is furnished with a vertical row of jets **52** at an angle to the tank radius at that point screwed into corresponding ports **53** in the inner wall of said chamber.

The chambers **49***a*, **49***b* communicate with the interior of the tank **10** through the ports **51** and **53** respectively.

The jets **50** project in the same clockwise direction as the jets **40**, while the jets **52** project in the same anti-clockwise direction as the jets **41**.

The chambers **38***a* furnished with the jets **40** are in communication with the lower chamber **17** by means of connecting ports **54**. The chambers **49***a* furnished with the jets **50** are in communication with the lower chamber **17** by way of pipes **55**. The chambers **38***b* furnished with the jets **41** are in communication with the upper chamber **18** by way of apertures **56** in the floor of each chamber **38***b*. The chambers **49***b* furnished with the jets **52** are in communication with the upper chamber **18** by means of pipes **57**.

In the operation of the washing machine the clothes are placed in the machine and the tank **10** is filled to the desired level with cold water from a source of supply by starting the pump **22**, the filling being advantageously controlled by an electric clock meter, not shown, calibrated in gallons. During this operation solid detergent may be added to the liquid in the tank **10**, or a liquid stock solution may be added from a stock tank connected to the suction pipe **27**. The cover **13** is closed down and the tank contents may be raised to operational temperature by steam injection. To create the required turbulence the motor **26** is started to operate the valves **24** and **25** alternately at the desired speed on filling with cold water. When the valve **24** is opened liquid from the tank **10** is circulated by the pump **22** and forced through the pipe **19** into the lower chamber **17**, part of said liquid passing through the ports **54** into the respective chambers **38***a* to be forced out through the jets **40**, and part passing via the pipes **55** to the respective chambers **49***a* to be forced out through the jets **50**. The jets **50** drive the liquid around the tank **10** in clockwise direction, as indicated at Fig. 4, while the jets **40** impinge on the jets **50** on an imaginary circle dividing the annulus between the tank and the jet column into two equal areas, as indicated at C in Fig. 4, so creating a turbulence.

After a predetermined time the valve **24** is closed and then the valve **25** opened, whereupon the liquid is forced by the pump **22** through the pipe **20** into the upper chamber **18**, some passing by way of the apertures **56** to the vertical chamber **38***b* to be forced through the jets **41**, and some passing through the pipes **57** to the chambers **49***b* to be forced through the jets **52**.

The discharge of the jets **41** and **52** is opposite in direction to that of the jets **40** and **50** and the liquid is therefore now forced around the tank in a counter-clockwise direction, the reversal of current creating an increased turbulence.

The constant alternation of direction of the jet forces creates a great turbulence which imitates the turbulence created by the blades of an equi-spaced three bladed oscillating or reversing impeller.

The timing of the operation of the valves **24**, **25** may be arranged to give the same effect as that of such an impeller moving to-and-fro through an angle of 120°, or one complete revolution in alternately opposite directions, or a number of revolutions in one direction followed by the same number in the opposite direction.

The turbulence created in the liquid in the manner described results in a perfect laundering of the articles

in the tank without risk of damage as experienced with blade impellers or beaters.

At the conclusion of the washing time, the valve **29** is opened to the drain, thus cutting off the through-way to the pipe **21**, and free liquid from the tank **10** is discharged through the pipe **30**.

The valve **29** is then closed to the drain and opened to the through-way and simultaneously the supply valve is opened to admit water for rinsing purposes. The supply of rinse water from main **31** may be progressively reduced from hot to cold by means of the mixing valve **35**. A continuous overflow rinse takes place for the desired time through the medium of the chambered cover **13**, water passing through a circumferential ring of perforations **13***c* in the cover **13**, and through a registering vent **13***d* in the cover **13** to the overflow pipe **36**.

The supply valve is now closed and the valve **29** opened to drain whereupon the pump **22** empties the tank of free liquid and is then switched off.

The washing and rinsing operations are now completed.

It will be noted by reference to Fig. 1 that the bottom row of jets **40**, **41** is angled slightly upwards, the effect of this being to prevent articles in the tank **10** from settling on the bottom.

The swirling action of the liquid in the tank causes the creation of a miniature vortex which causes the upper row of jets **40** or **41** on the centre column **37** to be uncovered by the liquid and the discharge from these uncovered jets acting on the surface of the liquid keeps the articles in the liquid fully immersed.

The invention has so far been described as a single unit operation.

The diagram shown in Figs. 7 and 8 shows a battery of three machines.

Parts corresponding to those described with reference to Figs. 1 to 6 are indicated by the same reference characters distinguished by the additional of the exponent "1."

The operation of the individual machines is the same as that previously described.

Isolating valves indicated at **58**, **59** are intercalated in the pipe lines 19^1, 20^1, and at **60** in the pipe line 27^1, whereby the respective tanks may be isolated from the supply lines during loading or unloading.

Although the description has so far referred to the operation of a washing machine, it is to be understood that similar operations take place in reference to a mixing machine.

I claim:

1. In washing machinery, mixing machinery and like machinery in which the required turbulence or agitation is obtained by liquid pressure jets, a cylindrical tank having inner and outer walls forming an annular cavity for containing liquids and other materials; pairs of juxtaposed outwardly directed jet nozzles located at the inner wall of the tank; and pairs of juxtaposed companion inwardly directed jet nozzles located at the outer wall of the tank opposite said outwardly directed nozzles, said pairs of jet nozzles being respectively superposed to form vertical rows circumferentially spaced around the annular cavity of the tank, the nozzles of each pair diverging in opposite directions from a radius of the tank extending between them, and the angle of divergence of the companion inwardly and outwardly directed nozzles which diverge in the same clockwise direction from the radii of the tank being such that their liquid streams tend to converge at places substantially midway between the inner and outer walls of the tank and act upon the liquid and other material in the tank to cause circulation thereof about the axis of the tank when liquid under pressure is supplied to said nozzles.

2. The washing machinery, mixing machinery and like machinery as defined in claim 1, in which there is liquid supply duct means leading to all the nozzles which diverge in clockwise direction from the radii of the tank, and another liquid supply duct means leading to the nozzles which diverge in anticlockwise direction from the radii of the tank.

3. The washing machinery, mixing machinery and like machinery as defined in claim 2, in which there is liquid discharge duct means connected at one end to the tank; a liquid pump connected to the other end of the discharge duct means; and a two-way valve connected to the output side of the liquid pump, said two inlet duct means being respectively connected to opposite sides of the two-way valve, whereby liquid under pressure may alternately be conducted to said respective inlet duct means and the nozzles connected thereto, said tank, discharge duct means, pump, two-way valve, inlet duct means and nozzles forming a closed liquid recirculating system.

References Cited in the file of this patent

UNITED STATES PATENTS

571,758	Foster	Nov. 24, 1896
1,850,124	Bean	Mar. 22, 1932
2,227,926	Drum	Jan. 7, 1941
2,322,743	Bell	June 29, 1943
2,711,641	Groff	June 28, 1955

FOREIGN PATENTS

492,058	Germany	Feb. 20, 1930
781,752	Great Britain	Aug. 28, 1957