

Nov. 17, 1931.

J. H. KENDIG

1,832,560

WASHING MACHINE

Filed March 20, 1919

6 Sheets-Sheet 1

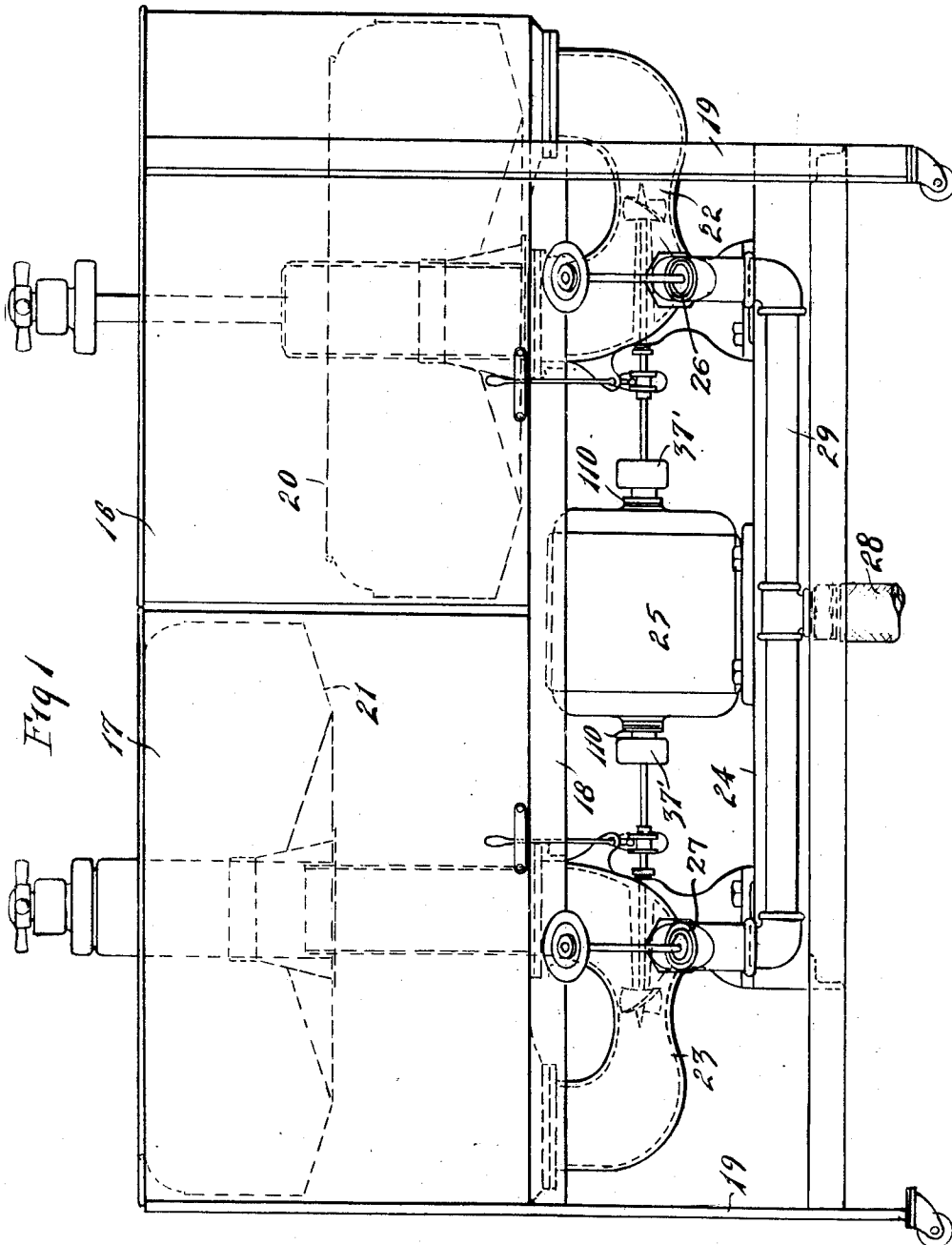


Fig. 1

WITNESS

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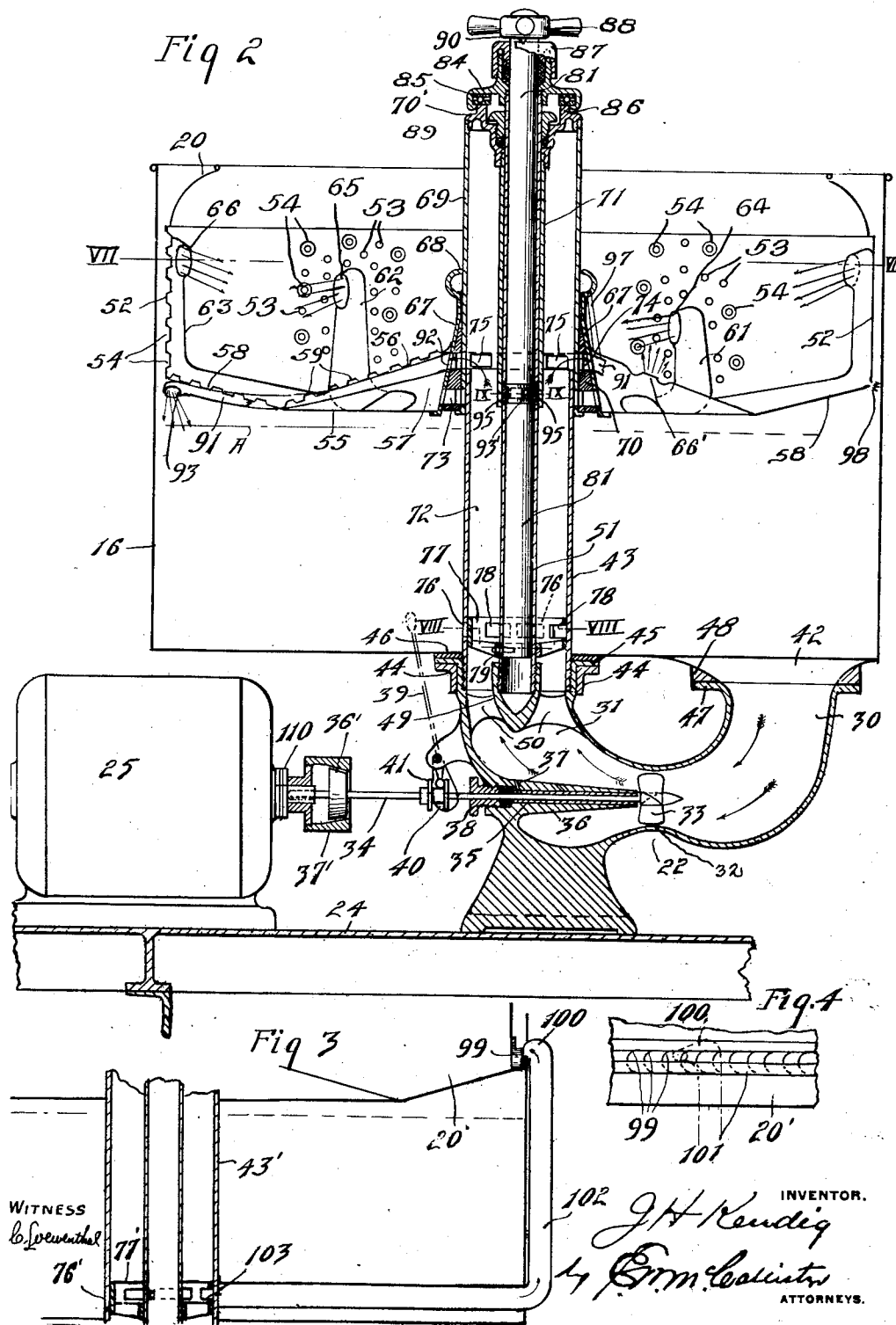
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Fig. 7

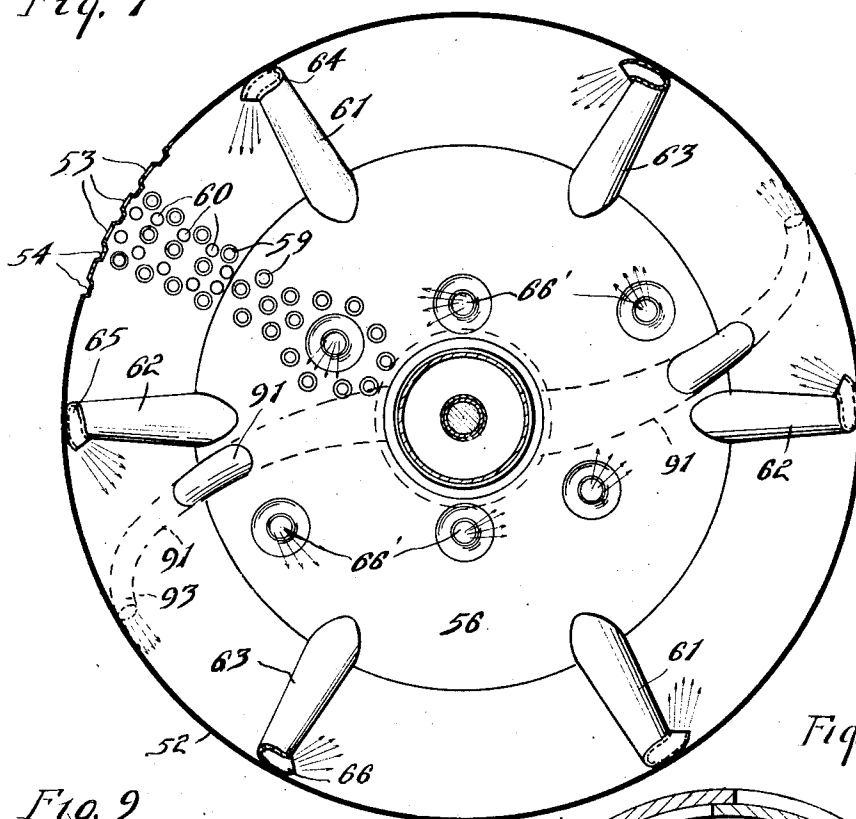


Fig. 8

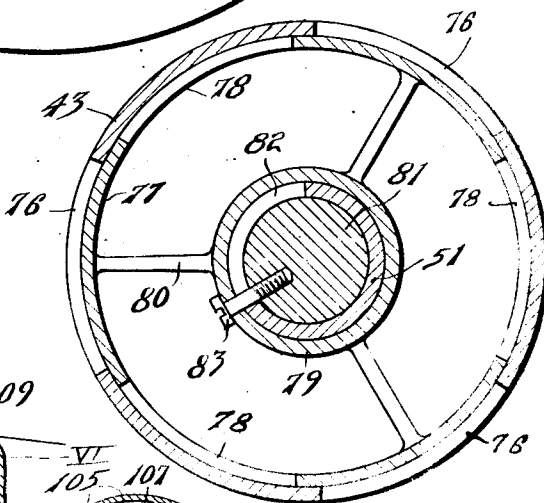


Fig. 9

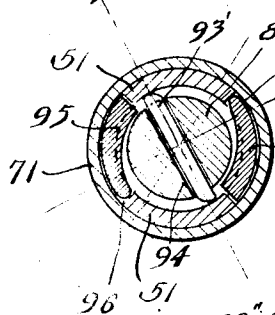


Fig. 5

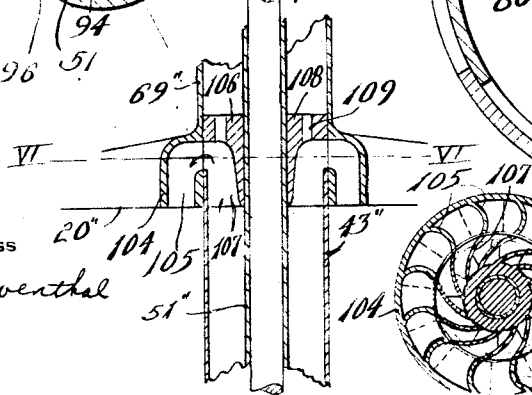
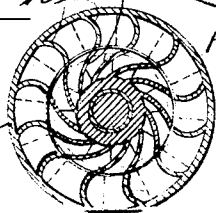


Fig. 6



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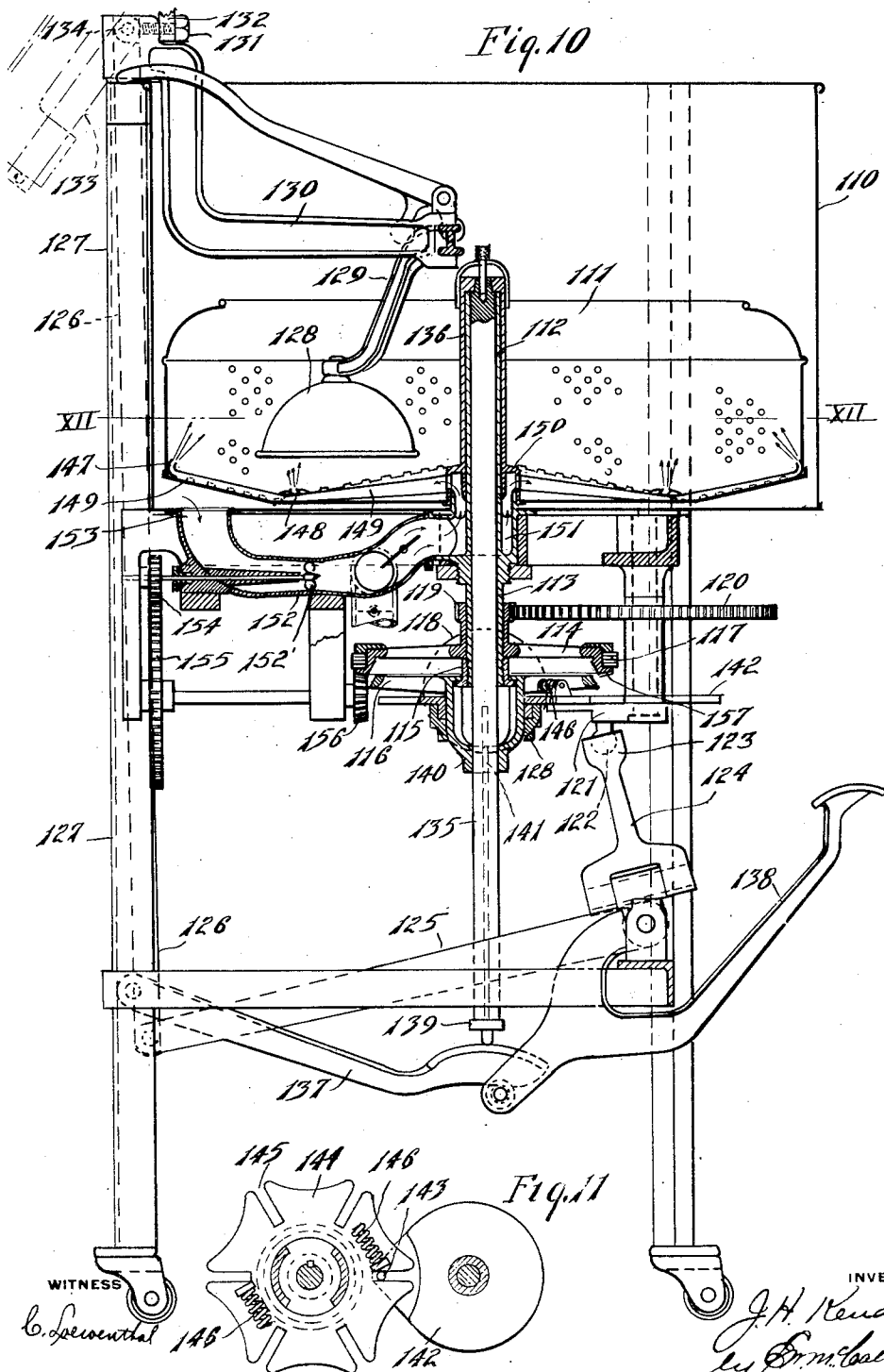
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Fig. 12

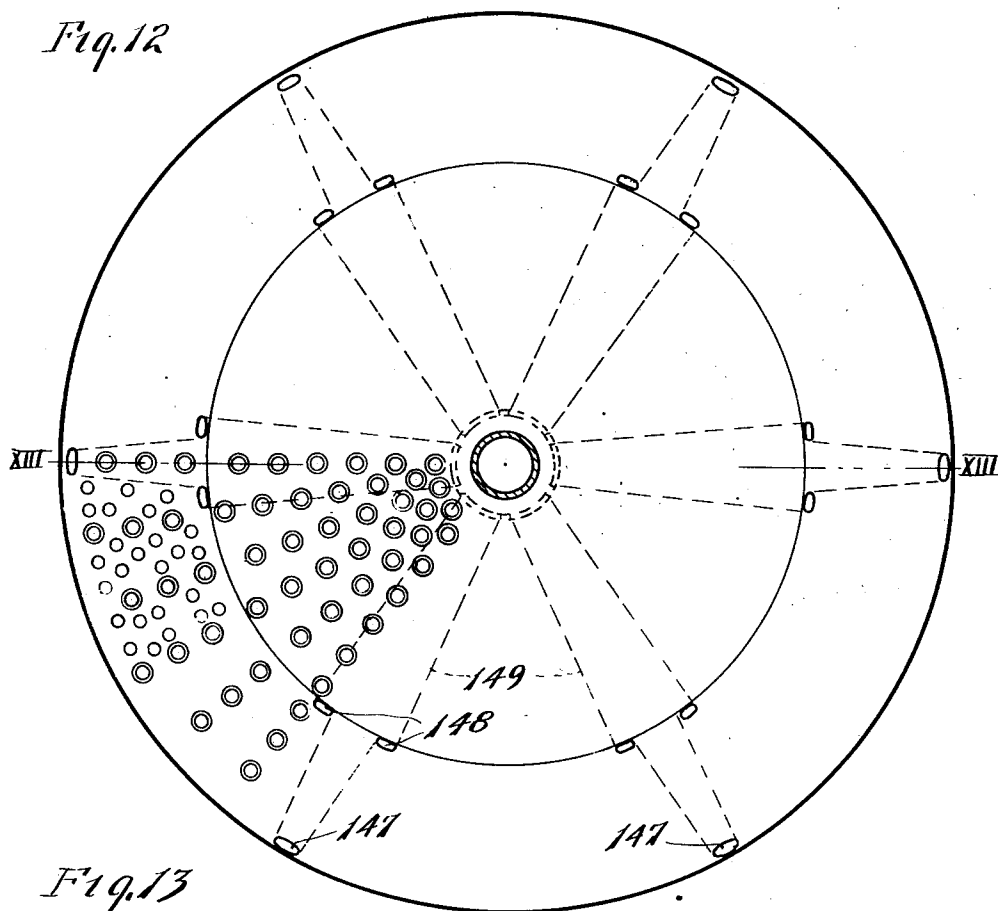
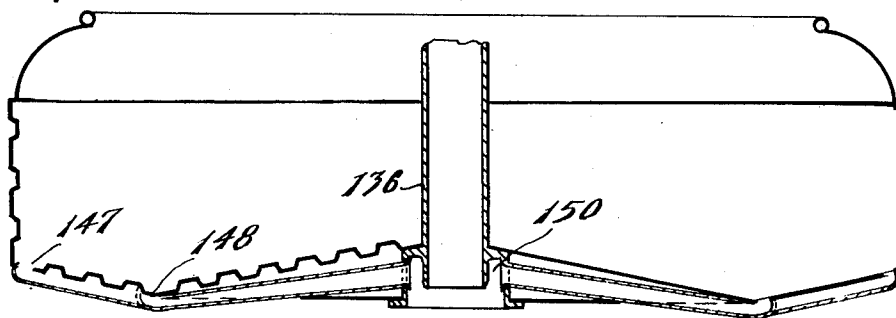


Fig. 13



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WASHING MACHINE

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Fig 14

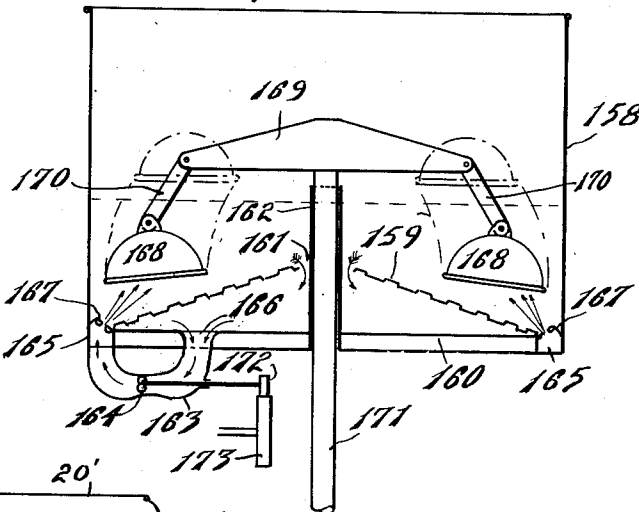


Fig. 16

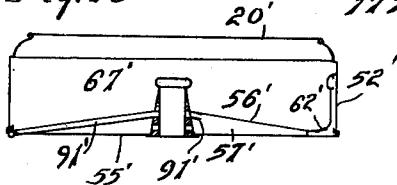
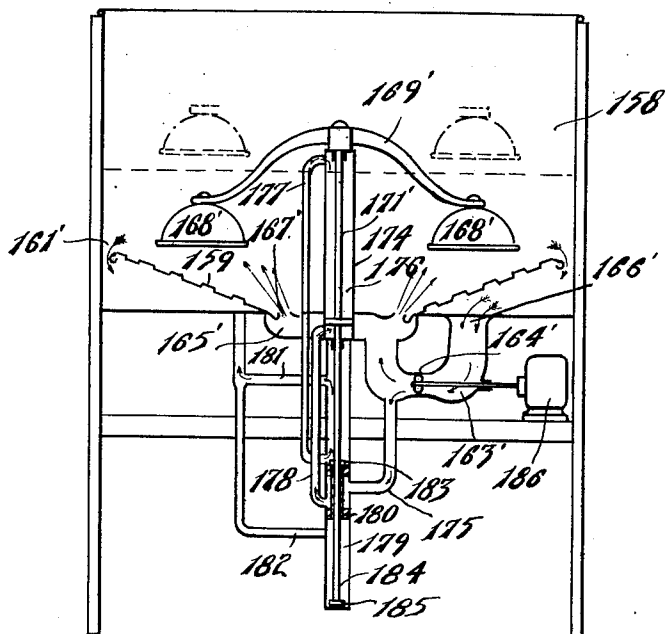


Fig 15



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UNITED STATES PATENT OFFICE

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WASHING MACHINE

Application filed March 20, 1919. Serial No. 283,858.

This invention relates to washing machines and more particularly to machines for washing fabrics such as clothes, etc., and has for an object to produce a washing machine of simple construction wherein the number of moving elements is relatively small.

Another object is to produce a machine wherein the clothes are washed and manipulated by means of jets of water forced against the fabric under pressure.

Another object is to produce a machine wherein the fabrics are conveniently dried in a centrifugal drier without necessitating the handling of saturated fabrics.

Another object is to produce a centrifugal drier that is operated by a fluid turbine which is actuated by a directly driven pump, thereby eliminating many moving parts that would otherwise be required.

Another object is to produce a washing machine wherein the fabrics are gently rubbed by projections on the walls of the machine as the clothes are moved over the surfaces by water jets.

Another object is to produce a machine that will manipulate the fabric gently by rapidly circulating the water in the receptacle over and over and through the clothes many times in a comparatively short period of time, whereby the time required for the washing of the clothes is reduced to a minimum.

Another object is to produce a machine that will operate with comparative quietness on account of the absence of moving parts.

Another object is to produce an efficient washing machine that may be economically manufactured.

Another object is to produce a washing machine having a washing receptacle and a rinsing receptacle, each having a centrifugal drier whereby the fabrics may be rinsed and dried in one receptacle while the fabrics in the other receptacle are being washed and dried, thereby materially saving time in the operation and reducing the handling of the fabric to a minimum.

Another object is to produce a machine that is simple and inexpensive to operate and

which will require a minimum of attention and lubrication.

Another object is to produce a washing machine that is free of any moving parts which are liable to catch the clothing or fingers of the operators and which is safe for inexperienced operators.

These and other objects which will be made apparent from the further description of the invention disclosed in the accompanying drawings, wherein certain embodiments of the invention are illustrated.

Fig. 1 is a side elevation of the preferred form of my invention.

Fig. 2 is a vertical section through one of the machines illustrated in Fig. 1.

Fig. 3 is a diagrammatic vertical section of a modified form of turbine for rotating the basket.

Fig. 4 is a side elevation of a fragment of the basket shown in Fig. 3.

Fig. 5 is a diagrammatic sectional view of another modified form of turbine for rotating the basket.

Fig. 6 is a transverse section on the line VI—VI of Fig. 5.

Fig. 7 is a transverse section through the basket shown in Fig. 2 taken on the line VII—VII of Fig. 2.

Fig. 8 is a transverse section through the center column shown in Fig. 2 taken on the line VIII—VIII of that figure.

Fig. 9 is a transverse section through the center column taken on the line IX—IX of Fig. 2 and illustrating a section of the braking mechanism.

Fig. 10 is a vertical section through a modified form of washing machine using vacuum cups as part of the washing mechanism and embodying features of my invention.

Fig. 11 is a plan view of a mechanical basket turning device illustrated in Fig. 10.

Fig. 12 is a transverse section through the basket shown in Fig. 10 taken on the line XII—XII of that figure.

Fig. 13 is a vertical section of the basket shown in Figs. 10 and 12 taken on the line XIII—XIII of Fig. 12.

Fig. 14 is a diagrammatic vertical section

of a modified form of machine embodying features of my invention.

Fig. 15 is a diagrammatic vertical section of another modification of machines embodying my invention.

Fig. 16 is a sectional view of a modified form of basket.

A single machine employing a centrifugal drier and embodying many of the features of the machine illustrated in Fig. 10 has been in use. This machine is provided with a centrifugal drier basket in which the clothes are washed within the basket while the basket is in its lowermost position, by means of vacuum cups which are reciprocated vertically by more or less complicated mechanical elements, such as gears, levers, etc. The basket is raised out of the water by a foot pedal and is rotated with sufficient velocity to throw off the water in the clothes by centrifugal force. The rotating mechanism also consists of a series of gears, clutches and friction drives. To dry the clothes after they have been washed necessitates the removal of the cups, the raising of the basket manually by means of the foot pedal and the throwing in of a clutch. It is the usual practice with a machine of this type to wash several batches of clothes in the same wash water, lay the dried clothes aside and then withdraw the wash water and substitute the rinse water, after which operation the washed clothes are rinsed in separate batches. Time in the operation is lost in waiting on two or three batches of clothes to be washed before the rinsing operation can be started, and time is also consumed in waiting for the tub to drain and the rinse water to be put in, and the machine is, of course, unavailable during the rinsing operation for washing purposes, resulting in a further loss of time. Therefore time could be saved by using two machines, first starting both machines washing and then using one for rinsing after the first batch has been washed. The rinsing operation will thereafter be more or less continuous, and the washing operation will also be continuous, except for a change of wash water as it becomes necessary. The cost of manufacturing two machines of the type illustrated in Fig. 10 would be prohibitive from a commercial standpoint, and therefore one of the principal objects of my invention is to simplify the construction of a machine employing centrifugal driers so that two machines can be combined and mounted upon the same frame and handled as a unit. This construction also affords an increased amount of ballast for the centrifugal drier and therefore materially reduces the vibration of the machine, which is a very important advantage in view of the excessive vibration set up by the drier where a single machine is used.

Referring to Figs. 1 and 2 disclosing the

preferred form of my invention, the apparatus includes a pair of tubs or receptacles 16 and 17 preferably placed side by side in close proximity and supported upon a frame 18, which is held at a convenient altitude by three supporting legs 19, only two of which are visible in the figure. Two of the legs are disposed on opposite sides of the tub 16, and the third is disposed at the extreme end of the machine adjacent the tub 17. The tubs 16 and 17 are each provided with a centrifugal drier basket 20 and 21 respectively, and a hydraulic pump 22 and 23 respectively. The pumps are mounted upon a base member 24 which also supports an electric motor 25 disposed between the pumps and adapted to drive them by means of connections to be hereinafter described. Each pump 22 and 23 is provided with a waste outlet controlled by valves 26 and 27 respectively, and the valves are connected to a common drain pipe 28 or hose by means of a pipe 29. With this apparatus water may be pumped from one tub to the other if desired by simply opening one of the valves of one tub and directing the pipe 28 into the other tub.

Referring to Fig. 2, wherein a complete machine unit is illustrated, the device includes a receptacle or tub 16 adapted to contain the wash water, which is preferably placed in the machine up to the level A indicated by the broken line, the quantity being sufficient to nearly cover the container or basket 20 when it is in its lowermost position as indicated in Fig. 1 in dotted lines.

One of the principal objects of my invention is to produce a washing machine wherein the operation of washing and manipulating the fabrics and wringing or drying the fabrics is performed by means of water circulated by a simple pump, thereby eliminating the mechanical operating elements such as gears, levers and other moving parts. With this in view, I have provided a simple form of pump 22, which comprises a U-shaped Venturi tube terminating at one end in an intake opening 30 and a discharge outlet 31 and having a reduced portion 32 having a cross sectional area less than that of the intake and the outlet of the tube, forming in effect a Venturi tube, in which is mounted for rotation a screw propeller 33 of suitable design. The propeller is adapted to be rotated at high velocity by means of a shaft 34, which extends through the pump casing and is journaled therein in an extended bearing bushing 35, which is fitted in an inwardly projecting boss 36 formed integrally with the pump casing or tube. The bearing bushing 35 and the boss 36 are provided with lubricating holes 37 so that the shaft is lubricated by water circulating along the shaft. Leakage of water is prevented by the packing gland 38, which is adapted to be screwed into the pump casing. The shaft is rotated

by means of the motor 25 through the medium of a cone clutch 36', which is adapted to be held in operative engagement with the cone sleeve 37' by the thrust of the propeller, which tends to pull the shaft away from the motor. The clutch is disengaged from the sleeve by means of the clutch lever 39 when the said lever is moved to the right. The lever is provided with a counter weight 40 for the purpose of returning the lever to vertical position, and the operating sleeve 41 is located on the shaft so that the lever 39 will normally hold the clutch in disengaged position. In order to start the pump, the lever 39 is gently moved toward the right until the clutch 36' engages the sleeve 37', after which the lever may be released, as the thrust of the propeller will then hold the clutch in engagement.

The intake 30 of the pump is registered with the opening 42 in the bottom of the tub or receptacle 16, and the discharge outlet 31 of the pump is registered with the center of the tub, and is provided with a tubular extension 43, which will hereinafter be referred to as the outer center column. The pump 22 is securely mounted upon the base 24, which also supports the motor 25 and the pump 23, and the said pumps are aligned with the motor upon this base and assembled upon the machine as a single unit, to which the remaining parts are adjusted without disturbing the alignment of the motor and the pumps. The pumps are further supported by means of transverse brackets 44, Fig. 2, which straddle the flanges 45 and which are secured to or may be integral with the frame members 18, Fig. 1, which support the tubs. The flange 45 is secured to a collar 46 carried by the bottom of the tub so as to form a water tight connection between the tub and the pump, and the flange 47 of the intake end of the pump is secured to a collar 48 carried by the bottom of the tub and which surrounds the conical intake opening 42.

The discharge end of the pump is provided with an integral socket 49 disposed centrally of the discharge outlet and supported by integral webs 50 connecting the socket with the walls of the pump casing.

A tubular inner column 51 is securely fastened at its lower end to the socket 49 either by screw threads or by brazing, and this column together with the outer center column 43 serves as a central support about which the container or basket 20 is adapted to rotate when the basket is in either raised or lowered position.

The basket 20, Figs. 2 and 7, is circular in shape and of slightly smaller diameter than the tub. The side wall 52 is provided with a plurality of perforations 53, Fig. 7, for the purpose of permitting the escape of water from the sides of the basket when the basket is being rotated during the centrifugal dry-

ing operation, and is also provided with a plurality of conical projections 54, Figs. 2 and 7, which are preferably struck out of the metal forming the side wall. These lugs are for the purpose of gently rubbing the fabric during the washing operation as will hereinafter appear.

The central portion of the basket is hollow and consists of a flat bottom wall 55 and a conical upper wall 56 forming a chamber 57 therebetween adapted to receive fluid and will hereinafter be referred to as a fluid distributing chamber. The conical wall 56 and the annular bottom 58 disposed between that wall and the side wall, are provided with conical lugs 59 similar to those in the side wall and are for a similar purpose. The annular bottom portion 58 is also provided with perforations 60, Fig. 7, for the purpose of permitting water to drain from the basket when the basket is raised out of the water into the position illustrated in Fig. 2.

The basket is provided with a plurality of radially disposed water conduits 61, 62 and 63 communicating with the distributing chamber 57 at their inner ends, and which extend upwardly along the inside of the vertical walls of the basket, where they terminate in discharge nozzles 64, 65 and 66 respectively. The nozzles which are of ample capacity are directed downwardly toward the center of the basket and at an angle to a radial plane traversing each nozzle, so that the reaction of the water discharged by the nozzles tends to rotate the basket, while the jets strike and manipulate the fabrics and keep them against the rubbing surface on the bottom of the basket. The nozzles 64, 65 and 66, see Fig. 2, are located at different elevations in the basket and consequently discharge jets of water into the basket at different elevations. The nozzles are also disposed so that they will discharge the water at different angles with respect to the axis of the basket.

The conical bottom 56 is also provided with a series of discharge orifices or nozzles 66', which open out of the distributing chamber 57 and which discharge upwardly toward the periphery of the basket and in a direction tangent to the orbit of revolution of the nozzles. These nozzles are disposed at different distances from the center of the basket and consequently the water jets delivered therefrom operate on different parts of the fabric above them.

The pump 22 is designed to circulate a comparatively large quantity of water, and for the purpose of a machine for domestic use this quantity is in excess of a hundred gallons per minute. The water under considerable pressure is discharged from the nozzles, which have comparatively large discharge orifices, and therefore the volume and velocity of the water is sufficient to displace and manipulate the fabrics within the bas-

ket with such energy that they are thoroughly washed within a comparatively short period of time. Each piece of fabric is subjected simultaneously with the others, to violent continuous agitation by the water, and as the basket containing the fabrics is rotated by the reaction of the water discharged from the nozzles, each piece as it is brought into contact with the walls of the basket is gently rubbed, thereby aiding in the washing process.

The center of the basket is provided with a conical valve sleeve 67, which is attached to the bottom 55 and the conical bottom 56, so that it closes the center of the chamber 57. The sleeve is provided at its upper end with an annular channel 68, the purpose of which will hereinafter appear. The basket is adapted to fit over an operating cylinder 69, which is slidably mounted for vertical and rotary movement on the exterior of the outer center column 43, and the cylinder is provided at its lower end with a conical valve 70, which is adapted to receive and support the valve sleeve, and thereby support the basket upon the cylinder 69.

The upper end of the cylinder 69 is closed by a cap 70' screwed or otherwise secured to the upper end thereof and which is provided with a downwardly projecting brake sleeve 71 fitting over and sliding upon the inner center column 51, so that the cylinder 69 carrying the basket 20 thereon is free to slide vertically on the outer and inner columns 43 and 51 respectively. The basket is therefore free to rotate about the center column as an axis, the columns serving as a bearing for the basket.

The space 72 between the outer and inner center columns is in open communication with the discharge outlet 31 of the pump 22, and therefore the cylinder 69 carrying the basket 20 is responsive to fluid pressure within the pump and the center column 72, and when the pressure within that column exceeds a determined amount, the basket 20 will be raised to the position shown in Fig. 2 by the cylinder 69.

The conical valve 70 on the cylinder 69 is provided with two annular ports 73 and 74, the latter communicating with the interior of the cylinder 69 through ports 75 in that cylinder which are adapted to be uncovered only when the cylinder is raised to its uppermost position, at which time the ports 75 are exposed to the interior of the outer center column 43. The port 73 extends through the walls of the cylinder 69 and is disposed beneath the port 74 so that when the cylinder 69 is in its lowermost position, the port 73 will register with the ports 76, Figs. 2 and 8, opening out of the outer center column 43 adjacent the bottom of the tub 16. It will be seen that the ports 75 are closed by the wall of the outer center column 43 when the basket

is in its lowermost position, and that water will flow through the ports 76 into the distributing chamber 57 at this time, from whence it is discharged into the basket through the nozzles 64, 65, 66 and 66' for the purpose of manipulating and washing the clothes or fabrics therein. The size of the discharge nozzles is so proportioned with respect to the capacity of the pump or the volume of water delivered thereby, that the pressure within the center column while the ports 76 are open and water is being discharged from the basket nozzles, is insufficient to raise the basket. The entire quantity of water discharged by the pump is therefore at this time discharged into the basket, with the result that the fabrics or clothes therein are energetically tumbled and jostled about in the basket by the jets, during which operation the basket is revolving at a moderate velocity, and the fabrics are revolving slowly about the center column in the opposite direction. The clothes are rubbed gently by the lugs or knobs 59 by reason of the relative movement of the fabrics and the basket, and the water jets are discharged against different portions of the fabrics throughout the entire washing operation. Each piece is incessantly jostled and rubbed and separated from neighboring pieces in a turbulent mass of soapy water, and by reason of this energetic action the fabrics are washed in shorter time than is usually required by washing machines, and by a means requiring less energy and mechanical apparatus than is required for mechanically operated washing elements driven through gears, levers, etc.

The discharge of water through the ports 76 is controlled by a manually operable cylindrical valve or gate 77 provided with gate openings or ports 78, Figs. 2 and 8. This gate is adapted to close the three ports 76 shown in Fig. 8, by a rotation of the valve 77 through approximately 60 degrees, but it will be understood that a greater number of ports may be employed thereby reducing the rotary movement required for closing the ports. This gate or valve 77 is provided with a center hub 79 loosely fitting the inner center column 51 and the hub is connected with the gate by integral radial webs or spokes 80 between which the water in the outer center column 43 may freely pass.

The gate is rotated by means of an operating shaft or rod 81, which is rotatably mounted in the inner center column 51, which column is provided with a horizontal slot 82, Fig. 8, through which a screw or pin 83 projects. This screw connects the gate hub 79 with the operating rod 81. The slot 82 is of sufficient length to permit of rotation of the operating rod through a range of more than 60 degrees for a purpose that will hereinafter appear.

The upper end of the rod terminates above

the top of the inner center column 51 and projects through a thrust bearing collar 84 which is screwed on or otherwise secured to the top of the center column 51, and which is provided on its underside with an anti-friction bearing 85 adapted to be engaged by an upwardly projecting annular flange 86 carried by the cylinder cap 70'. This collar 84 serves therefore as a thrust bearing limit stop for the basket when the basket is in its uppermost position, as indicated in Fig. 2. The collar 84 is also provided with a packing gland 87 surrounding the operating rod 81, adapted to prevent the leakage of water from between the inner center column 51 and the said operating rod. A handle 88 is mounted on the upper end of the rod and serves as a means whereby the rod may be manually operated. A packing gland 89 surrounds the inner center column 51 and is screwed into the upper side of the cylinder cap 70' for preventing leakage of water from between the brake sleeve 71 and the inner center column. This gland is disposed between the upper face of the cap 70' and the thrust collar 84 so that it is out of engagement with the collar 84 when the basket is in its raised position.

When it is desired to wring or dry the clothes or fabrics after they have been washed, the handle 88 is turned one-sixth of a revolution so as to turn the valve 77 into a position that will close the ports 76 in the outer center column 43, as shown in Fig. 8. A downward projecting lug 90 is provided on the under side of the handle 88 which is adapted to drop into V-shaped grooves cut in the top face of the gland 87 at spaces 60 degrees apart so that the handle will be automatically arrested after it has been turned through 60 degrees of a revolution.

When the valve or gate 77 has been turned so that the ports 76 have been closed, the escape of water from the outer center column will be entirely shut off, and this will cause the pressure in the center column to rise sufficiently to raise the basket filled with fabric out of the wash water into the raised position illustrated in Fig. 2. The clothes or fabrics within the basket are dried or wrung after the basket has been raised by causing the basket to be rotated at high velocity, so as to throw off the water by centrifugal force.

The means for rotating the basket or centrifugal drier comprises a pair of tapered reaction turbine tubes 91, one of which is shown in side elevation in Fig. 2, and both of which are shown in plan view in Fig. 7. These tubes are in communication at their inner ends with ports 92 in the conical valve sleeve 67 which register with the annular valve port 74 in the conical valve 70 carried by the basket, and the tubes extend, as

shown, from these ports 92 through the distributing chamber 57 and through the bottom of the basket and terminate in nozzles 93 beneath the bottom of the basket and at the periphery thereof. The nozzles are disposed on opposite sides of the basket and are directed in opposite directions tangent to the periphery of the basket and slightly downward so that the water discharged therefrom will be directed downward and against the side of the tub, into the wash water directly beneath. The reaction of the water discharged by the tubes rotates the basket at the desired velocity.

Referring to Fig. 2, it will be seen that the discharge of water through the turbine tubes will commence immediately after the ports 75 in the cylinder 69 have been uncovered by the upward movement of the basket, and that the upward movement of the basket and rotation thereof will be occasioned automatically as a result of the turning of the handle 88 which closes the valve 77.

When it is desired to stop the rotation of the basket after the clothes or fabrics have been sufficiently dried, the handle 88 is again turned in the same direction that it was turned to raise the basket, and this action will cause a cam 93, Figs. 2 and 9, slidably mounted in a slot 94 in the rod 81, to be moved into contact with the arcuate tapered brake shoes 95 disposed in notches 96 cut in the inner center column, and force them outwardly into engagement with the interior surface of the brake sleeve 71, contacting therewith at a point adjacent the lower end thereof. The friction of the shoes 95 against the brake sleeve 71 gradually reduces the velocity of rotation of the basket which may gradually be brought to rest. The basket is thus held stationary against the power of the turbine, which at this time is materially reduced for the reason that the additional rotation of the valve 77 by the rod 81 has partly opened the ports 76, so as to permit of the discharge of water into the wash water beneath the basket and thereby partially relieving the pressure within the cylinder 69. The basket may be supported at any point intermediate the upper and lower positions by the brake shoes 95.

After the fabrics have been removed from the basket, it may be lowered for another washing operation by simply reversing the handle 88, so that it is again brought to its original position, at which time the ports 76 will be wide open and the pressure in the outer center column reduced sufficiently to permit the basket to descend into the wash water. The reverse movement of the rod 81 releases the brake shoes 95, so that the basket is free to respond to the pressure within the center column and descend when the pressure falls sufficiently. When the basket has attained its lowermost position,

the ports 73 will again register with the ports 76 and the discharge of water through the nozzles 64, 65, 66 and 66' will immediately thereafter be resumed. Fabrics to be washed may then be placed in the basket or they may be placed in the basket before it is lowered into the wash water.

Referring to Fig. 2, it will be seen that the basket may be removed so that the tub may be cleaned by simply sliding it upward over the cylinder 69 and the handle 88. When it is replaced the valve sleeve 67 will seat upon the conical valve 70. The sleeve and the valve are preferably fitted so that a water tight joint is formed there between when the basket is seated on the cone so that water may not leak upward or downward from between the sleeve and the cone, but in order to permit any water which might leak past the cone 70 from entering the basket while the basket is being rotated at high speed, the previously referred to annular channel 68 is provided at the upper end of the sleeve 67 to catch the water thrown off by the cylinder at this point. A tube 97 establishes communication between the channel 68 and the distributing chamber 57, whereby water may be discharged from the channel into the chamber. Water leaking into the chamber through the tube 97, or from the ports in the conical valve 70 will be forced outwardly by centrifugal force through the radial discharge passages 63 in the basket, from whence it escapes through a minute vent 98, Fig. 2, provided at the elbow of each tube. Water cannot therefore accumulate in the passages 63 or be discharged from their respective nozzles during the drying operation.

Referring to Figs. 3 and 4, a modified form of turbine for rotating the basket at high velocity is shown. In place of the reaction tubes 91 employed in the basket above described, a series of Pelton buckets 99 are disposed around the periphery of the basket 20' adjacent its bottom edge, forming an impulse and reaction turbine which is adapted to receive a jet or jets of water discharged from a stationary nozzle or nozzles 100, one of which is shown suitably arranged to discharge a jet of water tangent to the periphery of the basket, so that it first strikes the upper half of each bucket. The lower half of the buckets are provided with a shroud 101 to prevent the radial escape of fluid from the buckets. These buckets transmit, in a well known manner, rotary motion to the basket when water is discharged against them. The nozzle 100 communicates with the interior of the center column 43' through a stationary tube 102, which is secured to the exterior of the said center column and which receives water therefrom through a port 103 in the said column. This port is controlled by a valve 77', similar in every respect to the valve 77, illustrated in Figs. 2 and

8. When the valve 77' is rotated to close the ports 76' to shut off the circulation of water into the basket 20', the port 103 is uncovered and water is discharged through the tube 102 and nozzle 100. When the basket has ascended to its uppermost position the buckets 99 will register with the nozzle 100 and rotary movement will be imparted thereto immediately thereafter.

Referring to Figs. 5 and 6, another modified turbine is illustrated. In this case the basket is rotated by an impulse and reaction turbine 104 provided with vanes 105 arranged in the basket center around the outer center column 43'', so that they will receive water therefrom through the stator element 106 of the turbine. The stator comprises a series of vanes 107 arranged about the inner center column 51'', which are adapted to discharge the water horizontally against the buckets or vanes 105 in the rotor 104. The buckets 105 are designed to reverse the direction of flow of the water and discharges it downward out of the turbine.

The crown 108 of the stator 106 is adapted to serve as a guide and bearing for the cylinder 69'', to which the basket 20'' and the rotor 104 are attached. Water may pass through ports 109 in the stator crown into the upper part of the cylinder 69'' for the purpose of raising the basket and holding it in elevated position during the drying operation.

Referring again to Fig. 2, it will be seen that the basket rotates about a double bearing; the lower portion of the basket is supported adjacent its center of centrifugal force by the upper end of the outer center column 43, and the upper end of the basket is supported by the upper end of the inner center column 51. It will be observed that the only oil lubrication required for this machine is at the bearings and thrust bearings 110 of the motor. The propeller shaft and the bearing about which the basket rotates are constantly lubricated by water circulated by the pump and which is constantly accessible to all of the said bearings during the operation of the machine.

In Fig. 16, I have shown a modified form of basket wherein the conical bottom 56' extends downward from the center and terminates at the vertical side wall 52' of the basket adjacent the edge of the flat bottom plate 55'. This construction forms a truss in which the conical bottom serves as a tension and compression member preventing vertical displacement of the sides of the basket with respect to the center sleeve 67'. The reaction tubes 91' are encased by the bottom members and the discharge nozzles thereof project through the bottom plate. The nozzle conduits 62' in this basket communicate with the distributing chamber 57' at a point adjacent the vertical sides thereof. The fabric sup-

porting bottom 56' of this basket requires no drainage perforations as the water will flow down the conical bottom and pass out of the basket through the perforations in the side of the basket. In certain respects, this form of basket is preferable to that shown in Fig. 2, for the reason that it is a more rigid and economical construction, and by reason of the shorter nozzle conduits, the resistance of the water through them is correspondingly reduced.

The simplicity of the constructions makes it possible to construct and market a machine such as is illustrated in Fig. 1, at practically the same cost as the single tub machines now commercially sold and which are capable of doing only half the work within a longer period of time.

The operation of the complete machine shown in Fig. 1, is as follows: Assuming that the clutches are disengaged from the motor and that wash water has been placed in each tub or receptacle to the level indicated by the dotted line A, Fig. 2, the washing operation is started by first placing clothes or fabrics which are to be subsequently boiled in one basket 20 and those which are not to be boiled in the other basket 21, while the baskets are in their lowermost position. The motor 25 is then started and the clutches 37' moved to connect the pump propeller shafts with the motor. Water will thereafter be circulated through the nozzles 64, 65, 66 and 66' in the manner previously described. This operation is continued until the fabrics or clothes are thoroughly washed. When the washing operation has been completed, the handle 88 of one tub 16 is turned by the operator until the ports 76 in the outer center column are closed. The basket will then be raised by the increased pressure in the center column and the basket rotated in the manner previously described. When the fabrics have been dried sufficiently, the rotation of the basket is arrested by further turning of the handle 88, which applies the brakes in the manner previously set forth. The other basket 21 may then be similarly raised and rotated to dry the fabrics in the tub 17, during which interval the clothes or fabrics in the first basket 20 may be removed and placed in the basket just emptied. The basket of the first tub 16 is next caused to be lowered into the wash water by a reverse movement of the operating handle, which releases the brakes and opens the ports 76.

The fabrics in the second basket 21 are by this time sufficiently dried so that the operator may then stop the basket by means of the handle controlling the operation of that basket. The tub 17 containing this batch of fabrics will thereafter be used as a rinsing machine. Without removing the fabrics the wash water in this tub is pumped out of the tub through the waste pipe 28 after the valve

27 has been opened to permit of its escape. After the water has been pumped from the tub 17, which operation requires but a few seconds, the valve 27 is closed and rinse water is placed in the machine. The basket is then lowered so that the fabrics will be manipulated and rinsed by the jets of clear water discharged into the basket. The rinse water may be changed continuously by discharging clear water from the hydrant into the tub and at the same time permitting an equal quantity to be forced out of the drain pipe 28. The escape of water is controlled by the valve 27, which at such time is set in slightly opened position. When the fabrics have been sufficiently rinsed they are dried by raising the basket and rotating it in the manner previously described. The washing and rinsing operation is henceforth carried on simultaneously until the entire quantity of fabrics have been washed.

It will be seen that during the entire operation, it is unnecessary for the operator to either rinse the fabrics by hand or handle water saturated fabrics, as is necessary in the operation of other portable washing apparatus. The machine operates quietly and may be readily cleaned and inspected. The machine requires practically no oil lubrication and is controlled by simple operating mechanism. The tubs are supported upon a single frame having three supporting legs provided with castors, so that the frame is free to oscillate slightly when the baskets are rotated. The oscillation is dampened materially by reason of the water ballast in each tub and therefore the oscillation is less than that of a single tub machine such as is illustrated in Fig. 10, having half the amount of water. A slight amount of oscillation is beneficial, as it relieves the bearings of the basket and center column from excessive strains, but the oscillations of a single machine becomes excessive when the fabrics are unbalanced and therefore the extra ballast provided by the combination of two tubs is of decided benefit.

In Fig. 10, I have illustrated a form of washing machine now in use, in which there is a centrifugal drier and mechanically operated vacuum cups or plungers adapted to be reciprocated vertically into and out of contact with the fabrics within the drier. In this type of machine the action of the plungers is depended upon entirely to manipulate the fabrics, and the plungers are given a rotary movement upon their downward stroke whereby a slow rotary motion is imparted to the basket. I have found that by providing this type of machine with a drier having rubbing lugs the shape of a frustrum of a cone projecting upward from the bottom, as in the basket of the machine illustrated in Fig. 1, and by causing relative movement of the fabrics and the drier, and

by causing the fabrics to be turned so that different parts of the fabrics are exposed to the rubbing surfaces, that the fabrics are washed more thoroughly and in a considerably shorter time than was possible before these improvements had been applied. The fabric turning action is accomplished by means of jets of water forced upwardly out of nozzles in the bottom of the drier basket, which strike the underside of the fabrics and turn and separate them. The basket is rotated with respect to the fabrics by means of a star wheel or intermittent gear, which is adapted to rotate the basket about one-sixth of a revolution during the interval in which the fabrics are being forced against the bottom of the drier by the plungers.

Briefly this type of machine includes a tub 110 having a rotary drier basket 111 rotatably mounted therein upon a center column 112 which extends upwardly through the bottom of the receptacle. The center column also projects downwardly and terminates in a sleeve 113 upon which is slidably and rotatably mounted a driving clutch wheel 114. This wheel is retained upon the sleeve by means of a collar 115 which also supports the cone member 116 of the clutch.

The driving clutch is provided with a friction ring 117 adapted to engage a friction disc 118, which is driven by an electric motor, not shown. This clutch is provided with a pinion 119 adapted to mesh with a gear 120 when the clutch is in its lowermost position and is adapted to be disengaged when the driving clutch 114 is raised. The gear 120 is provided at the lower end of the hub thereof, with a crank 121 having a ball stud 122 adapted to fit into a ball socket 123 of the wobble crank 124. The wobble crank is pivoted for universal motion at its lower end and serves to oscillate the crank lever 125 vertically. A vertical shaft 126 is pivotally secured at its lower end to the free end of the crank lever 125, and the upper end of the shaft projects above the top of the tub and is supported in a guide 127 which also serves as one of the legs of the tub.

The plungers of this type of machine are bell-shaped and usually two plungers 128, only one of which is shown, are secured to a bracket 129 which is pivotally mounted on the plunger arm 130. This arm is detachably secured to the vertically operating shaft 126 by means of a socket fitting over the end of the shaft and a set screw 131 which is adapted to be operated to grip the shaft, by means of a handle 132. In this type of machine the plunger arm is usually detached from the shaft during the driving operation when the basket is raised, so that the plungers will not interfere with the rotation of the basket. I have provided an improved means for mounting the plunger arm, whereby the arm is hinged to the shaft, so that the plungers may

be tilted back of the shaft as indicated in broken lines in Fig. 10. This construction consists of an auxiliary shaft 133 pivotally hinged to the shaft 126 by a pin 134. The auxiliary shaft has a tongue and groove connection with the shaft 126, and the joint is such that the auxiliary shaft cannot be moved past the vertical position when moved toward the right. When it is desired to tilt the plunger arm, the screw 131 is loosened and the arm is raised vertically until the socket clears the hinge joint. The auxiliary shaft may then be tilted backward to the position indicated in broken lines in Fig. 10. When the plunger arm is in this position, the center of gravity thereof will lie on the left side of the shaft 126 and therefore will remain in that position until manually tilted to operative position by the operator. Rotation of the gear 120 causes vertical reciprocatory movement of the plungers, so that they are intermittently raised and lowered into contact with the fabrics.

The basket is adapted to be raised out of the wash water and rotated at a high velocity for the purpose of drying the fabrics in the basket. The basket is raised by a center shaft 135, to which the basket is secured at its upper end, by means of a sleeve 136, which slides over the outside of the center column 112 and forms a bearing for the basket. The shaft 135 extends below the sleeve 136 and is supported upon a lever 137 actuated by a foot lever 138. When the foot lever is pressed down the shaft 135 is raised, thereby lifting the basket out of the water. The nut 139 on the lower end of the shaft 135 engages the lower end of the hub 140 of the cone clutch 116 and moves it upward into engagement with the driving clutch 114. The cone clutch is splined to the shaft 135 by means of a key 141, and the shaft is rotated by the cone clutch after the clutch has been moved into engagement with the driving clutch. Further upward movement of the shaft raises the driving clutch so that the pinion 119 is disengaged from the gear 120. The plunger driving mechanism is therefore non-operative when the basket is in raised position and is being rotated.

The means for raising the basket and rotating it after it has been raised, and the means for reciprocating the plungers are old in the art, and no claim is made to this part of the apparatus. As has been previously stated, my improvements on this type of machine consist in the means for rotating the basket when it is in washing position, whereby the fabrics are rubbed by the knobs on the bottom thereof, as shown in Fig. 10, and in the means for turning the fabrics over in the basket so that different parts of the fabrics are rubbed by the basket and the plungers.

The means for rotating the basket includes

the star wheel or intermittent gear shown in Figs. 10 and 11. The gear consists of a driving wheel 142 carrying a driving pin 143, which cooperates with a star wheel 144. This form of wheel is well known in the gearing art and therefore its principles of operation will not be described in detail. It will be seen from Fig. 11 that the pin 143 enters a slot 145 at each revolution of the pin and turns the star wheel through 60 degrees of a revolution, and the star wheel is locked in stationary position during the time the pin is disengaged from the star wheel according to well known principles of operation. The driving wheel 142 is integral with the crank 121 and is rotated by the gear 120. The star wheel is rotatably mounted on the hub 140 of the cone clutch 116 and is yieldingly connected with the cone clutch by means of compression springs 146. When the driving pin 143 strikes the slot in the star wheel, the springs are first compressed and the basket which is driven by the star wheel is gradually accelerated. When the star wheel is locked, the springs gradually stop the basket, so that the springs are in effect shock absorbers which cushion the movements of the basket. The driving pin is so positioned with respect to the ball stud 122 that the movement imparted to the basket is at its maximum velocity when the plungers are in their lowermost position, as indicated in Fig. 10. The effect of this apparatus is to rotate the basket when the plungers are engaging the clothes and when they are withdrawing therefrom. The clothes are given a slight movement by the basket as the plungers are withdrawn, thereby bringing different fabrics under the plungers at each downward operation. The fabrics are rubbed by the knobs on the bottom of the basket. The fabrics are turned over in the drier by means of jets of water which are discharged upward against the under side of the fabric through nozzles 147 and 148 provided in the bottom of the basket. The nozzles open out of a series of discharge conduits 149 shown in enlarged scale in a slightly modified form in Figs. 12 and 13. The conduits 149 communicate with a hood 150 integral with the lower end of the sleeve 136, which hood forms the upper part of a water chamber 151, Fig. 10, surrounding the center column 112, and closes the top of the chamber when the basket is in its lowermost position. A Venturi tube 152 communicates at one end with the water chamber 151 and at the other end with the interior of the tub 110 through the intake port 153, which is located beneath the basket. A screw propeller pump 152' is located in the reduced neck of the Venturi tube and is adapted to be rotated at high velocity by means of a chain of gears 154, 155, 156, the latter of which meshes with a bevel gear 157

on the under side of the driving clutch 114. When the basket is in raised position the clutch 114 is also raised out of engagement with the gear 156, so that the pump is not operated when the basket is raised to drying position. Water is circulated through the Venturi tube or pump and discharged through the nozzles under pressure sufficient to turn the clothes over and manipulate them continuously during the washing operation. It is obvious that the propellers may be driven directly by a motor, as is done in the machine illustrated in Fig. 1, or it may be driven by a friction drive operated directly by the friction disc similar to the drive shown in Fig. 14.

Referring to Figs. 14 and 15, I have shown another modified form of washing machine, which consists principally of a tub and vertically reciprocable plungers for manipulating the clothes. Washing machines have been in use employing this method of washing, and the shaft for operating the plungers in such machines is provided with a more or less complicated ratchet and pawl means for revolving the plungers in steps, so that they descend upon the fabrics at a different spot at each downward stroke. Such machines are usually provided with a smooth bottom for the reason that no means has been provided to turn the fabrics over, and if rubbing surfaces were provided only the undermost fabrics would be rubbed. This is undesirable for the reason that all of the rubbing would be done on the same piece at the same spot.

In improving such machines, I provide the tubs with means for discharging jets of water upwardly as in the machines previously described and for the same purpose. Instead of a flat, smooth bottom I provide a conical shaped bottom provided with rubbing knobs similar to those employed in the machines illustrated in Figs. 1 and 10.

Referring to Fig. 14, I have diagrammatically illustrated in section my improved machine, which consists of a tub 158 provided with a conical rubbing bottom 159 disposed above the bottom 160 of the tub. This bottom has an opening 161 surrounding the center column 162 and may be removed for the purpose of cleaning the tub. The Venturi tube 163 containing the propeller pump 164 communicates at the end with an annular conduit 165 at the periphery of the tub beneath the bottom thereof, and at the other end with the interior of the tub through the inlet 166 beneath the conical bottom 159. The water circulated by the pump 164 is discharged into the annular conduit and through a series of discharge nozzles 167 opening out of the conduit and adapted to discharge jets of wash water upwardly and inwardly toward the center of the tub. The water flows through the opening 161 in the conical bot-

tom 159 and is drawn through the pump inlet 166. The fabrics are manipulated by a pair of plungers 168, which are pivotally connected to a cross beam 169 by means of the links 170. A reciprocable shaft 171 operates through the center column 162 and is connected to the cross beam. Any mechanical means may be employed for reciprocating the shaft so as to impart reciprocatory movement to the plungers. As the plungers descend they will move in the path indicated in dotted lines in Fig. 14 and will work the fabrics over the conical bottom toward the discharge nozzle 167. The jets from the nozzles will lift and turn the fabrics and force them toward the center of the tub. The nozzles 167 are disposed at a slight angle with respect to an axial plane so that the jets will move the fabrics and revolve them around the center of the tub. The plungers are not revolved, but as the fabrics are revolving slowly the plungers will encounter a different piece of fabric at each downward stroke. The pump in this machine is driven by means of a friction wheel 172, which contacts with a drive disc or gear 173, which may be a part of the shaft reciprocating mechanism.

In Fig. 15, I have diagrammatically illustrated a machine similar in essential elements to the machine illustrated in Fig. 14. The conical bottom in this machine slopes downward from the wall of the tub 158' toward the center thereof, and the nozzles 167' are disposed near the center of the tub and are supplied with water from a central chamber 165'. The Venturi tube 163' communicates at one end with the center chamber 165' and the other end communicates with the interior of the tube through the inlet port 166'. The water flows out of the nozzles near the center of the tube and down toward the pump inlet through the openings 161' at the periphery of the conical bottom 159'.

The plungers work the fabrics toward the center of the tub and the jets turn and work them away from the center and revolve them about the center of the tub.

In this machine I have shown a water motor 174 for reciprocating the plungers vertically and which is adapted to be operated on fluid delivered from the pump 164' through a conduit 175. The water motor consists of a cylinder 174 in which a piston 176 reciprocates. The piston is mounted on a rod 171', which carries the plunger beam 169' and the plungers 168'. The cylinder 174 is provided with fluid from conduits 177 and 178, which communicate with opposite ends of the cylinder and open into a valve chamber 179 containing a slide valve 180. The valve chamber is provided with exhaust conduits 181 and 182 which communicate with the opposite ends of the valve chamber. The valve is of the balanced type and is provided at each end with a piston fitting the

valve chamber cylinder. The supply conduit 175 discharges into the valve chamber at a point between the pistons of the valve. The pistons are adapted to alternately open and close communication between the supply conduit 175 and the conduits 177 and 178, and as shown, the valve has just been shifted downward by reason of the engagement of the collar 183 secured to the valve rod 184 with the valve. When the valve is in the position shown in Fig. 15, water passes through the pump and through the conduit 175, past the valve and through conduit 178 in the lower end of the cylinder. The water on the upper side of the piston is being exhausted through conduit 177, the valve chamber, and conduit 181, to the tub. This movement of the water raises the piston and the plungers and when the collar 185 on the lower end of the valve rod strikes the lower end of the valve, the valve will be moved upward so that the flow of water through the motor is reversed.

The pump propeller 164' in this case is shown directly connected with the shaft of an electric motor 186. The hydraulic motor is simple and less complicated than the usual machinery necessary to reciprocate the plungers. The power required is less and the time consumed in the washing operation is materially shortened by the use of the improvements herein described.

It is obvious that many changes may be made in the details of the machines herein illustrated and described without departing from the spirit of the invention, and therefore the invention is not limited to the specific constructions herein disclosed.

I claim:

1. The combination with a washing machine having a rotatable receptacle, of a means including a nozzle carried by the receptacle for discharging a jet of water into the receptacle and into contact with the fabric therein whereby the fabric is rotated in one direction and the receptacle is rotated in the opposite direction by the reaction of the jet upon the nozzle.

2. The combination with a fabric washing machine having a rotary basket for retaining the fabrics having a bottom provided with a rubbing surface, of a means for discharging a jet of washing fluid downward for working the fabrics downward against the rubbing surface and for rotating the basket to move the bottom thereof with respect to the fabrics, and a means whereby the under surface of the fabrics are agitated for turning the fabrics.

3. In combination in a fabric washing machine, a receptacle, a downwardly directed nozzle for discharging a jet of water downwardly against the fabric with sufficient force to move the fabric downward, and means for discharging a jet of water upward against

the fabric for turning and displacing the fabric, so that the first said means may act on different portions of the fabric.

4. The combination with a washing machine for fabrics having a rotary receptacle provided with a rubbing surface, of a nozzle carried by the rotary receptacle for discharging a jet of water into the receptacle against the fabric, whereby the receptacle is rotated by the reactive force of the jet and moved with respect to the fabric.

5. The combination with a washing machine for fabrics having a rotary receptacle provided with a bottom and side wall and mounted for rotation on a conduit, of nozzle means carried by the rotary receptacle and communicating with the conduit for discharging jets of water through the bottom and side walls into the receptacle, whereby the fabrics are turned and agitated.

6. In combination in a washing machine, a receptacle, a rotatable basket within the receptacle, a motor driven pump adapted to draw washing fluid from the receptacle, and discharge the same thereinto, and a turbine carried by the basket actuated solely by the fluid discharged into the receptacle by the pump for rotating the basket.

7. In combination in a washing machine, a receptacle, a basket within the receptacle, a pump for circulating fluid in the receptacle and means actuated by fluid delivered by the pump for raising the basket.

8. In combination in a washing machine, a receptacle, a basket within the receptacle adapted to rotate about its vertical axis, a fluid pump, means actuated by fluid delivered by the pump for raising the basket, means actuated by fluid delivered by the pump for imparting rotary movement to the basket when the basket is in raised position, and means cooperating with the basket for retarding the rotation of the basket and adapted to resist the action of the fluid delivered by the pump, whereby the basket may be brought to rest and retained stationary while the basket is under the influence of the fluid delivered by the pump.

9. In combination in a washing machine having an operating motor carried thereon, a receptacle, a basket within the receptacle, a pump driven by the motor for circulating the water retained by the receptacle, fluid pressure actuated means for moving the basket and operated on fluid pressure created by the pump, and means for controlling the fluid pressure, whereby the movement of the basket may be controlled.

10. In combination in a washing machine, a receptacle, a basket within the receptacle adapted to be operated in lowered or raised position, a fluid pump, a delivery conduit communicating with the pump, fluid conduits opening into and adapted to discharge fluid into the basket, in communication with the

delivery conduit when the basket is in its lowered position, a fluid operated turbine for rotating the basket, and means for supplying fluid to the turbine when the basket is in its raised position.

11. In combination in a washing machine, a receptacle, a rotary basket within the receptacle, a fluid pump, a delivery conduit communicating with the pump, fluid conduits in the basket communicating with the conduit terminating in discharge nozzles adapted to discharge jets of fluid into the basket at an angle to the radii of the basket whereby rotary movement is imparted to the basket by the reactive force of the jets.

12. In combination in a washing machine, a receptacle, a drier basket in the receptacle adapted to be raised and lowered to drying and washing positions respectively, a fluid pump, a discharge conduit communicating with the pump, a fluid conduit adapted to discharge fluid into the basket, in communication with the discharge conduit when the basket is in lower position, and means for closing communication between the fluid conduit and the discharge conduit.

13. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be raised and lowered, a fluid pump, a discharge conduit communicating with the pump, a fluid conduit adapted to discharge fluid when the basket is in lower position, means for closing communication between the fluid conduit and the discharge conduit, and fluid pressure actuated means controlled by the last said means for causing the basket to be raised.

14. In combination in a washing machine, a receptacle, a rotary basket in the receptacle adapted to be moved longitudinally and rotated in response to fluid pressure and means actuated by the basket when the latter is moved longitudinally for controlling the said fluid pressure for effecting rotation of the basket.

15. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be raised and lowered, a fluid discharge conduit, a fluid conduit adapted to discharge fluid from the discharge conduit into the basket and communicating with the discharge conduit when the basket is in lower position and adapted to be closed when the basket is in raised position.

16. In combination in a washing machine, a receptacle, a rotatable basket in the receptacle movable longitudinally between different operative positions, a fluid discharge conduit, a turbine element on the basket receiving fluid from the discharge conduit, and means actuated by the basket when the latter is moved longitudinally for controlling the fluid supply to the said element.

17. In combination in a washing machine, a receptacle, a basket in the receptacle adapt-

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ed to be raised and lowered and rotated, a fluid discharge conduit, fluid pressure actuated means for raising the basket communicating with the discharge conduit, and means for controlling the supply of fluid pressure to the said pressure actuated means.

18. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be raised and lowered and rotated, fluid pressure actuated means for raising the basket when the pressure exceeds a determined amount, fluid actuated means for rotating the basket, a fluid delivery conduit communicating with the said fluid actuated means, means for maintaining fluid pressure in the delivery conduit during the normal washing operation, and means for varying the pressure in the conduit whereby the basket is raised or lowered.

19. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be lowered and raised and rotated, fluid actuated means for raising the basket, fluid actuated means for rotating the basket, a fluid delivery conduit, means for maintaining pressure in the conduit, means for increasing the pressure in the conduit to raise the basket, and means for supplying the basket rotating means with operative fluid after the basket has been raised a determined distance.

20. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be raised and lowered, means for circulating water and discharging it under pressure into the basket, and fluid pressure actuated means for raising and lowering the basket responsive to variations in pressure in the circulating means, and means for varying the pressure in the circulating means, comprising means for controlling the discharge of fluid into the basket.

21. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be raised and lowered and rotated, a pump for circulating water through the basket for washing the articles therein, and means actuated by fluid delivery by the pump for raising the basket, and for rotating the basket.

22. In combination in a washing machine, a receptacle, a basket in the receptacle adapted to be raised and lowered and rotated, a pump for circulating water through the basket for washing the articles therein, and independent means actuated by fluid delivered by the pump for rotating the basket while in lowered position, for raising the basket and for rotating the basket when in raised position.

23. In combination in a washing machine, a receptacle, a rotary basket in the receptacle adapted to be raised and lowered, a vertical shaft about which the basket rotates, an operating rod within the shaft and extending exteriorly of the upper end of the shaft and braking means operated by the rod and co-

operating with the basket whereby the rotary movement of the basket may be arrested.

24. In combination in a washing machine, a receptacle, a rotary basket in the receptacle adapted to be raised and lowered, a vertical shaft about which the basket rotates, an operating rod within the shaft and extending exteriorly of the upper end of the shaft and means operated by the rod and co-operating with the basket whereby the basket may be held stationary by the said means at any point between the limits of its vertical movement.

25. In combination in a washing machine, a receptacle, a basket within the receptacle adapted to be raised and lowered and responsive to fluid pressure, valve means for controlling the fluid pressure, a means for retaining the basket in any determined elevation within the limits of movement, and common means for actuating the valve means and the said retaining means.

26. A washing machine comprising a pair of hydraulically operated washing machines, placed side by side, a pump for each machine having oppositely pitched propellers, and a motor for actuating both propellers located between the pumps and having the propellers in direct connection with the motor shaft, whereby the thrust of the pump propellers is substantially balanced when the pumps are operating simultaneously.

27. A washing machine comprising in combination a pair of receptacles, separate pump means having intake and outlet chambers for separately and simultaneously circulating fluid in each receptacle, a discharge conduit for each circulating means communicating with the outlet chamber and each controlled by a valve and communicating with a common conduit, for passing fluid from one receptacle to the other.

28. The combination with a washing machine, having a pair of independently operable centrifugal driers, each operating in a separate tub containing washing fluid serving as ballast, of a movable support for supporting both tubs whereby the axial gyrations of either drier are affected and dampened by the fluid ballast of both tubs.

29. The combination with a pair of centrifugal driers mounted on the same movable support, of a motor and a non-positive driving connection between the motor and the driers for simultaneously rotating the driers at speeds commensurate with their resistance to rotation.

30. In combination in a washing machine, a receptacle, a column in the receptacle, a rotary basket supported by the column, and means for discharging liquid out of the column and toward the center of the basket, comprising conduits carried by the basket and opening adjacent the sides of the basket.

31. In combination in a washing machine,

a receptacle, a fluid delivering column extending into the receptacle, a basket slidably mounted for longitudinal movement upon the column and having a closure member co-operating with the column and actuated by fluid pressure for imparting longitudinal movement to the basket.

32. In combination in a washing machine, a receptacle, a column in the receptacle, a basket rotatably mounted on the column, means for supplying fluid to the column, and means actuated by fluid delivered from the column for rotating the basket.

33. In combination in a washing machine, a receptacle, a column in the receptacle, a basket mounted thereon for rotary and vertical movement, means for supplying the column with fluid, means actuated by said fluid for raising the basket, means actuated by said fluid for rotating the basket, and means automatically actuated by movement of the basket for controlling the fluid supply to the last said means.

34. In combination in a washing machine, a receptacle, a rotary basket in the receptacle, means for rotating the said basket, means for controlling the basket rotating means, means for actuating the controlling means, and means operated by the last said means for resisting rotary movement of the basket.

35. The combination with a washing machine having a rotary basket adapted to be immersed in washing fluid during the washing operation and elevated above the fluid during the drying operation, of means for discharging fluid under pressure into the basket when the basket is immersed in the washing fluid for rotating the basket.

36. In combination with a washing machine having a rotary basket adapted to be immersed in the washing fluid during the washing operation and elevated above the washing fluid during the drying operation and provided with a fluid actuated turbine for rotating the basket, of a fluid supply system for discharging fluid under pressure into the basket during the washing operation and for delivering fluid to the said turbine during the drying operation.

37. The combination with a washing machine having a rotary basket adapted to be immersed in the washing fluid during the washing operation and to be rotated at high speed when out of washing relation with the washing fluid, of a fluid pressure generating means for circulating the wash water through the basket during the washing operation, means actuated by fluid pressure generated by the said means for so separating the water and the basket that they are out of washing relation during the drying operation, and means for rotating the basket.

38. In combination in a washing machine, a receptacle, a fluid conduit therein, a rotary basket within the receptacle mounted for

vertical and rotary movement, a fluid pressure means for maintaining fluid pressure in the conduit and circulating water through the basket for washing the clothes when the basket is in lowered position, means actuated by fluid in the conduit for raising the basket when the fluid pressure in the conduit exceeds a determined amount, means for increasing the fluid pressure in the conduit for raising the basket including means for stopping the circulation of fluid through the basket, and fluid actuated means for rotating the basket when the basket has been raised to its upper operative position.

39. In combination in a washing machine, a receptacle, a basket in the receptacle movable to and between upper and lower positions therein, fluid pressure actuated means for raising the basket, and fluid pressure actuated means for rotating the basket after the basket has been moved to raised position.

40. The combination with a washing machine having a receptacle for containing washing fluid, and a centrifugal drier adapted to be raised above the washing fluid during the drying operation, of means for imparting to the washing fluid in the receptacle a rotary movement about the axis of rotation of the drier during the drying operation.

41. A washing machine comprising a plurality of receptacles, a pump having its inlet communicating with one of the receptacles and adapted to circulate water there-through whereby the materials in that receptacle are washed, and provided with a conduit whereby fluid delivered by the pump may be discharged into another receptacle, means for controlling the delivery of fluid through the said conduit and a separate pump means for the last named receptacle whereby the fluid delivered to that receptacle may be returned to the first receptacle.

42. In a centrifugal machine, the combination with a center column for supplying operating fluid and having a rotatable member provided with fluid discharge outlets, of a drier basket detachably mounted on the said rotatable member and having a turbine for receiving actuating fluid from the said outlets.

43. In a centrifugal machine, the combination with a center column for supplying operating fluid and a turbine member rotatably mounted upon the said column and receiving actuating fluid therefrom, of a centrifugal drier basket detachably mounted upon said turbine member.

44. In a centrifugal machine, the combination with a center column for supplying operating fluid and a longitudinally movable turbine member mounted upon said column and actuated by fluid delivered from the said column, of a centrifugal drier basket mounted upon the said turbine member.

45. In a centrifugal machine, a center col-

umn for supplying operating fluid, a cylindrical turbine element having telescoping connection with the said column and actuated by fluid from the said column and a centrifugal drier basket mounted upon the said turbine element.

46. The combination with a washing machine comprising a pair of separate receptacles for containing washing fluid having variable density characteristics and a separate pump for circulating the washing fluid in each receptacle, of driving means for connecting the pumps whereby they are driven at synchronous speed and at a speed substantially proportional to resultant load fluctuations due to different characteristics of the fluid circulated by the pumps.

47. A washing machine comprising in combination a pair of separate receptacles for containing washing fluid, a separate pump having a rotary impeller for circulating the washing fluid in each receptacle, means for positively connecting the impellers for equalizing their speed of rotation regardless of characteristic differences in said fluids and means for rotating the said pumps.

48. In a washing machine, the combination with a receptacle for washing fluid, a basket therein movable between upper and lower positions and rotatable at relatively high speed when in upper position, of means supported by fluid pressure and constituting a fluid bearing for retaining the basket in upper position.

49. The combination with a closed fluid circulating system for washing articles in a receptacle movable by the circulated water at a relatively slow speed during the washing operation, of means responsive to fluid circulated by the system for rotating the basket at relatively high speed.

50. The combination with a closed fluid circulating system for washing articles in a movable receptacle, of means responsive to fluid pressure within the system for raising the receptacle.

51. In combination in a washing machine, a receptacle, a basket within the receptacle movable between upper and lower positions, fluid conduits opening into the basket for discharging fluid therein when the basket is in lower position, a fluid operated turbine for rotating the basket and means for supplying fluid to the turbine when the basket is in its raised position.

52. In combination in a washing machine, a receptacle, a rotary basket within the receptacle, and fluid conduits in the basket terminating in discharge nozzles adapted to discharge jets of fluid into the basket at an angle to the radii of the basket whereby rotary movement is imparted to the basket by the reactive force of the jets.

53. In combination in a washing machine, a receptacle, a basket in the receptacle mov-

able between upper and lower positions, a fluid supply conduit, a conduit for discharging fluid into the basket in communication with the supply conduit when the basket is in lower position, means for closing communication between the supply conduit and the second conduit, and fluid pressure actuated means controlled by the last said means for causing the basket to be raised.

54. In combination in a washing machine, a receptacle, a rotatable basket in the receptacle movable axially between different operative positions, a fluid delivering conduit, different pressure actuated means communicating with the said conduit for moving the receptacle axially between the said operative positions and for rotating the receptacle, and means for varying the pressure in the conduit.

55. In combination in a washing machine, a rotatable receptacle movable axially between different operative positions, a pump for circulating water through the receptacle for washing the articles therein and means actuated by fluid delivered by the pump for moving the receptacle axially and for rotating the receptacle.

56. In combination in a washing machine, a rotatable receptacle movable axially between different operative positions, a fluid supply means for discharging therefrom washing fluid into the receptacle for washing the articles therein and different means actuated by fluid from the said supply for moving the receptacle axially and for rotating the receptacle.

57. The combination with a pair of independently operable centrifugal driers mounted on the same movable support, of a single driving means mounted on the support and movable therewith and a non-positive driving connection between the driving means and the driers for rotating the driers simultaneously.

58. The combination with a centrifugal drier mounted upon a movable frame, of a plurality of washing compartments containing fluid and mounted upon and movable with the frame and serving as ballast for dampening the oscillations of the drier.

59. The combination with a washing machine having a rotary basket adapted to be immersed in washing fluid during the washing operation and elevated above the fluid during the drying operation, of means for discharging fluid under pressure from the basket when the basket is in elevated position for rotating the basket.

60. The combination with a washing machine having a rotary basket adapted to be immersed in the washing fluid during the washing operation and to be rotated at high speed when out of washing relation to the washing fluid, of a fluid pressure generating means for circulating the washing fluid

through the basket during the washing operation, and means actuated by fluid pressure generated by the said means for rotating the basket at high speed when out of washing relation to the washing fluid.

61. A method of washing clothing and the like which consists in causing the washing water and contents of a washing tub or the like to be given a motion in an endless path, and moving the articles to be washed in a current over and closely adjacent to a surface provided with perforations and constituting a rubbing surface.

62. A method of washing clothing and the like which consists in introducing the water in a swift current tangentially into the tub, thereby causing the entire contents of the washing tub to be given a swift whirling motion in an endless path, and moving the articles to be washed over a perforated rubbing surface, and at the same time forcing the clothing against said rubbing surface by means of water currents passing through it.

63. In a washing machine, the combination with a tub or receptacle for the water and articles to be washed, having in a wall thereof, adapted to be covered by the water, a perforated surface, of means for introducing water into said receptacle in a direction to produce an endless current around said receptacle and along said perforated surface, give the contents of the receptacle a whirling motion therein, and draw the articles to be washed along said perforated surface and substantially in contact therewith during their whirling course, and means for drawing the overflow out through said perforations during the continuance of the whirling motion to keep the level of water in the receptacle constant.

64. In a washing machine, the combination with a receptacle for the water and articles to be washed having a curved interior, of means for introducing water tangentially into the same to produce a whirling motion of the contents of said receptacle, said receptacle having a perforated portion below the top thereof through which the water is discharged therefrom and in contact with which the articles to be washed are passed during their circulation in said receptacle.

65. A washing machine comprising in combination a pair of receptacles, pump means having separate intake conduits communicating with the receptacles and having a discharge conduit for delivering fluid to either receptacle, and valves for controlling the delivery of fluid from the receptacles to the said discharge conduit.

66. A washing machine comprising in combination a receptacle for washing fluid in which fabrics are washed, and a second receptacle containing a centrifuge in which the fluid is extracted from the fabrics, pump

means having a separate intake conduit communicating with each of the receptacles and having a discharge conduit for delivering fluid to either receptacle, and valves for selectively controlling the delivery of fluid from the receptacles to the said discharge conduit.

67. A washing machine comprising in combination a support mounted upon castors whereby it is rendered movable in response to the action of a centrifuge and whereby the centrifuge is permitted to approximately rotate about its center of mass, and a centrifuge for extracting washing fluid from the fabrics contained therein, mounted with its axis of rotation vertical and eccentric to the center of mass of the washing machine, whereby horizontal gyration of the axis of the centrifuge, in its act of rotating about its attempted center of mass, is oval, due to greater inertia of mass of the machine in the direction of a line passing through the center of mass of the washing machine and the axis of the centrifuge.

In testimony whereof, I have hereunto subscribed my name this 17th day of March, 1919.

JULIAN H. KENDIG.

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