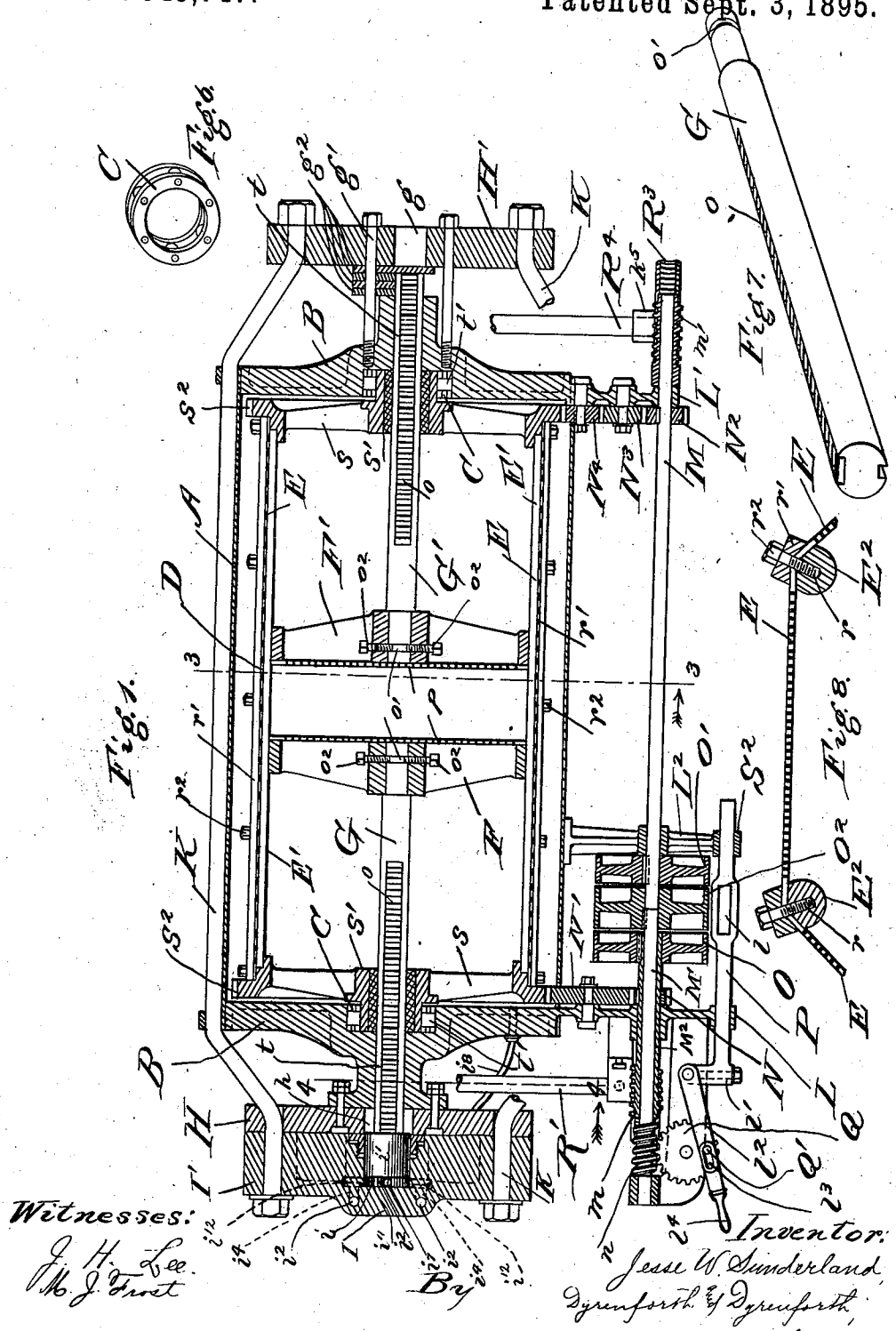
(No Model.)

2 Sheets—Sheet 1.

J. W. SUNDERLAND.

WASHING MACHINE.

No. 545,747. Patented Sept. 3, 1895.



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Inventor:
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(No Model.) 2 Sheets—Sheet 2.

J. W. SUNDERLAND.

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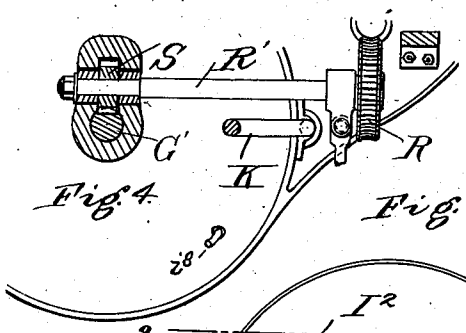

Fig. 4.

Fig. 2.

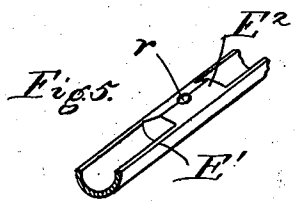

Fig. 5.

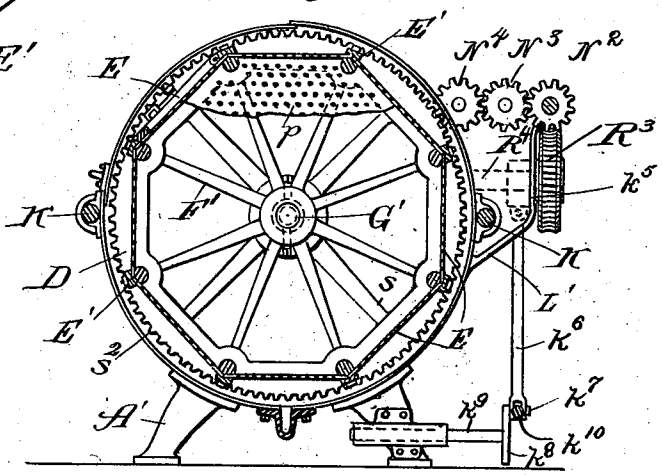

Fig. 3.

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UNITED STATES PATENT OFFICE.

JESSE W. SUNDERLAND, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO A. J. McDUFFEE, OF SAME PLACE.

WASHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 545,747, dated September 3, 1895.

Application filed March 24, 1894. Serial No. 504,958. (No model.)

To all whom it may concern:

Be it known that I, JESSE W. SUNDERLAND, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Washing-Machines, of which the following is a specification.

My invention relates to an improvement in washing-machines of the class in which a rotating cylinder having perforated walls is caused to rotate within a stationary cylinder and contains traveling disks, usually perforated, which are caused automatically to move toward and away from each other to effect a thorough washing and cleansing of the clothes contained in the cylinder.

In an apparatus of this character of the kind to which my invention more particularly relates the rotatable cylinder is caused to turn in one direction a certain number of times and thereupon to turn in the reverse direction, said rotation and reversal being effected through a belt-shifting mechanism on the pulleys, and it has been the practice to cause the rotation of the cylinders in the opposite directions, respectively, to produce the movement of the traveling disks within the cylinder.

My object is to improve washing machines of this character in general, and particularly to cause the movement of the traveling disks to be in a measure independent of the rotation of the cylinder, while at the same time causing both operations to be accomplished from the same power controlled by the belt-shifter.

In the drawings, Figure 1 is a plan sectional view on the line 2 2 of Fig. 2 and viewed in the direction of the arrow, showing the general construction of my device; Fig. 2, a view in end elevation, taken at the head of the machine; Fig. 3, a vertical transverse section taken on line 3 3 of Fig. 1 and viewed in the direction of the arrow, parts being broken away to illustrate details of the construction which would otherwise be hidden from view; Fig. 4, a broken end elevation, partly in section, the section being taken on line 4 4 of Fig. 1 and viewed in the direction of the arrow; Fig. 5, a sectional broken perspective of one of the brace-rods employed with the inner cylinder; Fig. 6, a perspective view of one of two similar roller-bearing devices employed with the inner cylinder; Fig. 7, a perspective view of one of two substantially similar plunger-rods which carry the traveling disks within the cylinder; and Fig. 8, an enlarged sectional view of a portion of the inner cylinder, showing the mode of holding the staves together.

A represents the outer cylinder, which is supported on legs A'.

The heads B are provided with central perforations t and formed with central inner recesses t' about the perforations t, and within which are supported nests of roller-bearings C.

D is an inner or washing cylinder comprising end spiders s, having central outward-projecting trunnions s', which extend into the recesses t' and carry the nests of roller-bearings C. The walls of the inner cylinder D comprise perforated longitudinally-extending staves E, held together at their edges by longitudinally-arranged brace-rods E'. The brace-rods E' are in the form of half tubes, as indicated in Fig. 5, provided at intervals with solid lugs E^2, containing threaded sockets r. The lug portions E^2 of the brace-rods E' present inclined surfaces which are at an angle to each other and extend flush with the inner surfaces of the staves E when the latter are placed in position. To secure the staves in place strips r', each having an inner face presenting a double bevel, are placed over the meeting edges of the staves, and screws r^2 are introduced through openings in the strips and into the sockets r. At their ends the staves E fit in annular recesses in the circumferential faces of the spiders, and beyond the said recesses the spiders are provided with peripheral cog-teeth s^2.

Within the cylinder D are supported the spiders F F', each carrying a perforated plate p. The spiders F F' have the circumferential configuration of the cylinder D and are adapted to slide in the latter. The spider F at its center fits over the inner end of a plunger-rod G, and the spider F' receives centrally the inner end of a plunger-rod G'. The rods G G' are each provided on one face with a rack o, which is shown in the drawings as presenting the outer edge of each tooth within the circumferential area of the rod. The rods G G' extend through the trunnions s' and

through the central apertures t of the heads B B of the outer cylinder. The spiders F F', though held to and carrying the plunger-rods G G', are rotatable thereon, this being accomplished by providing an annular groove o' near the end of each plunger-rod, which groove is engaged by set-screws o^2 passing through the hubs of the spiders. The heads B B at opposite ends of the cylinder A carry, bolted thereto, supplemental heads H H', and pivotally mounted upon the head H is hydraulic-jack mechanism I, presently described. Tie-rods K extend from one supplemental head H to the other supplemental head H', as illustrated in Fig. 1.

Supported in a suitable bracket L, at one side of the head end of the machine and extending to a corresponding bracket L' at the foot end of the machine, is a horizontal shaft made of two independent sections M M'. Loosely surrounding the shaft-section M' is a hollow shaft or sleeve M^2. The shaft-section M' is provided at its outer end with a worm n and on the outer end portion of the sleeve M^2 is a worm m. At its outer end the shaft-section M is provided beyond the bracket L' with a worm m'. On the sleeve M^2, in the position shown, is a pinion N, which meshes with a pinion N', journaled on the bracket L, and the pinion N' extends at its periphery through a slot or opening in the outer casing A, and in turn meshes with the cogs s^3 on the spider s at the head of the machine. The shaft-section M carries, adjacent to the bracket L', a pinion N^2, which meshes with a pinion N^3, which in turn meshes with a pinion N^4. The pinions N^3 N^4 are journaled upon the sides of the bracket L', and the pinion N^4 extends at its periphery through an opening in the outer cylinder A and meshes with the cogs s^2 on the spider s at the foot end of the cylinder D. The sleeve M^2 at its inner end carries a belt-pulley O, and the shaft-section M near its inner end carries a belt-pulley O'. Between the belt-pulleys O O' and covering the joints of the shaft-sections M' M is a pulley O^2, keyed to the shaft-section M'. Extending from the bracket L to a supplemental bracket L^2, which forms one of the bearings of the shaft-sections M, is a belt-shifting arm P, having the aperture l for the belt, and also the socketed end l', to which is secured one end of a lever l^2. The aperture l should be of a length approximating the width of the pulley O^2, and the drive-belt employed should be of a width approximating the length of said aperture. The lever l^2 has the elongated slot l^3 and handle l^4. A worm-gear Q, journaled on an arm of the bracket L to mesh with the worm n on the shaft-section M', has the eccentric-pin Q', which enters the elongated slot l^3 in the lever l^2. The worm m is adapted to mesh with a worm-wheel R, mounted upon a shaft R', extending across the head of the cylinder and terminating at its opposite end in bearings formed on the head B, and illustrated in Fig. 4. Between the said bearings at the head B the shaft R' carries a pinion S, said pinion meshing with the teeth o on the plunger-rod G. The shaft R' is so mounted in its bearings on the head B that it may vibrate to a limited extent at its outer end where it carries the worm-wheel R. Near its outer end the shaft R' is journaled in a bearing R^2, supported on the upper end of a rod k, extending downward to a rotatable plate k', with which plate it has an eccentric connection, as through the pin k^2. From the center of the plate k' extends a shaft k^3, having its bearings in the legs A' of the machine, which rod k^3 carries at its opposite extremity laterally-extending pedal-arms k^4. When the shaft k^3 is turned to the position indicated in Fig. 2, the worm-gear R is raised into mesh with the worm m to be driven thereby. When the shaft k^3 is turned by depressing the upper pedal k^4, the shaft R' is swung downward at its free end and disengages the worm-gear R from the worm m. At the opposite end of the machine the same construction is presented—that is to say, with the worm m' there meshes the worm-gear R^3, (see Fig. 3,) the shaft R^4 of which carries a pinion corresponding with the pinion S, which engages the teeth on the plunger-rod G'. The shaft R^4 is journaled in the bearing on the adjacent head B of the cylinder in a manner to permit the shaft to swing in its bearing and carry the worm-gear R^3 into and out of engagement with the worm m'. The shaft R^4 is journaled adjacent to the worm-gear R^3 in a bearing-collar k^5 on the upper end of a rod k^6, which at its lower end is pivoted upon a pin k^7 on a disk k^8. The disk is on the end of a rock-shaft k^9, journaled in a bearing on one of the legs of the machine, and carries a pin k^7, eccentric with relation to said shaft. Extending between and pivotally connected at opposite ends to the pins k^8 k^7 on the respective disks k' k^8 is a rod k^{10}, whereby movement of the shaft k^3 to raise or lower the worm-gear R is imparted to the shaft k^9 and attendant parts, whereby the worm-gear R^3 is thrown into and out of mesh with the worm m' at the same time that the worm-gear R is thrown into and out of mesh with the worm m.

The hydraulic-jack mechanism comprises a casing I, having a smooth inner face conforming to the outer face of the supplemental head H. The casing I is pivotally mounted at one end upon an extension of one of the tie-bars K. It may swing on said tie-bar between vertical and horizontal positions, and at its free end it is formed into a hook I', whereby when swung to the horizontal position it engages and is held rigidly in place by the tie-bar K on the opposite side of the machine. In the casing I, is a chamber i, containing a piston i'. In the casing at opposite sides of the said chamber are two pump-cylinders i^2 i^3, in which work pistons upon the ends of piston-rods i^4 i^5, at their outer ends connected with a pump-lever I^2, which is pivoted upon the casing be-

tween the piston-rods i^3. Extending from the cylinders i^2 to the end of the chamber i are passages i^4. (Indicated by dotted lines in Fig. 1.) Leading to the lower end of the cylinders i^2 is a water-supply pipe i^5, and interposed in the branches of the said pipe are check-valves i^6, which permit water to pass freely through them to the cylinders, but prevent its retrogression. In the passages i^4, between the pump-cylinders and chamber i, are check-valves i^{12}, which prevent retrogression of water from the chamber to the cylinders under the suction action of the pump-pistons when water is drawn in through the check-valves i^6. As valves for this purpose are provided in all pumps or hydraulic jacks, it is thought to be unnecessary in the present connection to illustrate them by special view. In the end of the chamber i is an outlet-port i^7, which communicates with a pipe i^8, which extends therefrom through the adjacent head B to the interior of the cylinder A. Interposed in the pipe i^8 is a valve i^9, opened and closed by means of the hand-wheel i^{10}. The sections of the pipes i^5 i^8 adjacent to the casing I are of flexible material and offer no obstacle to the swinging of the casing between its vertical and horizontal positions.

In the supplemental head H, registering on one side with the opening t and at its opposite side with the chamber i, when the casing I is in the horizontal position, is an opening h of a diameter slightly exceeding the diameter of the chamber i. The piston i' is prevented from covering the ports in the chamber i by a pin i^{11}, carried by the piston, which strikes the inner end of the chamber when the piston is moved inward. It is to be understood that during the washing operation, presently described, the hydraulic jack is swung to the vertical position to permit free reciprocation of the plunger-rod G, and when the wringing operation is to take place the plunger-rod is moved inward as far as it will go under the action of the pinion S, operated from the worm m, at which time its outer end just clears the inner face of the hydraulic jack when the latter is swung down to the horizontal plane. Water pumped into the chamber i against the piston i' forces the latter outward into the opening h and against the outer end of the plunger-rod G. The plunger-rod G′ moves through an opening g in the supplemental head H′, and when at the inward limit of its movement under the action of the pinion on the shaft R^4 its outer end has passed inward through the opening g to a position between the supplemental head H′ and adjacent head B. Pivoted upon a bolt g', adjacent to the opening g, are one or more stop-plates g^2, which may be swung from a position out of the path of the outer end of the plunger-rod G′ to a position across the path of the latter. As hereinafter explained, when it is desired to perform the wringing operation the plunger-rods G G′ are moved to their inward limits and one or more of the plates g^2 are swung across the path of the plunger-rod G′, depending upon the distance of the outer end of the latter from the inner face of the supplemental head H′. This prevents the said plunger-rod from being forced outward by pressure from the rod G under the action of the hydraulic jack.

The operation is a follows: The hydraulic jack I being turned on its pivot to the vertical plane to uncover the opening h through the supplemental head H and the internal traveling spiders F F′ being in the position indicated in Fig. 1, the belt is shifted by hand through the medium of the lever l^2 to overlap the pulley O, while still retaining its grip upon the pulley O^2. Pressure is exerted upon one of the pedals k^4 to move the worm-gears R R^3 into mesh with the worms m m', respectively. When the machine is started, the belt rotates the pulleys O O^2. Through the pulley O the sleeve M^2 and pinion N are rotated to rotate the pinion N′ and turn the cylinder D on its trunnions. The rotation of the cylinder D through its engagement at the opposite end with the pinion N^4 rotates the latter, the pinion N^3, and pinion N^2 on the shaft M. The rotation of the pulley O^2 produces rotation of the shaft M′ and its worm m. It will be understood, therefore, that in the rotation of the pulleys O O^2 the shaft M′ and its worm n and the sleeve M^2 and its worm m are all rotated, imparting rotation to the cylinder D, and, through the latter and the gears N^4 N^3 N^2, imparting rotation to the shaft M and its worm m', the rotation of the shaft M and worm m' being, however, in the direction contrary to that of the shaft M′ and sleeve M^2. During this rotation the worm m turns the worm-gear R, shaft R′, and pinion S to cause the plunger-rod G and spider F to move in the outward direction; and the engagement of the worm-gear R^3 with the worm m' causes it and the shaft R^4 to turn in the direction for moving the plunger-rod G′ and spider F′ in the outward direction. The plate g^2, which in Fig. 1 is shown in the path of the end of the plunger-rod G′, must be turned aside before the commencement of the operation. The rotation of the shaft M′, and consequent turning of its worm n, rotates the worm-wheel Q, and as the spiders F F′, near the opposite ends of the cylinder, the pin Q′ engages one end of the slot l^3 of the lever l^2 and pushes the latter in the direction to slide the belt-shifting bar P to the position wherein the belt engages the pulleys O^2 and O′. The engagement of the belt with the pulley O′ produces immediate reversal of said pulley and the shaft M, whereby through the gears N^2 N^3 N^4 the rotation of the cylinder D is reversed, and through the engagement of the cylinder with the pinion N′ and through the latter with the pinion N the rotation of the sleeve M^2 and attendant parts is reversed. Therefore as soon as the belt is shipped from the pulley O to the pulley O′ the plunger-rods G G′ are moved in the direction of

each other. When the spiders arrive at the position indicated in Fig. 1, their movement is again reversed and the operation will be continuous. The inward and outward play of the perforated plates p and the rotation back and forth of the cylinder D perform the washing operation, the articles to be washed being interposed between the plates p, and the cylinder A being filled with water to the desired depth before the operation commences.

To produce thorough wringing of the clothes under a pressure between the disks p beyond that which can be exerted from the drive-belt, the water is withdrawn from the cylinder A and the movement of the mechanism described is stopped when the spiders are both at their innermost position indicated in Fig. 1. As a preliminary to performing the wringing operation, the rock-shaft k^3 is turned by pressure upon one of the pedals k^4 to lower the worm-gears R R^3 out of engagement with the worm m m', whereby movement of the plunger-rods G G′ is stopped. One or more stop-plates g^2 are then swung across the path of the plunger-rod G′. The hydraulic jack is then lowered to the horizontal position and the valve i^9 is closed. The pump-lever I^2 is then operated to force water into the chamber i against the end of the piston i' and force the latter with the plunger-rod G and spider F in the direction of the spider F′. By this means great pressure is exerted between the plates p, and the bar G′ is prevented from yielding by the stop plate or plates g^2. The power-shaft from which the machine is operated may be provided, as is common in all such cases, with fast and loose pulleys and belt-shipping mechanism, all of which it is not thought necessary to illustrate. If desired, the belt-shipping mechanism may be moved to stop the machine before the wringing mechanism is brought into action. It is better, however, to permit the cylinder D and disks p to rotate, as described, while the wringing operation is being performed, because the motion tends to discharge the water by centrifugal force as it is squeezed out of the washed articles by the hydraulic jack. When the wringing operation is completed, the working of the pump is stopped and the valve i^9 is opened by means of the hand-wheel i^{10}, causing the water in the chamber i to flow out through the pipe i^8 into the base of the cylinder A. The hydraulic jack is then swung to the vertical plane, the stop plate or plates g^2 are turned out of the way, and the rock-shaft k^3 is turned to cause the worm-gears R R^3 to mesh with the worms m m'. This action causes the plunger-rods to be moved in the direction of the ends of the cylinder, and the machine is then stopped and the washed and wrung articles taken therefrom. The machine is then ready for another operation.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a washing-machine, the combination with the washing cylinder and a traveling plate therein, of a plunger rod carrying said plate and having rack teeth, a pinion engaging said rack teeth, a shaft carrying said pinion, a worm and worm gear driving said shaft, a pulley shaft and belt driving said worm, and means, substantially as described, for separating said worm and worm gear, at will, whereby movement of the plunger may be prevented, substantially as and for the purpose set forth.

2. In a washing-machine, the combination with the cylinder and the traveling plates therein, each plate having outward projecting plunger rods having rack teeth, of pinions engaging the teeth on said rods respectively, a sectional shaft M M′, a sleeve M^2 loosely surrounding the shaft-section M′, belt pulleys on the shaft-section M and sleeve M^2 respectively, an intermediate pulley on the shaft-section M′, belt shipping mechanism connected with and operated by the shaft-section M′, a gear connection between the shaft-section M and one said pinion, a gear connection between the sleeve M^2 and the other said pinion, and gear connection, substantially as described, between the shaft-section M and the sleeve M^2 respectively and the opposite ends of the rotatable cylinder, all substantially as and for the purpose set forth.

3. A washing-machine comprising, in combination, the following elements: a rotatable cylinder having peripheral gear at each end, traveling plates within said cylinder, rods G G′ carrying said plates and supported in the opposite heads of the washing machine, said rods provided with rack teeth, pinions engaging said rods respectively, a sectional shaft M M′, a sleeve M^2 on the shaft-section M′, belt pulleys O O′ on the sleeve M^2 and shaft-section M, respectively, an intermediate pulley O^2 on the shaft-section M′, gear between the sleeve M^2 and one end of the rotatable cylinder and meshing with the peripheral gear thereon, and gear in different number between the shaft-section M and the peripheral gear on the opposite end of the rotatable cylinder, and a belt shifting device comprising a belt engaging bar, a worm on the shaft-section M′ and a pinion engaging said worm and connected eccentrically with the handle of said bar, all substantially as and for the purpose set forth.

4. In a washing-machine, the internal rotatable cylinder comprising in combination the spider heads s, semi-tubular brace rods E′ having the lugs E^2 and perforated staves E supported on said brace rods through the medium of nuts and bolts entering said lugs, substantially as and for the purpose set forth.

JESSE W. SUNDERLAND.

In presence of—
M. J. FROST,
W. N. WILLIAMS.