Sept. 18, 1951 G. FIELDS 2,568,614

CLOTHES WASHING MACHINE WITH A HORIZONTALLY RECIPROCATING AGITATOR

Filed Oct. 4, 1945 4 Sheets-Sheet 1

Fig. 1

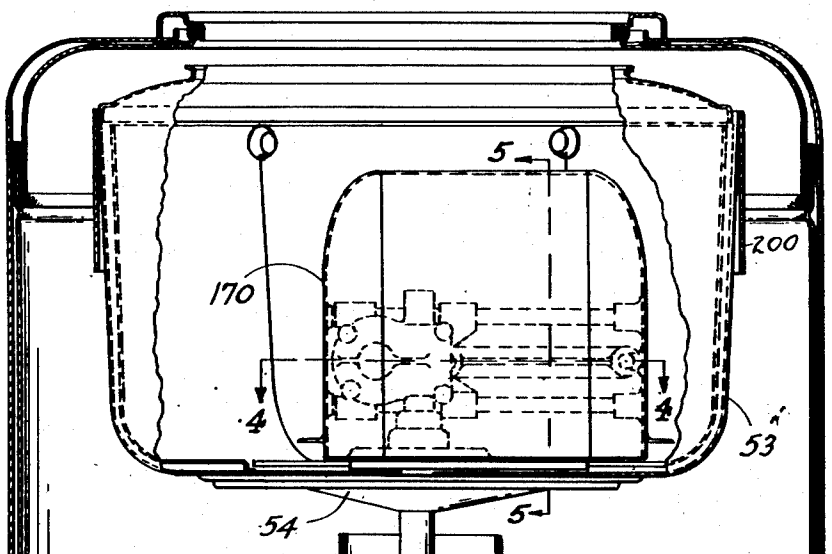
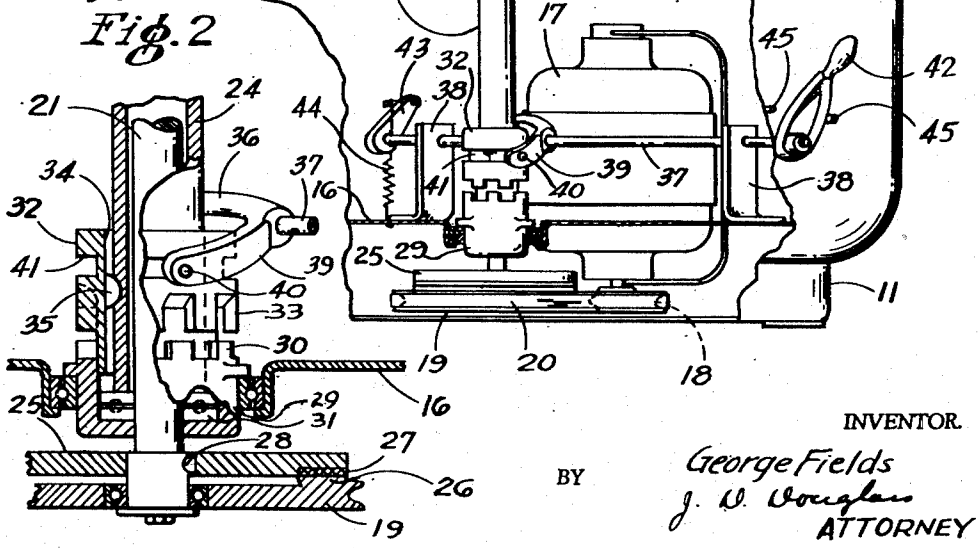


Fig. 2



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Filed Oct. 4, 1945 4 Sheets-Sheet 2

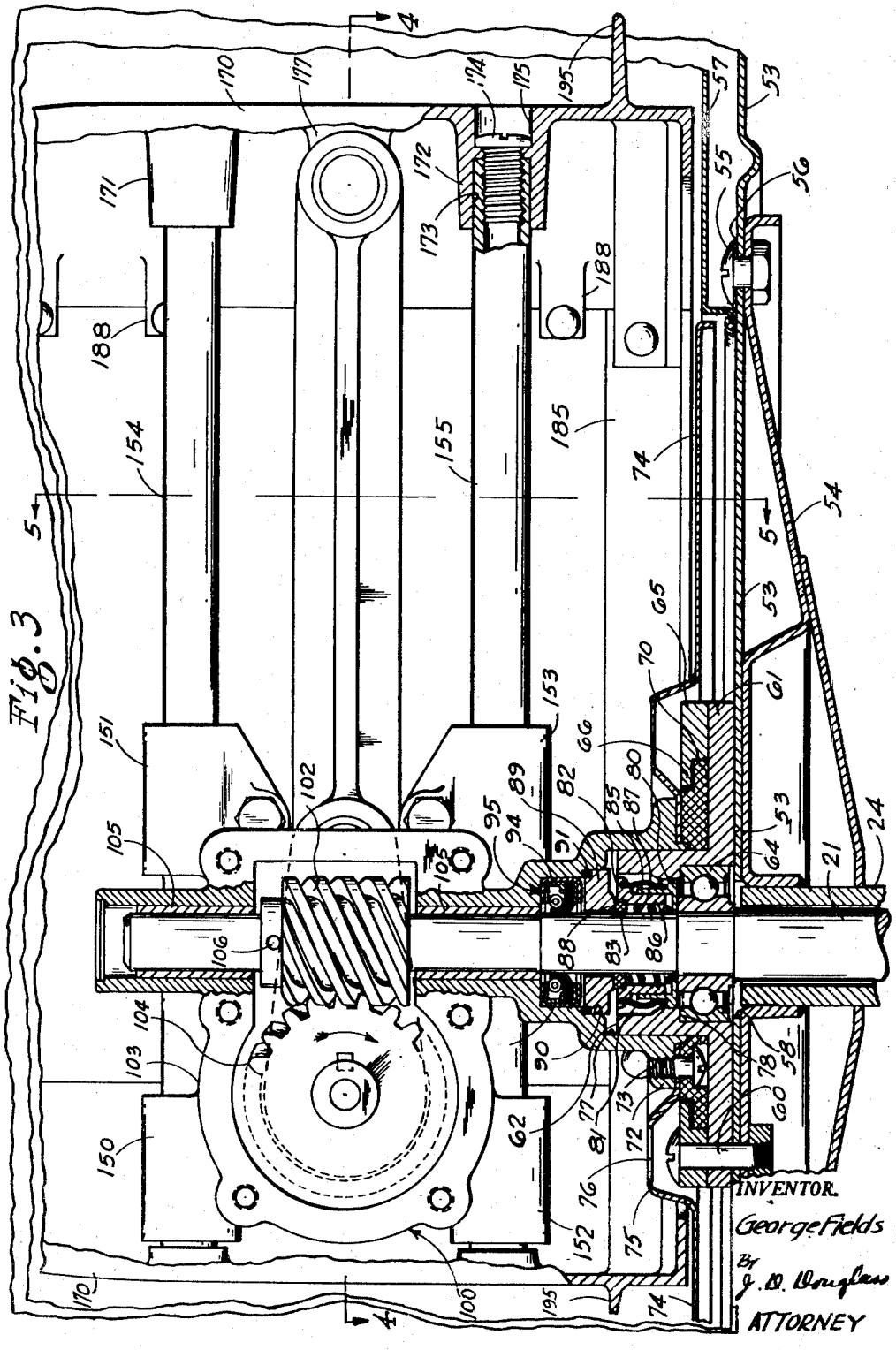

Fig. 3

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Filed Oct. 4, 1945 4 Sheets-Sheet 3

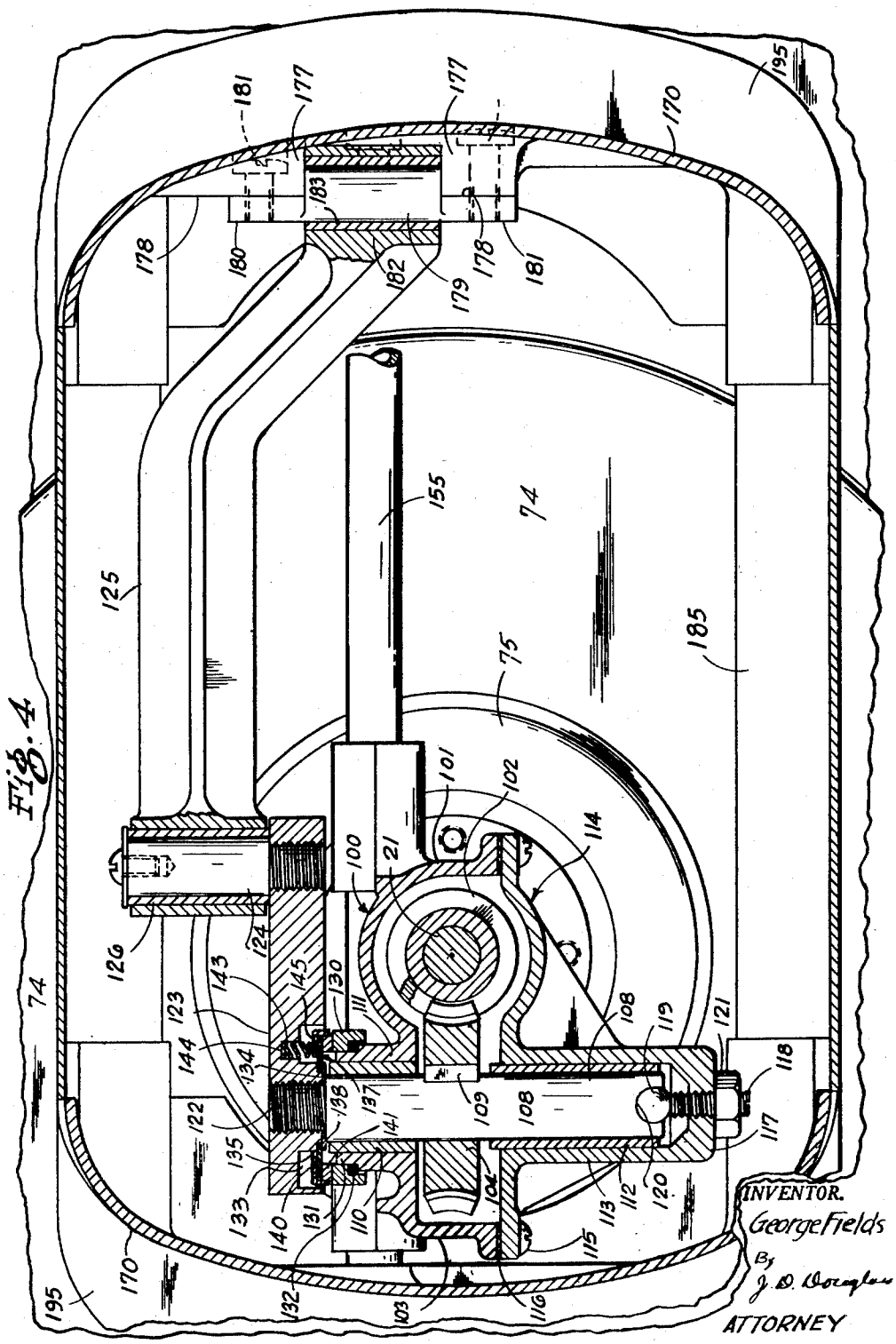

Fig. 4

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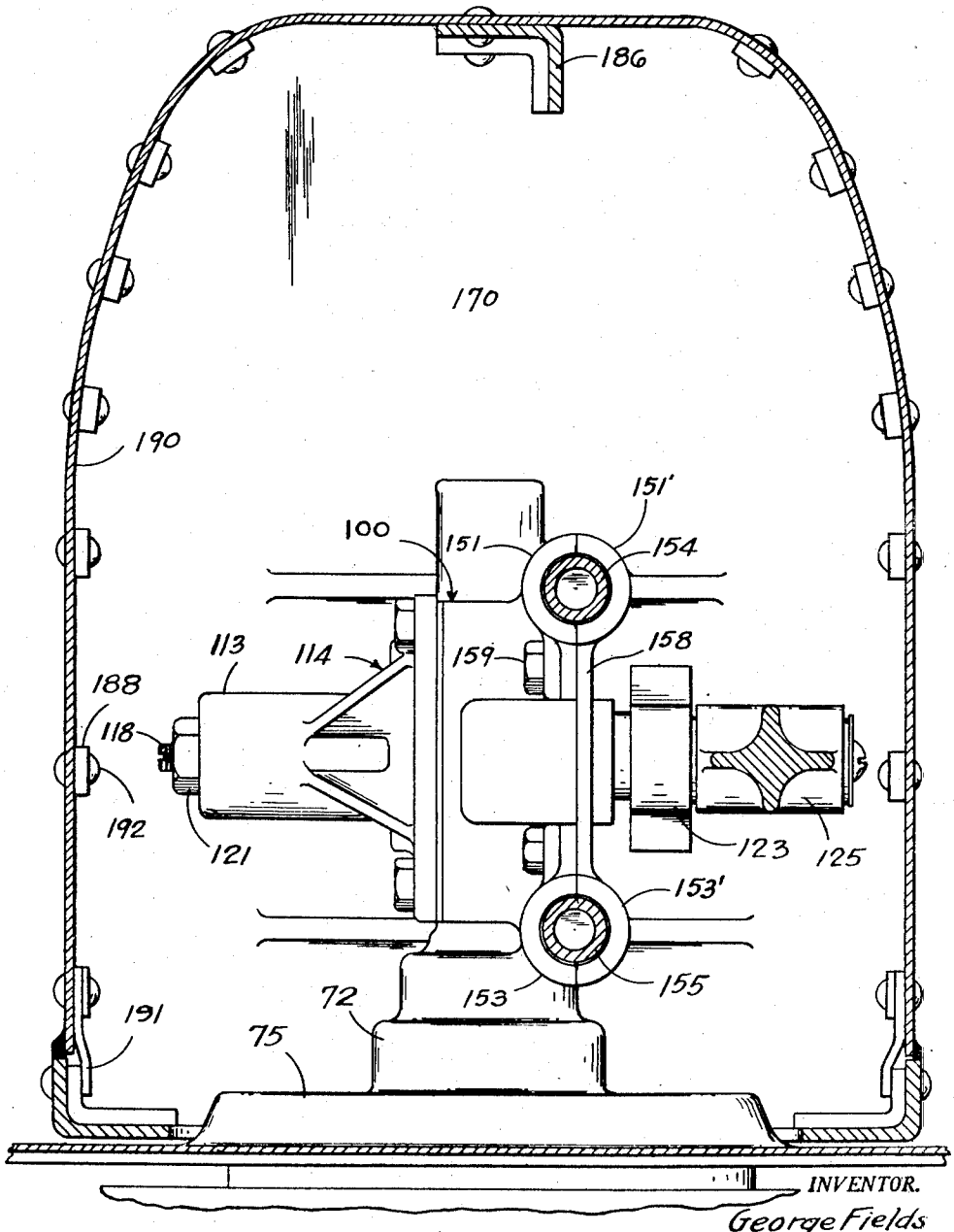
CLOTHES WASHING MACHINE WITH A HORIZONTALLY RECIPROCATING AGITATOR

Filed Oct. 4, 1945 4 Sheets-Sheet 4

Fig. 5



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2,568,614

UNITED STATES PATENT OFFICE

2,568,614

CLOTHES-WASHING MACHINE WITH A HORIZONTALLY RECIPROCATING AGITATOR

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Application October 4, 1945, Serial No. 620,209

11 Claims. (Cl. 68—23)

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This invention relates to improvements in a washing machine, and more particularly to an improved means for agitating the clothes in the washing fluid to effect the washing thereof.

Heretofore the clothes have been agitated in the washing fluid in several different manners, the most popular of which comprises placing an agitator inside the tub which may partake of an oscillating movement therein or by placing the clothes in a rotating drum inside the tub and which carries the clothes through the washing fluid. The present invention has to do particularly with the type of agitator which moves inside the tub.

One of the principal defects in previous agitator devices was that the agitator oscillated with considerable speed and had a tendency to catch and tear the clothes. This is particularly true of that type of agitator which is provided with vanes and utilizes an oscillating movement. The sudden changes in direction of the agitator often causes the vanes to catch in the clothing, which is torn thereby. If the agitator is designed so that it does not catch the clothing, then it loses some of its efficiency as an agitator which detracts from its ability to properly clean the clothes and thus makes it necessary to increase the washing time. Still another disadvantage of the prior devices resided in the necessity for a complicated gearing system for effecting the desired reciprocating motion. Among the other disadvantages was the perfecting of suitable seals to retain the washing fluied against leakage from around the agitator as well as preventing the leakage of the lubricant from the gear housing.

By my present invention, I have provided a mechanism whereby the materials to be washed are moved through the washing fluid in a highly efficient manner but wherein the tendency to tear the material is completely eliminated. Furthermore, the mechanism for effecting the desired movement has been greatly simplified, which not only reduces the amount of servicing but decreases the weight of the machine as well as the cost of manufacture. Furthermore, by the present invention, the clothes are more evenly distributed and washed.

Although the invention about to be described will be described in connection with a type of washing machine where the materials are first washed and then centrifuged to remove the excess water, it will be apparent that the mechanism is equally useful in conjunction with washing machines of the so-called wringer or

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separate spinner type, and that therefore the invention is not limited in its scope to the particular type of machine disclosed or otherwise than as is set forth the in the appended claims.

Generally speaking, the apparatus includes an agitator which moves diametrically to and fro across the axis of the tub and at the same time partakes of a gradual rotary movement in the tub. Preferably, the reciprocatory movement is positive and the rotary movement depends on the loading of the mechanism.

The manner of operation and the construction of the apparatus, as well as other advantages due to the construction, will become more apparent from the following description of an embodiment thereof, the description being illustrated by the accompanying drawings and forming a part of this specification.

In the drawings:

Fig. 1 is a vertical view of a washing machine incorporating the agitator of my invention, certain of the parts being broken away and shown in section, and certain otherwise hidden parts being indicated by dash lines;

Fig. 2 is an enlarged fragmentary section of a clutch used in my machine;

Fig. 3 is an enlarged vertical medial section through the agitator showing a fragment of the tube and with certain parts shown in elevation;

Fig. 4 is a horizontal section taken from a plane indicated by the line 4—4 of Figs. 1 and 3; and

Fig. 5 is a vertical section taken on the line 5—5 of Figs. 1 and 3.

Preferably, the agitator includes a shell or housing of generally rectangular formation which is supported in closely spaced relation to the bottom of the tub and which is provided with a mechanism for moving it in a reciprocating manner transversely across the bottom of the tub. The shape of the agitator is such that the materials being washed are intermittently pressed against the side of the tub, first on one side and then on the opposite side.

The reciprocating motion is accompanied by an intermittent rotary motion.

Referring now to the drawings, throughout which like parts are designated by like reference characters, and more particularly to Fig. 1, the complete machine may include an outer casing 10 having a floor engaging portion 11. An inner casing 12 may also be provided and serve to store water after extracting it from the clothes if desired, the inner casing being provided with a bottom 13 having a central aperture 14 from

which rises a tube 15. Supported below the bottom 13, on a frame 16, is a motor 17 that is provided with a sheave 18 which drives a second sheave 19 through a belt 20. The sheave 19 is connected to a shaft 21 through a suitable clutch mechanism.

The clutch preferably comprises any suitable mechanism which will drive the shaft 21 with a continuous rotary motion and which when desired will also drive a sleeve 24 with a continuous rotary motion. Since the invention is adaptable to machines where the tub is not rotated, the sleeve 24 in its broader aspects may be considered merely as the support for the tub. Obviously, if the tub is not rotated, the sleeve could be omitted. In the embodiment shown, however, the motor frictionally drives the shaft 21. Means is provided for driving the sleeve 24, when centrifuging is being effected, together with the shaft 21. This objective may be realized by many other means than that disclosed, and it is therefore not desired to limit the invention to the specific construction disclosed.

In the embodiment shown, the sheave 19 is rotatably journalled on the shaft 21 and drives the shaft through frictional engagement with a friction ring 25 which engages with a friction surface 26 on the sheave 19. A suitable clutch lining 27 secured to the ring 25 may provide the desired friction surface. The ring 25 is keyed at 28 to the shaft 21. Also secured to the shaft 21 is a cup shaped sleeve 29 which is provided with a toothed upper extremity 30. The sleeve 24 extends downward inside of the cup and engages with a thrust bearing 31. A movable sleeve 32 is provided having a lower toothed end 33 adapted for interlocking engagement with the teeth 30. This sleeve is provided with a keyway 34 slidably engaged with a key 35 carried by the sleeve 24. An operating yoke 36 is provided, being carried on a rod 37 journalled in brackets 38 carried by the bottom wall or frame of the housing. The yoke is provided with arms 39 having pins 40 which engage in the annular channel 41 of the sleeve. A lever 42 is provided on one end of the rod 37 which extends exteriorly of the housing. The other end of the rod is provided with a crank arm 43 connected by a spring 44 to the frame and so arranged that the clutch is either held in the engaged or disengaged position as desired. Stops 45 may be provided to determine the limits to which the lever 42 may be moved.

The drive is from the sheave 19 through the friction material 27 to the ring 25 and thence to the shaft 21. When it is desired to rotate the sleeve, the lever 42 is moved to the opposite position shown, which moves the toothed sleeve 32 into engagement with the sleeve 29 which then drives the upper sleeve 32 and through the key 35, the sleeve 24. A feature of this type of drive is that slippage between the parts 25, 26 and 27 occurs when the sleeve 24 is picked up, thus preventing stalling of the motor. I also contemplate the use of a fluid drive coupling in place of the parts 25, 26 and 27, which effects substantially the same operation. Still another type of mechanism is illustrated and claimed in my copending application, Serial No. 648,117 filed February 16, 1946.

The upper end of the casings 10 and 12 are provided with a suitable closure, but since it does not form a part of the present invention, no further description is deemed necessary.

The sleeve 24 is rigidly connected to the bottom of the tub 53, a bracket 54 (Fig. 3) providing additional rigidity for the connection. The

bolts 55 connect the tub and the periphery of the bracket together as well as the lock ring 56 which engages the lower edges of the removable segments 57 which are the subject of my copending application, Serial No. 600,802, filed June 21, 1945, now U. S. Patent No. 2,465,216.

The agitator and its associated drive may move in a rotary direction during the process of reciprocation, and one means for effecting this movement is obtained by the effects of torque on the parts and a slight vertical relative movement between certain of parts, which changes the frictional resistance.

Secured to the bottom of the tub by bolts 60, inside and surrounding the opening 58 for the shaft 21, is a bearing member which comprises a ring shaped bottom portion 61 provided with a coaxial sleeve 62 which extends upward around the shaft 21 and is spaced therefrom. The sleeve is provided with a counter bore which receives the outer race of a bearing 64, the inner race of which is secured on the shaft 21 abutting a shoulder on the shaft. Also secured by the bolts 60 on top of the ring 61 is a second ring 65 having an overhanging part 66 which, together with the ring 61, provides an annular channel.

Seated on the ring 61 and held in place by the ring 65—66 is a friction ring 70. This ring carries the weight of the housing for the agitator drive gears. The bottom of the housing is generally bell shaped, being provided at its lower extremity with a flange 72 to which the ring 70 is secured by studs 73. The heads of the studs are countersunk in the bottom surface of the ring, and the shanks are screw threaded into the housing. The same studs also hold in place a guard ring 74 which cooperates with the segments as described in the aforementioned Patent No. 2,465,216. The guard ring is provided with an annular raised portion 75 to provide clearance space for the heads of the bolts 60 and which is formed with an opening 76 through which access may be had to the bolts 60.

The sleeve 62, on the member 61, extends up into a bore 77 of the gear housing, preferably this is a close sliding fit. A slight clearance space is provided between the flange of the friction ring 70 which is disposed in the channel formed by the part 66 of the ring 65 whereby a slight degree of vertical movement of the housing may be realized with respect to the member 61 and its associated sleeve 62. The shaft 21 is, however, held against upward movement by the bearing 64, the upper edge of which engages with the shoulder 78 in the sleeve 62.

A seal is provided which prevents washing fluid from obtaining access to the bearing 64 and leaking out around the shaft 21, and permits the relative vertical movement. The seal comprises a ring 80 having a press fit with the interior of the sleeve 62 at the boss 78 and is connected by a flexible sleeve 81 to an upper ring 82. The ring 82 carries a self lubricated plain bearing of oilless composition material 83 disposed in the upper face of the ring 82 and surrounding the shaft 21 with a close fit. The rings 80 and 82 are provided with telescoping sleeves 85 and 86, and a helical spring 87 is provided, the lower end of which engages with an inwardly extending flange on the ring 80, and the upper end of which presses against the bearing 83, forcing the bearing 83 into fluid tight engagement with a seat 88 on a ring 89. The ring 89 is secured in a bore 90 in the upper end of the housing by a press fit. A gasket 91 may also be pro-

vided to further assure that the ring 89 is sealed against the leakage of fluid past it.

Above the ring 89, the housing is formed with an annular chamber 94 in which is disposed a seal 95 which prevents leakage of lubricant from the gear housing proper from around the shaft.

Above the bell shaped bottom portion of the housing just described, is disposed the gear housing which contains a worm and worm gear, which worm gear drives a crank arm that is connected to the agitator. The housing at this point comprises a casing 100, having a generally cylindrical part 101 (Fig. 4) for housing the worm 102 and a circular part 103 for housing the worm gear 104. The shaft 21 extends through the chamber 101, being rotatably journalled therein in bushings 105 and carries the worm 102 which is keyed thereto by a pin 106. It should be noted that, in the position shown, there is a clearance space between the ends of the worm and the bearings 105 which, as will appear later, allows a certain amount of relative longitudinal movement between the shaft and its worm and the housing.

The worm gear 104 is carried on a horizontally disposed shaft 108 being keyed thereon by a key 109. The shaft has one end journalled in a bushing 110 of a boss 111 of the main housing, and the other end in a bushing 112 of a boss 113 carried by the cover late 114 which is secured to the housing by screws 115, a suitable gasket 116 being disposed therebetween. The end of the boss 113 is provided with a closed end wall 117 through which is threaded an adjustable thrust screw 118 adapted to engage a ball 119 disposed in a socket 120 in the end of the shaft, the screw being provided with a lock nut 121.

The other end of the shaft 108 extends through the other side of the housing and is provided with a reduced threaded end 122 upon which a crank arm 123 is carried. The crank arm is provided with a crank pin 124 upon which a pitman 125 is journalled, a suitable bearing 126, which may be of the water lubricating type being provided between the pin 124 and the pitman.

A rotary seal is provided between the crank arm 123 and the boss 111 which prevents washing fluid from obtaining access to the interior of the housing, as well as preventing lubricants from escaping, and preferably comprises a ring shaped bushing 130 of the so-called oilless type which is pressed on a reduced end 131 of the housing, a suitable gasket being provided at 132 between a shoulder on the bushing and the shoulder at the junction of the reduced portion 131 and 111. The crank arm, on the side toward the housing is provided with a circular channel 133 which surrounds the shaft 122 in spaced relation thereto to provide a hub 134 on the crank at the shaft, which hub is provided with a seat 135. A resilient washer 137 of rubber or like material has its inner portion seated on said seat being clamped between the seat and a metal washer 138, the metal washer being engaged by the shoulder formed at the junction of the reduced part 122 with the main body 108 of the shaft. The crank arm being threaded on the part 122, the washer engages with the washer 137 pressing it against the metal washer 138 which is held by the shoulder securely clamping the rubber washer in fluid sealing engagement with the shaft.

The extremity of the rubber washer 137 is secured in a cup shaped metal ring 140, being

held in the ring by a cup shaped oilless bushing 141 which has a press fit with the circumferential wall of the ring 140. The bushings 131 and 141 are provided with ground seating surfaces adapted for engagement with each other and permitting the ring 141 to revolve against the ring 130 and still maintain a fluidtight seat. The ring 141 is held spring pressed against the ring 130 by springs 143 which are seated in recesses 144 in the bottom of the channel 133 and engage over projections 145 on the ring.

It should be understood that this seal may take various forms other than that shown, the illustration being for the purpose of affording a better understanding of the invention. For instance, one modification which will be apparent is that the recesses 144 could be replaced by a single annular channel, and a single helical spring could surround the shaft, one end being sealed in the channel, and the other end being seated against the cup 140. In either event, the washer 137, being resilient, the two oilless bushings are held in engagement with each other.

The crank and its associated pitman are adapted, upon rotation of the crank, to reciprocate the agitator transversely across the bottom of the tub. The agitator per se is a generally elongated dome shape; being hollow, it fits over the gear housing and its associated parts.

The gear housing supports a carriage which, in turn, supports the agitator. With this in view, the housing is provided with pairs of guides disposed in vertically spaced relation. The upper guides are shown at 150—151, and the lower guides at 152 and 153. Each pair of guides is provided with horizontally and axially aligned cylindrical bores which support rods 154 and 155 that reciprocate therein. Although the guides may be made integral with the rest of the housing, it is convenient to form them in two parts. In this instance, the housing is provided with upwardly projecting portions which have semi-cylindrical portions 150 and 151 and the downwardly projecting parts of similar formation with the semi-cylindrical parts 152 and 153. Caps are provided at 158 having semi-cylindrical parts 151' and 153' (Fig. 5) and which are clamped to the housing by cap screws 159, to provide the cylindrical guides. Obviously, the guides and rods could take other shapes than that shown. For instance, the rods could be rectangular bars, angle shaped, or T-shaped, in which event the guides would have a complementary formation. Bushings may be provided in the guides if desired. The rods 154 and 155 thus extend through the guides in vertical spaced parallel relation, and are reciprocable in the guides.

The agitator is supported by the rods 154 and 155, being secured to the ends thereof. It may take various forms and be constructed in various manners. It may be made of plastic or metal. In the present instance, for purpose of illustration only, I have shown a fabricated agitator. Generally, it comprises a body of dome shaped formation and substantially rectangular in plan view. It is formed by providing end castings 170 having vertically spaced bored bosses 171 and 172 that provide sockets at 173 which receive the ends of the rods 154 and 155. The rods are secured therein by screws 174 extending from the outside of the housing inward. The screw heads 174 engage with the bottom wall of the bore 175 and are threaded into the ends of the rods securely and rigidly connecting the ends 170 to the rods.

Both of the end parts may be substantially the same except that the right end casting as viewed in the figures is provided with a means for connecting it to the pitman 125. As best shown in Fig. 3, the end casting 170 intermediate the bosses 171—172 is provided with a pair of bosses 177.

The bosses 177 are disposed in horizontally spaced relation and are provided with inwardly facing seating surfaces 178. A wrist pin is provided and comprises a cylindrical center part 179 and the longitudinal extensions 180 having seats opposite to 178 and held on the bosses by cap screws 181. The cap screws are countersunk in the outside of the housing and extend through the bosses being threaded into the parts 180 of the wrist pin.

The pitman 125 (Fig. 3) is formed as shown, the end opposite the crank 123 being offset and provided with a wrist pin engaging part 182. A bushing 183 is provided in which the wrist pin is journalled.

The two end housings 170 are also connected to each other by angle bars 185 at the lower bottom corners and a third bar 186 at the top. The housings are also provided with a plurality of inwardly extending bosses or lugs 188 which extend from the ends toward the other housing and provide an edge support for a sheet metal member 190 which bridges the space between the two spaced end housings. Clips 191 may be provided at the lower edges of the member 190 for engagement with the bars 185 to hold the same in position. The edges of the member 190 may also be secured to the lugs 188 by rivets 192.

The agitator may also be provided with one or more fins 195 on opposite ends if desired. The rods 154, which support the agitator, need not be circular in form but can be angle bars or of any desired form. In event the cross sectional form of the rods is different than that shown, the guides 150 to 153 inclusive, would also be shaped to conform thereto.

In operation, it being assumed that the tub is filled to a predetermined level with a washing fluid, such as water, with the proper detergents added, and that the materials such as clothes to be washed are immersed in the water. With the lever 42, in the position shown, the motor is energized, rotating the pulley 19 which by frictional engagement through the facing 27 drives the ring 25 and hence the shaft 21. This shaft 21 rotates the worm 102 and it in turn drives the worm gear 104 which rotates the crank arm 123.

As shown in Fig. 1, the agitator at the extremity of its movement in either direction comes in relatively close spaced relation to the tub wall, it being moved from the one extremity shown to the other extremity which would be an equal distance to the left as viewed in that figure.

This transverse movement of the agitator acquires its greatest velocity when the agitator is midway in its movement and its lowest velocity when it reaches the end of its movement. The end result is that the clothes are intermittently pressed against opposite sides of the tub. The mass of the agitator is such that the movement of the fluid is rather violent, causing a considerable turbulence and moving the clothes and the water through each other. It should be particularly noted that the reversal of movement occurs at the minimum of speed, and that the clothes are not suddenly jerked upon the reversal of movement with the resultant tendency to tear them.

The transverse movement of the agitator is also accompanied by an intermittent but gradual rotary movement. This movement is such that if the agitator meets with a predetermined amount of resistance, it ceases to turn until the clothes are so distributed that the resistance is removed. This rotary movement thus also serves to distribute the clothes about the container in such a manner that all the articles are washed an equal amount. The rotary movement is effected by the action of the reciprocating drive as follows:

It will be seen that the construction is such that the agitator, its support, and the associated housing is free to rotate about the axis of the shaft 21.

If the shaft 21 is rotated in a counterclockwise direction, the worm gear will be driven in a clockwise direction. The resultant forces due to the driving rotation between the worm and worm gear is such the worm has a tendency to be raised and the worm gear to be pushed downward. This force varies, depending upon the resistance to the drive, which is directly dependant upon the effort required to push the agitator toward the side of the tub, since the shaft 21 to which the worm is attached is held against vertical upward movement by the thrust bearing 64. The only movement of which the shaft partakes is a rotary one. The pressure on the worm gear being downward and the worm gear being held by the shaft which is transversely journalled in the housing, this pressure on the worm gear is communicated to the housing pressing the same downward. This downward pressure is exerted through the bell shaped bottom or flange 72 through the friction member 70 to the member 61 seated on the bottom of the tub. Therefore, the greater the resistance met by the agitator, the greater the force of the worm gear and worm in opposite directions, and hence the greater the friction exerted between the housing and its support; and it is this friction that normally prevents the rotation of the agitator and its supporting housing. This friction is normally sufficient when the machine is loaded to overcome the normal tendency of the apparatus to rotate because of the rotating shaft 21. It will be remembered, however, that the clothes are intermittently pressed by the agitator against the wall of the tub and that this pressure is greatest when the agitator is at the limit of its outward movement. When the agitator moves backward toward the center, this pressure is relieved. As a matter of fact, at the start of the movement, the clothes actually help to move the agitator, and, therefore, after the crank moves past dead center, the resistance at that time is the least during the cycle, with the result that the friction which holds the agitator against rotation is least. This friction continues to be relatively light until the agitator again starts to meet resistance when it presses the clothes against the opposite side.

Therefore, during this period, the agitator may and does rotate a certain amount. This rotation is not a steady rotation but an intermittent rotation. Furthermore, the amount of rotation will vary, depending upon the amount of resistance that the agitator meets by its rotary engagement with the clothes; that is, if the clothes are unevenly distributed and there should be a space where there are no clothes, the agitator would move quickly through this space until it hits against the clothes, at which time it would stop. This is a very important advantage, because as

previously noted, the agitator presses the clothes against the side of the tub. This movement is accompanied also by a displacement of the water, and this carries with it the clothes which are thus immediately distributed in event that they should at any time accumulate in one spot.

In actual practice, when the clothes are evenly distributed, the movement of the agitator is an intermittent one of but a few degrees for each stroke. The normal operation, therefore, is for the agitator to reciprocate rapidly in a transverse direction diametrically across the tub while partaking of an intermittent rotary movement of a few degrees for each stroke, which movements causes the clothes to be washed and maintains an even distribution thereof during the washing.

In this particular embodiment shown, after the clothes are washed, the tub is spun to extract the water therefrom. As previously stated, however, this invention in its broader aspects contemplates the use of this agitator and its drive with any ordinary type of washing machine, including those using the roll type wringer or the separate spinner for extracting the water from the clothes. The only limitation as to the type of tub being that for best results and a more even distribution of the clothes, the tub should preferably be round.

In event, however, that the tub is also used as the extractor, as indicated herein, the operating handle is moved to its alternate position wherein the clutch elements **32** and **29** engage. At this time, since the tub is standing still, the agitator stops, the sheave **19** and the motor continuing to rotate, the friction member **27** sliding on the friction surface. The friction between the members **25**, **27** and **26**, however, is sufficient that the tub gradually picks up speed, being rotated by the sleeve **24** until eventually the shaft **21** and the sleeve, together with the tub and the agitator, are all rotating at full extracting speed, which speed depends on the speed of the motor and the amount of reduction in the drive. I have found a speed of 700 R. P. M. to be quite satisfactory.

Since the major part of the weight of the transmission is centrally disposed, and because the action of the agitator is such as to evenly distribute the clothes, the out of balance weight is relatively small. Such out of balance is taken care of by a suitable suspension not shown, and of which there are many known in the art. The water centrifuged from the clothes escapes up the inclined wall of the tub from around the upper edge thereof. A metal ring **200** secured to the upper end of the tub assists in maintaining the proper balance thereof. After the water is extracted from the tub, the motor is de-energized and the clothes may be removed.

Other means than that shown may be used to cause the agitator to take the reciprocation movement, the embodiments shown are for the purpose of clarity in disclosing the invention and are not intended as a limitation other than as is set forth in the appended claims. I am aware that numerous and extensive departures may be made therefrom without departing from the spirit or scope of the invention.

I claim:

1. A washing machine comprising a tub, an agitator for said tub adapted to push the clothes against the side of the tub, mounting means for said agitator supporting the agitator for reciprocation transversely of the tub, drive means for rotating the tub comprising a tube connected to the tub and a rotary shaft inside of the tube for driving said agitator, clutch means for driving the shaft and operable to drive said sleeve with the shaft to rotate the tub.

2. A washing machine comprising a tub mounted for revolution about its axis, an agitator for said tub disposed for reciprocation transversely to the axis thereof, a transmission for operating said agitator disposed inside of said agitator, said transmission and said agitator being mounted for rotation about an axis, and means connecting said tub and transmission and operable by the loading of the agitator to cause rotation of the agitator.

3. A washing machine of the class described including a tub mounted for rotation about its vertical axis, a transmission disposed inside the tub, guide means on said transmission, an agitator journalled in said guide means, said transmission including a worm and a worm gear, a shaft for driving the worm and a crank driven by the worm gear and pitman means connecting the crank to the agitator, said agitator being movable in said guide means transversely of the tub to press the materials being washed against the sides of the tub.

4. A washing machine including a tub, an agitator for said tub comprising a substantially rectangular hollow member, a mounting for said agitator comprising a transmission housing extending inside the agitator and having guides, guide rods connected to said agitator and disposed in said guides for guiding said agitator in its movement transversely across the tub, a crank connected to said agitator by a pitman and a worm gear and worm for rotating said crank disposed in said housing, a shaft for driving said worm gear extending through the bottom of the tub, said transmission being free to rotate on the bottom of the tub, and having frictional engagement with the bottom of the tub, said shaft being journalled in bearings and held thereby against vertical movement, said housing being supported for vertical movement relative to said shaft and operable upon a predetermined resistance to movement of said crank to be raised from frictional engagement with the tub, said agitator being rotated upon the release of said friction.

5. A washing machine including a tub, a transmission disposed inside the tub, guide means transmission disposed inside the tub, guide means on said transmission formed with guide ways extending transversely of said tub, an agitator, rod means extending longitudinally of the agitator and journalled in said guide ways, said transmission including a worm and a worm gear, a shaft for driving the worm and a crank driven by the worm gear, pitman means connecting the crank to the agitator, said agitator being movable in said guide means transversely of the tub to press the materials being washed against the sides of the tub.

6. A washing machine including a tub, a transmission housing disposed inside the tub, guide means on said housing formed with guide ways extending transversely of said tub, an agitator, rod means extending longitudinally of the agitator and reciprocably journalled in said guide ways, said housing enclosing a gear drive, a drive shaft connected to said gear drive and a crank driven by the gear drive, connecting means connecting the crank to the agitator, said agitator being movable in said guide means transversely of the tub to press the materials being washed against the sides of the tub.

7. A washing machine including a tub, an agi-

tator disposed inside said tub, a housing support member carried by said tub and a housing rotatably journalled thereon, said housing being formed with guides, and guide means on said agitator reciprocably journalled in said guides, a rotary shaft extending through said support into said housing and gear means driven thereby, and means connecting said gear means to said agitator for moving said agitator on said guides, said housing having portions for frictional engagement with said support and arranged to be moved from frictional engagement upon a decrease in load against said agitator to permit the driving force on the gear means to revolve the housing and the agitator.

8. A washing machine including a tub, a hollow agitator disposed inside said tub, a housing support member carried by said tub and a housing rotatably journalled thereon, means on said housing support to hold said housing for limited upward movement on the support, said housing being formed with guides, and guide rods extending between the walls of said agitator and reciprocably journalled in said guides, a rotary shaft extending through said support into said housing and a worm carried by said shaft and a worm gear driven thereby, and crank means connecting to said worm gear and connected to said agitator for moving said agitator on said guides, said housing having portions for frictional engagement with said support, said worm and worm gear adapted to determine said frictional engagement, said housing adapted to rotate upon a decrease in load against said agitator to permit the driving force on the gear means to revolve the housing and the agitator.

9. A washing machine comprising a tub, an agitator disposed in said tub, a shaft extending through the wall of said tub, a transmission housing within the tub, said shaft extending into and supporting said housing, transmission means within said housing driven by said shaft and operably connected to said agitator, said housing normally being free to revolve about said shaft and free within limits to move longitudinally of said shaft, friction clutch means disposed on said housing and said tub about said shaft and engageable to prevent rotation of said housing, said clutch means being operable by movement of said housing longitudinally of said shaft to hold said housing from revolving when force is applied on said housing.

10. A washing machine comprising a tub, an agitator disposed in said tub, a shaft extending through a wall of said tub, a transmission housing within the tub, said shaft extending into said housing, transmission gear means within said housing driven by said shaft and operably connected to said agitator, said housing and agitator normally being free to revolve about said shaft and being free within limits to move longitudinally of said shaft, friction means on said housing adjacent the shaft, means on said tub adapted to be engaged with said first named friction means upon longitudinal movement of said housing to prevent rotative movement thereof, said housing being adapted to be moved longitudinally of said shaft in response to horizonal forces on said agitator.

11. An apparatus of the class described comprising: a container, an agitator in said container, support means supporting said agitator for straight-line reciprocatory motion transversely across said container, said agitator being adapted to press the material being agitated toward the walls of said container, clutch means engageable between said container and said support means to hold said support means against rotative force, said clutch means being arranged to be moved into holding engagement by the force of the pressing of said material by said agitator and to be released upon decrease of said force below a predetermined value, and drive means connected to said agitator adapted to reciprocate said agitator and also to rotate said agitator and support means together when said clutch is released.

GEORGE FIELDS.

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