

June 12, 1951

J. W. CHAMBERLIN

2,556,490

WASHING BY INTERMITTENT HIGH AND LOW SPEED ROTATION

Filed Aug. 27, 1945

5 Sheets-Sheet 1

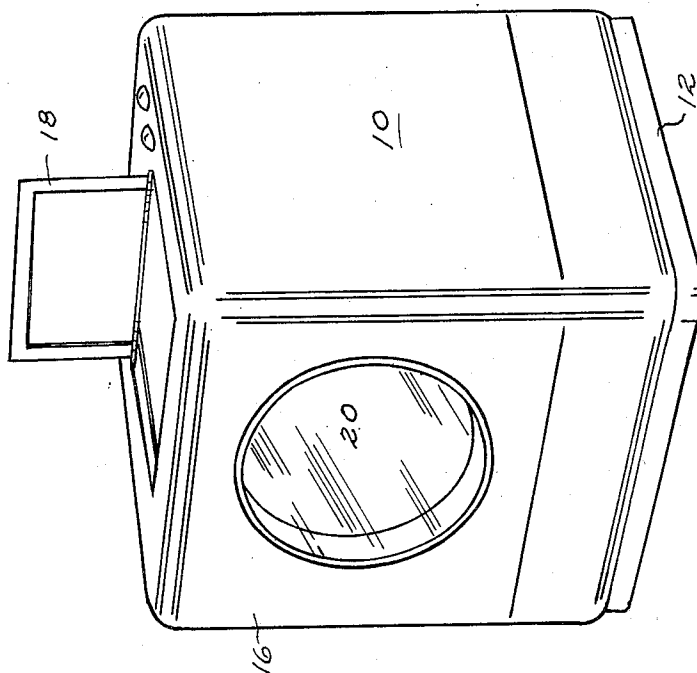


Fig. 1

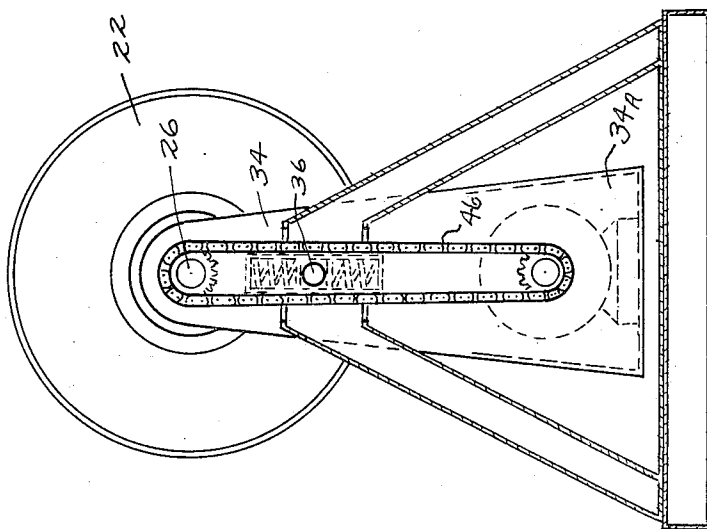


Fig. 3

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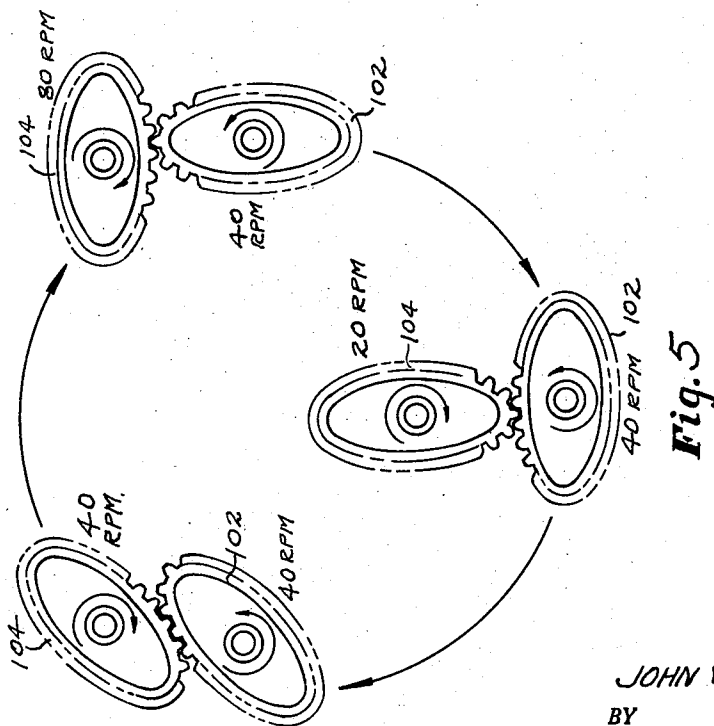
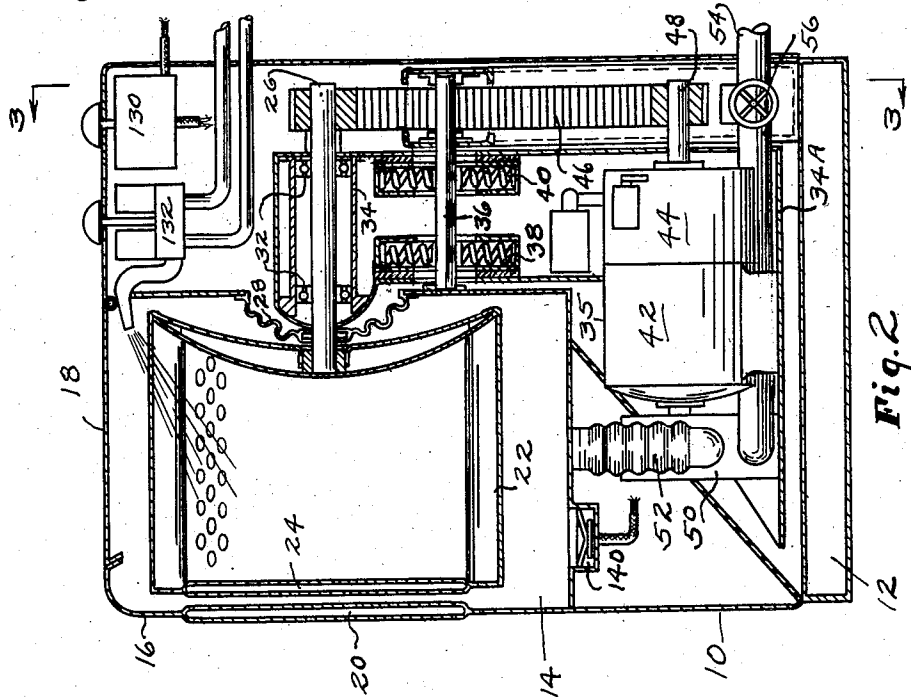
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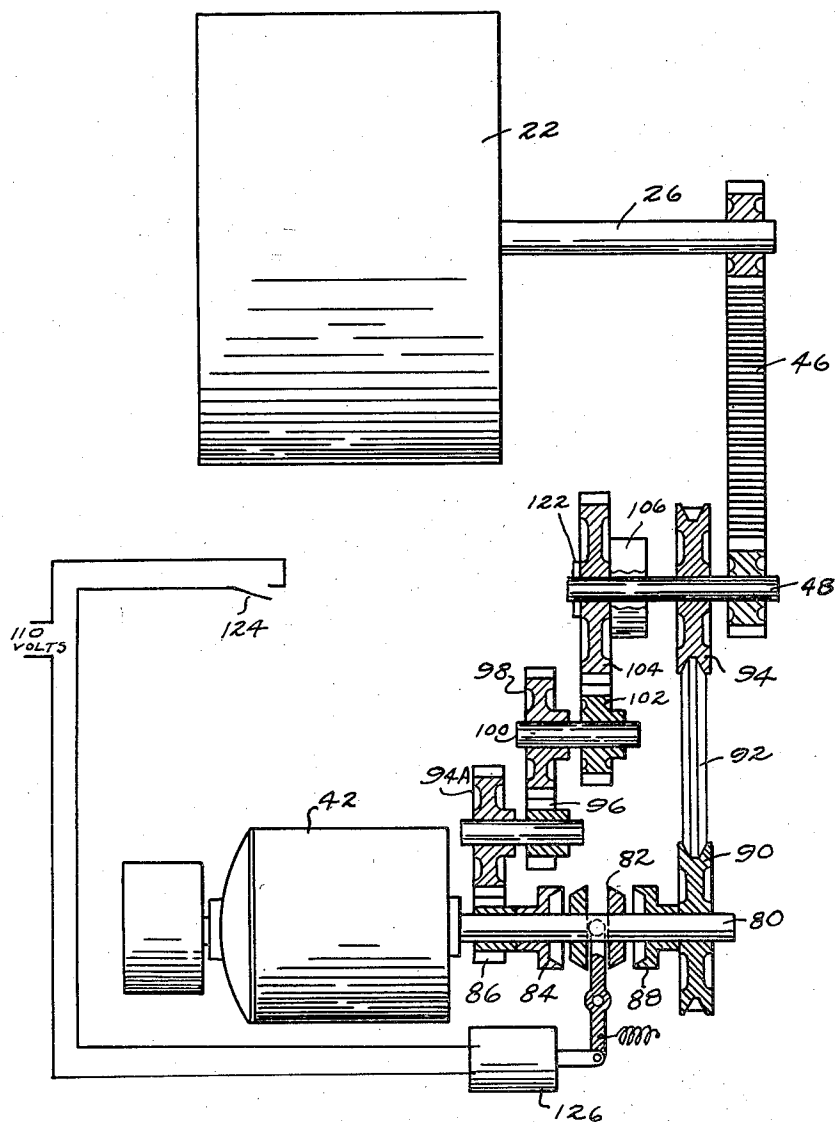


Fig. 4

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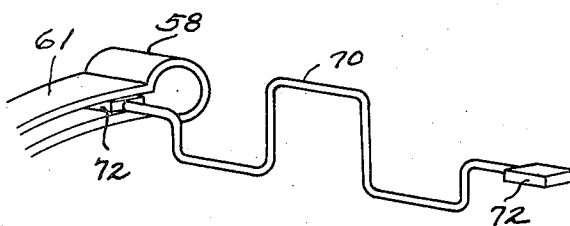
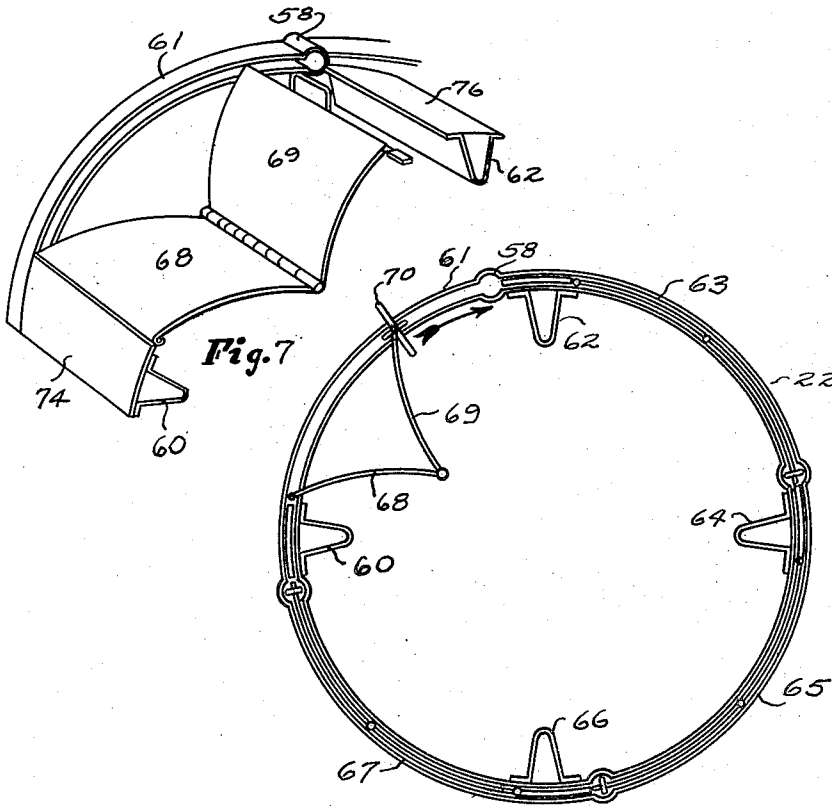


Fig. 8

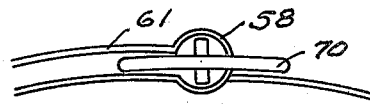


Fig. 9A

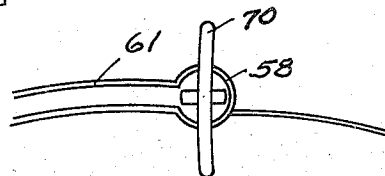


Fig. 9

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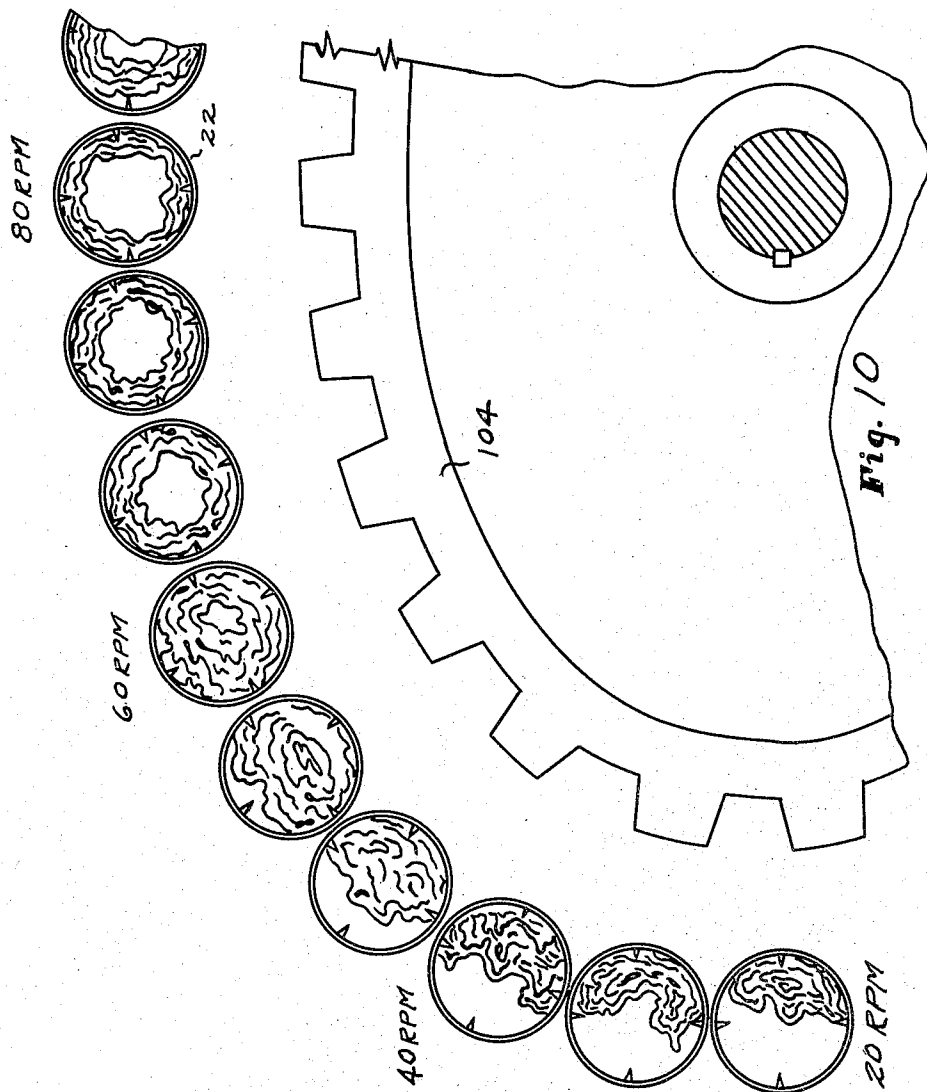
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5 Sheets-Sheet 5



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2,556,490

WASHING BY INTERMITTENT HIGH AND
LOW SPEED ROTATION

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Application August 27, 1945, Serial No. 612,807

4 Claims. (Cl. 8—159)

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This invention relates to textile washing apparatus and to a machine and method for washing, rinsing and extracting and the machine used for illustration is particularly designed for washing articles of clothing.

It is generally recognized that a rotating cylinder type washer operating on a substantially horizontal axis and using a tumbling action of clothes for producing a washing action causes less wear of the clothes than some other types of washers and particularly less wear than is occasioned by the use of vertical axis machines with agitator members therein. Important problems requiring special consideration have been apparent during development of the horizontal cylinder type of washing machine, one such problem arising from the necessity of preventing tangling of the clothes during the washing operation while maintaining the simplicity of operation and structure possible with single direction rotation. A second important problem is related to vibration encountered in operating the rotating cylinder containing the clothes at a speed of rotation sufficient to extract the washing solutions from the clothes after the washing operation is completed and following the rinsing.

An important advantage of horizontal cylinder type of washing machine, as it has been built in recent years, is the provision of a window or transparent wall at one end of the cylinder and substantially on the axis of the cylinder so that the washing action can be visually observed. Such a construction has been an important sales feature. However, it has been generally considered advisable to incorporate the transparent opening in a door which limits somewhat the space available for a transparent opening since if access to the cylinder could be had at another point a much larger window could be provided, thus affording a more satisfactory visual observation.

It is, therefore, a primary object of the present invention to provide a mechanism capable of unidirectional operation and of such varying rotational speed as to cause the textiles carried in the rotating drum or cylinder to be tumbled for washing and rinsing, but in such a manner that a satisfactory flexing action and scrubbing together of the clothing is obtained, but without objectionable tangling.

A further object of the invention is to provide a unidirectional rotation of the horizontally positioned washing cylinder with tumbling washing action produced by variable speed, operated in a range sufficiently broad to cause the textiles to be periodically completely unwound and distributed

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in a satisfactory manner with a minimum of special mechanism.

It is another object to provide a method of washing fabrics such as clothes in a generally cylindrical and generally horizontal drum which will assure satisfactory washing action by movement of the clothes in said drum during rotation and in the presence of a washing liquid, but which will also leave said clothes in a satisfactorily distributed position around the circumference ready for centrifugal action by increased rotational speed for removal of liquid therefrom.

It is a further object to provide a method of washing fabrics such as clothes in a generally cylindrical and generally horizontal drum which will make possible the use of a unidirectional rotation of said drum without objectionable tangling of said clothes.

It is another object to provide suspension structure of resilient character such that the cylinder during its rotation is permitted to rotate approximately around its center of mass, and to be resiliently supported in such manner as to absorb vibration caused by out of balance load in the cylinder.

It is a further object to provide means for access to the cylinder, for inserting and removing clothes therefrom, in the side of the cylinder instead of in an end thereof, thereby providing for a larger transparent window at the end for visually observing the washing action.

It is another object to provide openings in the side of the clothes cylinder of such nature that openings will be available in substantially any position that the cylinder may stop in its rotation and so constructed that the openings always tend to close on rotation of the cylinder.

The above and other objects of the invention will be apparent from the following more detailed description and by reference to the accompanying drawings forming a part hereof and wherein:

Figure 1 is a perspective view showing the top, front, and one side of the machine.

Figure 2 is a cross section of the machine, the view being from one side thereof.

Figure 3 is a view, partially diagrammatic showing the mounting of the cylinder and other parts to permit movement about its center of mass during rotation.

Figure 4 is a diagrammatic illustration of the driving mechanism for the cylinder.

Figure 5 is a diagram showing the operation of the elliptical gears.

Figure 6 is a cross section of the cylinder showing the door construction.

Figure 7 is a perspective view showing certain

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details of the door construction and the manner of opening thereof.

Figure 8 is a detail view partially perspective of the door handle and lock.

Figure 9 is a further detail of the door lock showing the handle in the open or unlatched position.

Figure 9A is identical to Figure 9 with the exception that the handle is shown in a closed or latched position.

Figure 10 is a series of views showing the variable tumbling and distributing action of the clothes during the cycle of operation of the elliptical gear drive during washing action.

Referring to the drawings, a substantially rectangular cabinet 10 with suitable supporting structure 12 in the lower portion thereof has an upper tub member 14 so secured to the cabinet member 10 that the front portion 16 has a common wall, or is parallel with the tub and the top door 18 of the tub 14 is also parallel with the top of the cabinet 10.

The tub member 14 is preferably of substantially cylindrical shape, which cylindrical shape may be varied in amount sufficient to provide a substantially flat top portion in the region where the door 18 is joined to the tub. The front wall 16, which in the construction shown forms a common wall with the cabinet 10 and the tub 14, is provided with a transparent member 20 which may be plate glass or other suitable transparent material and of a relatively large diameter to afford satisfactory visual view of the interior.

Inside the cylindrical tub, is a perforated cylinder 22 of substantially cylindrical shape, for containing clothes to be washed, the size of such cylinder being selected for the structure shown as approximately 20 inches in diameter by 14 inches deep. The end of the cylinder is provided with a glass or other transparent wall 24, which transparent wall is in substantial alignment with the outer transparent member 20 in the front of the tub. In the machine illustrated having a 20 inch diameter cylinder the diameter of the transparent wall 24 is approximately 16 inches. The cylinder 22 is supported on a shaft 26 extending through the rear wall of the tub 14, a flexible seal 28 being provided between the wall of tub and the shaft 26 so that the shaft is free to move relative to the tub. The shaft 26 is supported on spaced bearings 32 which are carried in a frame 34, which frame is in turn supported upon a suspension pivot shaft 36 through resilient mountings 38 and 40.

The frame 34 which supports the bearings for the cylinder aforementioned also extends downwardly toward the bottom of the cabinet and forms a supporting frame 34-A for the drive mechanism 35, the entire unit including cylinder 22 and drive mechanism being supported upon the pivotal suspension shaft 36.

The drive mechanism 35 mounted on the supporting frame 34-34A comprises a motor 42, a gear case 44, and a chain drive 46. The chain drive 46 extends from an output shaft 48 of the transmission to the previously mentioned shaft 26 of the cylinder 22.

Also supported upon the frame 34A is a pump 50 driven by the motor and which is connected by a flexible connection 52 to form a suitable sump for the tub 14, and which sump provides a drain into an outlet connection 54 and, if desired, a suitable drain valve 56 may be employed. The entire assembly of cylinder 22, drive shaft 26, motor 42, gear case 44, pump 50, and chain drive

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46 is supported and pivoted upon the suspension pivot shaft 36 as is best seen in Figure 3.

The support of the rotatable clothes cylinder 22 and drive mechanism on the suspension pivot shaft 36 below the axis of the cylinder with the resilient connection at the lower end makes possible a rotation of cylinder 22 about its center of mass even though such center of mass may be displaced somewhat from the center of rotation because of uneven distribution of the clothes load in the cylinder 22. This fact will be apparent on inspection of Figure 3 since by a swinging movement about shaft 36 the cylinder 22 has a freedom of movement in a horizontal direction because of the radial distance from the pivot 36, while freedom of movement in a vertical direction is afforded by the resilient members 38 and 40 which suspend the unit vertically on the springs as shown. Therefore, on rotation of the cylinder 22 when there is an out of balance load the cylinder will be free to gyrate in an orbital path in a plane perpendicular to its axis of rotation because of its horizontal and vertical freedom of movement. Furthermore the swinging about pivot 36 will be damped to a certain extent by the resilient sump connection 52 previously mentioned. Also the fact that a substantial portion of the weight is below pivot 36 will afford a pendulum action of the suspended unit.

In Figure 4 there is shown a view of the gear and drive mechanism in more detail than is possible on Figure 2. In Figure 4 the motor 42 has an outwardly extending power shaft 80 and on this shaft a clutch member 82, secured for rotation but with sliding movement relative to the shaft 80. The clutch member 84 is secured to rotate with a gear 86, but is free to rotate relative to the shaft 80 and to be clutched to rotate therewith on a movement of the clutch 82 into an engagement with the clutch member 84.

On the opposite end of the shaft 80 there is a second clutch member 88 secured to rotate with a pulley 90, the two members 88 and 90 being free to rotate relative to the shaft 80 until clutched thereto by movement of the clutch member 82 in the direction opposite to that required to clutch the member 84.

The pulley 90 is connected by a belt 92 to a second pulley 94, and to the drive previously mentioned as chain 46, and when the pulley 90 is connected to rotate with the motor shaft the cylinder 22 will be caused to rotate at a speed sufficiently high for centrifugal extraction of liquid from the clothes by the drive just mentioned.

However, a special drive is provided for producing a washing action. This drive starts at the motor shaft 80 with gear 86, a gear 94 being mounted to mesh with the gear 86 which in turn drives the gear 96 and gear 98. The gear 98 through a shaft 100 is connected to drive an elliptical gear 102 which meshes with a driven elliptical gear 104. The driven elliptical gear 104 is mounted on the shaft 48 and is connected thereto by an overrunning clutch 106, the shaft 48 being the same shaft as carries the pulley 94.

With the motor and clutch unit positioned to drive through the gearing just mentioned, including elliptical gears 102 and 104, the shaft 48 and hence the chain drive 46 to the cylinder will be driven at a constantly varying speed as determined by the meshing of the elliptical gears. Such a condition can be better understood by reference to Figure 5 where three positions in the rotation of the elliptical gears are shown. Be-

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ginning with the lower pair of gears in the cycle, the driving gear 102 is shown meshed with the driven gear 104 in such position that the resulting speed of the driven cylinder is say 20 R. P. M. (depending upon ratios selected) while the driving gear is operating at say 40 R. P. M. The second pair of gears shown in the cycle, or rather the position of the same pair of gears in the second position, shows the gears 102 and 104 meshed in such relationship that the R. P. M. of the cylinder is 40 R. P. M. or exactly equal to speed of the driving gear. In the third pair of gears shown in the cycle the speed of the driven gear is at a maximum of 80 R. P. M., the driving gear remaining as before at 40 R. P. M. It is thus apparent that the cylinder containing the clothes to be washed will be driven in a repeating cycle of varying speed such for instance as from 20 R. P. M. to 40 and 80 R. P. M. and then down to 40 and 20 R. P. M. in position to repeat the cycle.

It is here noted that the pulleys for chain drive 46 are shown of substantially equal diameter which would cause a full variation speed cycle during one revolution of drum 22 but it is evident that this variation cycle may be spread over greater or less revolutions by varying the relative sizes of the pulleys in chain drive 46.

There is shown in Figure 10 a series of views of the clothes containing cylinder or drum 22 with clothes therein in condition for washing, the several views showing the condition of the clothes during a cycle from 20 to 80 R. P. M. in the cycle of the meshing of the elliptical gear drive which affords continuous variation in speed. On reference to the figure, it is noted that at 20 R. P. M. the clothes are all at the bottom of the cylinder and as the speed is increased up to 40 R. P. M. there is additional tendency to tumble and as the speed increased to 60 the tumbling continues with the tendency from 60 to 80 R. P. M. for the clothes to arrange themselves around the circumference of the cylinder.

From 80 to 60 R. P. M. in the reduction range in speed, (which is a reversal of the showing in Figure 10), the clothes again reach a tumbling condition at 60 R. P. M., tumbling more at 40 and from 40 to 20, then come to the bottom of the cylinder as before. It is apparent upon inspection of the figures that there will be a continual tumbling, distributing, and gathering together of clothes as the cycle is repeated over and over again, and a scrubbing and tumbling action of the clothes due to this distribution and redistribution and tumbling is repeated.

The range of speed during the cycle of operation above noted from 20 R. P. M. to 80 R. P. M. provides a range of speed for a 20 inch diameter cylinder such that the lowest speed is below that which would hold the clothes on the circumference of the cylinder by the action of centrifugal force while the speed of 80 R. P. M. is above that which would just hold the clothes at the circumference of the cylinder against the action of gravity. Therefore the cycle of operation is such that the speed varies from a value which will allow the clothes to tumble on rotation of the cylinder to a speed equal to or above that which will hold the clothes on the circumference thereby producing a scrubbing or washing action in the presence of suitable washing solution which is contained in the lower portion of the tub 14 in the machine illustrated.

The steps in actuation above set forth comprise a method of washing in a clothes cylinder

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rotating on the generally horizontal axis. Such method produces an effective scrubbing together and flexing of the clothes which in the presence of a washing solution will be sufficient for effective washing. Furthermore the speed variation produces periodic distribution of the clothes around the circumference of the cylinder at substantially the maximum speed obtained during the cycle of speed variation and this distribution is sufficiently equalized to be satisfactory for high speed rotation of the cylinder for the purpose of centrifugal extraction of moisture from the clothes.

In order to produce the change in speed from the continuously varying cycle to the extraction speed a switch 124 is provided in connection with the transmission mechanism previously set forth. As shown in Figure 4 the switch 124 actuates a solenoid 126 which changes the position of the clutch into the position for high speed operation.

It is understood that various mechanism may be provided in the machine described for automatic operation such as a timer 130 and water mixing valve 132 the details of these several mechanisms will not be described here but for purpose of reference they may be understood as substantially equivalent to corresponding mechanisms provided in the disclosure of Patent Re. 22,375 in which the automatic operation is completely described.

The construction of the cylinder 22 for containing clothes to be washed is shown in partial detail in Figures 6 to 9 inclusive. The ends of the cylinder are made up of circular members having annular segmental slotted portions as shown in Figures 6 and 7. These slotted portions are four in number and are distributed around the circumference of each of the ends as shown in Figure 6 and are numbered segmental portions 61, 63, 65, and 67. Each of these segmental portions terminates in an enlarged substantially circular end portion 58. These segmental members are arranged around the circumference and between each pair of these members is a baffle 60, 62, 64, and 66 extending into the cylinder, the two circular end portions being substantially alike on each end of the cylinder and form tracks for mounting a door 68 made up of two portions pivoted as shown and extending over the length of the cylinder.

The cylinder is thus made up of a main frame comprising two circular ends with four connecting structural members, 60, 62, 64, 66, which also form baffles, these structural members connecting the two circular sections in spaced relation, there being four of these baffle connecting members equally spaced around the circumference of the two ends. The slotted portions are as above described positioned between the baffles also on the circumference of the two end walls and a door is formed in each space between the baffles, each door being made up of two hinged sections, one of these sections being hinged on its edge on one of the baffles and the other one being hinged at the opposite end of the first door section with a sliding member connected at its opposite end designed to slide into the slots.

The two curved hinged section portions of the door 68, 69 are so hinged that when a door handle 70 having extending portions 72 extending into the two segmental slots slides in the slots it makes it possible to slide the door to an open position such as shown in Figure 6. The opposite end of the door from that carrying the handle

70 is hinged to the adjacent baffle supporting portion 74 and thus the door may be opened by pulling on the handle 70 and causing the sliding end portion 72 to slide in the slots toward the hinge portion 76 as shown by the arrow in Figure 6.

Each of the segmental slotted portions 61, 63, 65 and 67 carries a separate door so that there are four of these doors which form the major portion of the circumference except for the baffle supporting portions 74 which form the wall of the cylinder between the doors. The doors may be of perforated construction and it is apparent that on rotation of the cylinder the tendency of centrifugal force acting on the door members as shown will be to exert a force tending to push the doors outwardly to their greatest extent and in so doing the ends 72 of the handle portion will slide in the slot 61 and cause the door to be guided to a fully closed position. When the door is in fully closed position, the handle 70 may be pushed to a flat position as shown in Figure 9 so that the door will be locked as the slide portion 72 will rotate in the enlarged end 58. It is apparent that since there are four doors around the circumference, each occupying almost one quarter of the circumference, that it will not be important as to what position the cylinder may stop in its circumference as the nearest door may be opened to obtain access to the interior of the cylinder. It is apparent also that the cylinder frame work is substantially held together by the end portions and the baffle supporting portions extending between the end portions and strength is added by the tubular construction of the baffles themselves, the doors being positioned in the openings between the baffles.

In operation water is admitted to the tub through mixing valve unit 132 to the level desired or as may be automatically controlled by a water level control such as shown at 140 in Figure 2. Such a unit forms no part of the present invention but is disclosed in Patent Number 2,305,154. With suitable soap added the clothes may be placed in the cylinder through door openings 18 in the tub and 68, 69 in the cylinder. The cylinder is then set in operation at washing speed by starting the motor 42 but with the switch 124 (Figure 4) open so that the cylinder 22 will be rotated in its variable speed washing operation as has been described and as shown in Figure 10. After the washing operation is completed and the water drained away and if centrifugal drying operation of the cylinder is desired it is accomplished by closing of the switch 124 which starts high speed rotation of cylinder 22 in the manner and by the mechanism which has been described. The use of suitable timing mechanism to accomplish desired rinsing and other steps in sequence automatically is preferably used which will avoid necessity of manual operation of controls. Such automatic operation of a washing machine is known in the art and reference is made to Patent Re. 22,375 where mechanism for accomplishing such a result is described.

During operation and particularly during acceleration to the higher speeds the resilient suspension disclosed herein makes possible a sufficient freedom of movement of the cylinder in vertical and horizontal directions to allow rotation of the cylinder about its center of mass to compensate for out-of-balance clothes load in the cylinder. Such freedom with resilient sup-

port and damping provided will minimize the vibrations carried through the supporting frame to the floor and avoid necessity of bolting the machine to the floor during operation.

Although the invention has been specifically described by reference to a structure used for illustration it is intended that variations may be made without departing from the fundamental principles disclosed and as set forth in the following claims.

I claim:

1. That method of cleaning materials such as clothes, by the manipulation of a rotatable generally cylindrical and generally horizontal drum, which comprises rotating the loaded drum continuously in one direction with its lower portion dipping into a cleaning fluid and at a continuously alternating speed which varies between a minimum and a maximum for washing, such that the wet materials will alternately hold centrifugally against the rotating drum at the maximum range of speed for washing, and will be caused to drop by gravity and to be held against the drum for a portion only of the rotation thereof at the minimum speed for washing, thereby providing for alternate distribution and tumbling action producing flexing of said clothes in the washing liquid, and finally distributing said clothes in said drum in a substantially uniform manner for centrifugal drying at a speed in excess of the maximum variable speed for washing.

2. That method of cleaning materials such as clothes, by the manipulation of a rotatable generally cylindrical and generally horizontal drum, which comprises rotating the loaded drum continuously in one direction in the presence of a cleaning liquid, the speed of rotation of said drum for washing being continuously and alternately varied from a maximum speed which will cause said clothes to be held against the periphery of said drum thereby to carry said clothes to a position near the upper portion of said drum during rotation, down to a minimum speed for washing which is substantially below the speed at which said clothes will be carried to the top of said drum during rotation.

3. That method of cleaning materials such as clothes, by the manipulation of a rotatable generally cylindrical and generally horizontal drum, which comprises rotating the loaded drum continuously in one direction with its lower portion dipping into a cleaning fluid and at a continuously alternating variable speed for washing, alternately providing maximum and minimum speeds for washing and speeds intermediate thereof at a value to cause clothes to tumble in said drum at speeds near said minimum, and alternately to cause the clothes to be carried to a position near the top of said drum in its rotation and to be distributed around the inner circumferential wall of said drum when said drum is rotated at a speed near said maximum.

4. That method of cleaning materials such as clothes, by the manipulation of a rotatable generally cylindrical and generally horizontal drum and subsequently removing a major portion of cleaning liquid by centrifugal action comprising rotation of a generally cylindrical and generally horizontal drum in one direction at a speed of rotation in a washing cycle continuously and alternately varying from a minimum to a maximum providing varying degrees of tumbling and holding the clothes to the circumference of the drum, the higher range of speed in said washing cycle assuring a holding of the clothes to the

circumferential wall and a distribution thereof about the circumferential wall, thereafter increasing the speed of rotation after the completion of the washing action to a higher speed for an extracting cycle.

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