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VARIABLE VOLUME WASHER

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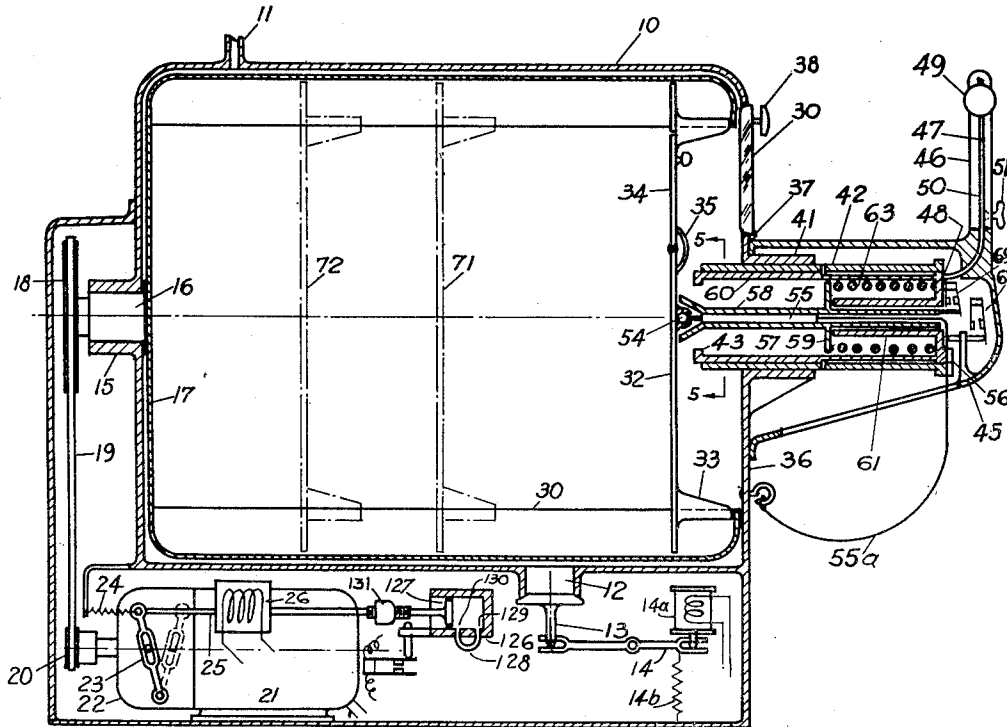


FIG. 1

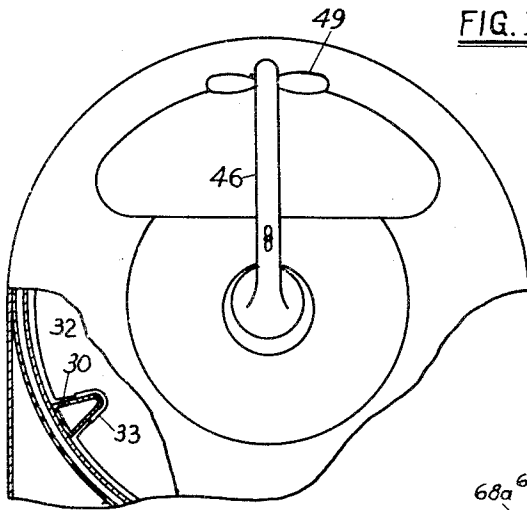


FIG. 2

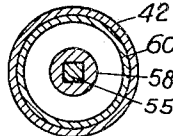


FIG. 5

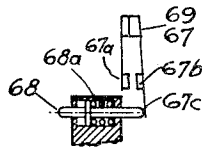


FIG. 4

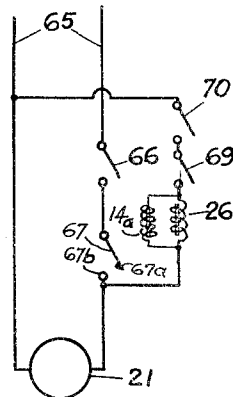


FIG. 3

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## UNITED STATES PATENT OFFICE

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## VARIABLE VOLUME WASHER

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7 Claims. (Cl. 68—24)

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This invention relates to a washing machine more particularly to a washing machine designed to conduct a washing and extracting operation within a single horizontal cylinder.

In washing machines of this general type, a cylinder is rotated under water in a shell at slow speed of the order of 30 to 40 revolutions a minute to effect the washing operation and then the water is drained off. In accordance with this invention, it is an object to subsequently rotate the same cylinder at a sufficient rate of speed to extract the moisture therefrom.

In the washing operation, it is desirable that the volume of the washing cylinder shall be substantially commensurate with the amount of clothes that are to be washed. In any device used for high speed extracting a still more important problem is presented in getting the clothes sufficiently balanced within the cylinder to prevent pounding.

It has heretofore, been proposed to conduct a washing operation in a cylinder in which, preparatory to the washing, a partition could be adjusted within the cylinder to confine the clothes to a limited portion of the cylinder, dependent upon the operator's estimate of the amount of clothes to be washed. Thus where a half load is required, the partition would be arranged to block off one-half of the cylinder. To obtain the advantage of that construction, however, it is necessary for the operator to make an estimate of the amount of clothes to be washed, and that estimate is not easy to make beforehand, because clothes are in dry condition and somewhat fluffed-up and composed of various materials.

It is an object of this invention to provide a device of the general character described in which the operator may adjust the volume of the cylinder after the washing operation has started while the clothes are in motion within the machine while immersed in water. In this way, the length of the washer to be used can be thus much more readily adjusted for the washing operation than before the clothes have been placed in the machine.

The further reducing of the volumetric capacity after the washing and rinsing operation allows the rotation of the cylinder at proper speed to allow the clothes to tumble to receive proper washing action and get distribution of the clothes preparatory to high speed for high speed extraction.

One of the principal difficulties in an extractor lies in the fact that the clothes are apt to gather at one side of the inner periphery of the machine

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without any equivalent balancing weight upon the other side and thus at the speed of extracting there is created a tremendous centrifugal force. It is an object of this invention to provide a novel means for distributing the clothes around the periphery of the drum before the extracting takes place by still further moving the partition so that the unbalanced effect is reduced to a minimum so that it ceases to be an objectionable factor.

While the clothes are in the washing machine within the water, they can be moved readily from one end to the other, and I have found that if they are somewhat crowded toward one end of the machine, while tumbling after the water has been drained off, but before the high speed operation takes place, that they tend to distribute themselves more equally around the inner periphery of the cylinder, and thus gradually reduce the unbalanced centrifugal effect above referred to.

It is an object of this invention to provide a device of the character described in which the volume of the cylinder may be adjusted during the washing operation to secure the most favorable conditions for washing.

It is a further object to facilitate the distribution of the clothes while they are rotating slowly in order to distribute them automatically to secure a balance for high speed extraction.

It is a further object, to provide a machine in which the washing and the extracting may both be done in the same cylinder without intermediate removal, in which the volume of the cylinder may be adjusted to the most favorable conditions for washing, and thereafter the clothes may be automatically distributed around the periphery to secure a balance for extracting.

This invention is particularly applicable to the small type of household washer in which, generally, the cylinder has its only bearing at one end which must, therefore, withstand all the centrifugal strains at any point within the cylinder. It will be obvious, that any unbalanced effect which occurs at the end remote from the bearing will have a much greater leverage in producing unbalanced effects on the bearing than if the same clothing distribution should occur at the end adjacent to the bearing.

It is a further object of this invention, therefore, in securing a proper distribution within the cylinder, to secure the above effects, to guide the clothes, preparatory to the extracting operation, toward the end of the cylinder which carries the bearing, so as to reduce the effect of unbalance to a minimum.

The invention accordingly comprises a machine possessing the features, properties and the relation of parts and combinations of elements which will be exemplified in the machine hereinafter described and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing; in which:

Fig. 1 is a vertical section through a washer embodying this invention. Fig. 2 is an end view looking from the right as seen in Fig. 1. Fig. 3 is a wiring diagram. Fig. 4 is a detail showing the switch mechanism. Fig. 5 is a view in cross-section taken on the line 5-5 of Fig. 1.

In the drawings, the numeral 10 designates a shell having a water inlet opening 11, and a water drainage opening 12, the latter being closed by a valve 13. This valve is shown as operated by a lever 14 operated by a solenoid 14a and held in closed position by a spring 14b.

In the end of the shell 10 is a bearing 15 for a shaft 16 which carries a cylinder 17, the sides of which are generally parallel to and fitting fairly closely within the walls of the shell. The shaft 16 is provided with a pulley 18 which is driven by belt 19 from a pulley 20 driven from a motor 21 through the medium of a change speed device generally indicated at 22 operated by a lever 23 which is moved in one direction by a spring 24 and operated in the other direction by a rod 25 under control of a solenoid 26. This change speed device is preferably of any conventional type in which the degree of movement of the lever 23 controls the degree of increase of speed.

Means are provided to control the speed of movement of the lever 23 and hence to control the speed at which the speed of rotation of the cylinder is increased. This is conventionally shown in the drawing as a dash pot 126 and plunger 127 connected to the rod 25. For purposes which will be described, however, this dash pot is preferably constructed to delay the initial movement of the lever 23, to hold the lever in a mid-position for an appreciable time, but to permit the plunger to move the last part of its travel rapidly. To accomplish this result, there may be provided in the walls of the pot a leakage passage 128 connecting the bottom of the pot at 129 with an intermediate portion of the wall at 130 so that the dash or piston moves slowly under the conventional leakage of a dash pot until the dash uncovers the opening at 130, thereupon this leakage passage 128 permits the rapid movement of the dash for the remainder of its journey. A turn buckle 131 adjusts the position of the lever 22 at the time of the low speed movement of the dash pot and hence controls the effective balancing speed.

The solenoids 14a and 26 are controlled in multiple by a hand switch 69 or by an automatic switch 70 as will be again referred to. The construction of these parts is such that when the solenoid 26 is energized, the lever 23 is moved to cause the pulley 20 to be operated at speed high enough to run the cylinder 17 at extracting speed, but when the solenoid 26 is deenergized, the spring 24 throws the lever 23 back to the slow speed position to drive the cylinder at washing speed.

The cylinder 17 has its cylindrical surface perforated as is usual, and it is provided upon its

interior with longitudinal ribs 30 for the usual purpose. The end of the cylinder remote from the bearing 16 is open to give access to the interior. A partition 32 is slidable within the cylinder, and is provided with slide bearings 33 extending parallel to the axis of the cylinder and positioned to bear lightly against the ribs, to assist in keeping the partition transverse to the axis. This partition is provided with a door 34 pivoted at 35 along a line close to the diameter to give the freest practical access to the interior. The end wall 36 of the shell is also provided with a door 30 pivoted at 37, and held by a latch 38.

Mounted on the end 36 of the shell 10 coaxial with the cylinder 17, is the control mechanism for the partition. For this purpose there is provided a coaxial cylindrical bearing 41 in which there slides a cylindrical sleeve 42 having flanges 43 adapted to bear against the partition 32 and move it into the cylinder whenever the sleeve is slid inward in its bearings. For convenience the bearing and sleeve are enclosed in a housing 45 attached to the end wall 36, and as a means of operating this sleeve, there is provided a vertical guideway 46 within this housing, within which there slides a metallic ribbon 47 which is flexible enough to bend around the corner within its guide, and yet stiff enough to move the sleeve with itself, when it is moved within the guide. The inner end of this ribbon is attached to the sleeve 42 at 48 while the outer end may be held in a slidable handle 49 connected to the ribbon by a slot 50 in the guide. The handle 49 may be held in its adjusted position in any desired manner. I have here shown a set screw 51.

With the foregoing construction, the handle 49 can force the partition toward the center of the cylinder, but it cannot return it because the flanges 43 bear against, but are not attached to the partition. To accomplish this latter object, there is provided upon the center of the partition a ball or other rotatable bearing 54 to which is attached a square rod 55 to which is attached a wire 55a, which extends out through the axis of the sleeve, where it may be caught upon a suitable catch 56 upon the sleeve.

With the construction so far described, the wire 55a serves as a rotatable connection between the sleeve and the partition. Within the broad purposes of this invention, for certain of its uses, any means of connecting the sleeve with the partition, to allow rotary motion to the partition, is satisfactory. I have chosen this method because it is a practical method of accomplishing the further objects of the invention.

As here shown the sleeve 42 is made in two parts namely an outer sleeve on which the lead line of the number 42 rests, and an inner sliding sleeve comprising a hollow stem 58 through which the rod 55 extends, a transverse flange 59 about midway of its length and a bearing sleeve 60 sliding within the sleeve 42. It is this bearing sleeve which carries the flange 43. The outer sleeve 42 has a downwardly and inwardly turned flange 61 bearing upon the outside of the stem 58, and furnishing a stop to limit the outward movement of the stem. Mounted within this inwardly turned flange 61 is a compression spring 63 bearing against the flange 59 and thus urging the stem outwardly into the shell, against the tension of the rod 55.

Referring now to Fig. 3, numeral 21 designates the motor for driving the cylinder connected to the power circuit 65 through a main control switch 66. This control switch may be operated

by hand if desired, but in a fully automatic machine it will be operated by the automatic control. It is desirable, however, to insure that the partition 32 shall be positioned to the best advantage at the beginning of the washing operation. By reason of the fact that the interior is reached by opening the door 34, the operator will draw the partition to the extreme right in order to facilitate this access. In order to remind her to adjust the position of the partition before starting the cylinder in operation, there can be provided a switch 67 within the housing 45 and mounted upon it having a pair of contacts 67a and 67b in series with the main line switch 66 and one of these arms 67b has a projection 67c. A pin 68 spring pressed in one direction by a spring 68a is in position to be encountered by the outer sleeve 42 when the latter is drawn to the extreme right position as seen in Fig. 1, and to be moved by the sleeve against the arm 67c to open the switch 67, thus it will be seen that the motor cannot be started by the main switch until the operator moves the partition 32 inwardly in adjusting the cylinder to the size of the bundle according to the feel.

As has been previously stated, some features of this invention are applicable to the washing of clothes independent of any subsequent step of extracting. When, however, the device is used for high extraction and the spring 63 and inner sleeve 58 are employed to secure the proper adjustment, I may also provide a switch 69 in series with the solenoid 26 which operates the high speed control. This switch 69 is substantially identical in construction with the switch 67 heretofore referred to except that it is mounted upon the sleeve 42 and its pin corresponding to the pin 68 is in position to be engaged and operated by the inner sleeve 60 when the latter is drawn to its extreme right position as seen in Fig. 1.

The automatic mechanism for throwing the cylinder into high speed for extracting, as has already been mentioned, is here shown diagrammatically principally by the solenoid 26. For the purpose of the wiring diagram, the solenoid is here shown as under the control of manual switch 70 which in an automatic machine, will represent the automatic switch.

With the above construction, it is intended that the operator after filling the machine with the detergent and with the clothes will move the partition 32 to secure the proper volume for the quantity of clothes involved which can be done by the handle 49. Once the rotation of the machine has been started, the operator may make the further adjustment of the position of the partition 32 by feel, if this proves desirable, but in most cases it will not be necessary.

With the partition in this position, the washing and rinsing sequence may be conducted either by hand or automatically in accordance with principles, outlined in my copending application Serial No. 515,356, Dec. 23, 1943. During these operations, the position of the partition 32, is that which is determined by the position of the sleeve 42 and the sleeve 60 remains housed within the sleeve 42, the action of the spring 63 being restrained by the wire 55. When, however, it is desired to throw the machine on extracting speed, the inner sleeve 60 is released from restraint and is forced outwardly by the spring 63 thereby moving the partition from the washing position 71 to a still further position inward as shown at 72 corresponding to the amount by which the sleeve 62 may be extruded from the sleeve 42 by the spring 63. With the construction

here shown, this release of the member 60 is accomplished by uncatching the wire 55 from the catch 56, but where the machine is operated completely automatically, the means for restraining the movement of the member 60 will be such that it can be readily released automatically, as will be understood. With the foregoing construction, it will be clear that where the machine is designed solely for washing, the double sleeve 60 need not be employed, but nevertheless the partition 32 is movable to any intermediate position most suitable for washing, as for example, the position 71, by means of the handle 49 and this can be accomplished equally well whether the cylinder is rotating or not.

It will also be clear from this description, that the machine regardless of whether the partition 32 is made adjustable for washing purposes or not, will nevertheless provide an automatic means for reducing the volume of the cylinder for extracting purposes which will enable the cylinder to wash at the volume most suitable for that operation and then to extract at a volume most suitable for that operation.

It will be clearly shown, however, that the machine is adapted for automatic washing and to permit the operator to adjust the volume of the machine to that which is most suitable for washing and then to provide for an automatic adjustment of that volume to secure conditions most suitable for extracting.

The best effect of balancing of the clothes within the cylinder for centrifuging, is obtained by moving the member 32 while the cylinder is rotating at a speed somewhat above a washing speed but below the speed at which the clothes are bound against the wall of the cylinder by centrifugal force, which we may call the critical speed. This critical balancing speed, with conventional sized cylinders is generally between 50 and 100 R. P. M. For this reason, the movement of the partition, the opening of the drain and the throwing into high gear are correlated so that the cylinder will rotate below the critical speed, while the partition is being moved and long enough for the desired distribution of the clothes, and thereafter the motor will pass on to extracting speeds.

To accomplish these results, the solenoid 14a may be correlated with the volume changing mechanism and the speed control mechanism to cause the machine to pass through critical speed and in proper timed sequence to the opening of the drain and the movement of the partition. As shown, the solenoid 14a is connected in multiple with solenoid 26 as will be seen from Fig. 3. Thus the release of the sleeve 60 will operate switch 69 to energize solenoids 14a and 26, but the retarding mechanism 126 insures that the cylinder will go through a period of slow speed operation after the water has been drained and while the partition is moved, thus insuring proper balance.

In the apparatus as shown, the dash pot 126 is designed to hold the motor at or below the critical speed until the balance is obtained, and at this time the piston passes the port 130 so that the remainder of the motion to extracting speed can be achieved at once.

With this construction, it will also be clear that all adjustments of volume are made toward the bearing end of the machine so that any effects of unbalance are reduced to a minimum.

Since certain changes may be made in the above construction and different embodiments of

the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A washer of the character described comprising a shell, a cylinder mounted for rotation about a horizontal axis within said shell, a partition slidable within said cylinder and rotatable therewith and means rotatably bearing against said partition and fixed against rotation for moving said partition during rotation of the cylinder comprising a member axially slidable in said shell in position to bear against said partition, a flexible thrust member connected to said axial member and a guide for said thrust member leading the same from an axial direction to a direction transverse to the axis.

2. A washer of the character described comprising a shell, a cylinder mounted for rotation about a horizontal axis within said shell, a partition slidable within said cylinder and rotatable therewith and means rotatably connected with said partition during rotation of the cylinder for moving said partition, and said means including a pair of telescoping members, stops to limit the amount of said telescoping movement, and spring means to extend said telescoping members and means releasable from the exterior of the shell for holding said members in telescoped position, comprising a flexible cord rotatably connected to said partition, and detachably connected to the telescoping member which is urged away from said partition by said spring.

3. A washer of the character described comprising a shell, a cylinder mounted for rotation about a horizontal axis within said shell, a partition slidable within said cylinder and rotatable therewith and means rotatably connected with said partition for moving said partition during rotation of the cylinder, said last named means including manually operated means for moving said partition for a part of its travel and spring motor means for moving said partition for a part of its travel, a releasable restraining element for restraining said spring means and an external releasing mechanism for said restraining means.

4. A washer of the character described comprising a shell having a horizontal bearing at one end thereof only, a cylinder rotatably mounted within said shell in said bearing, said shell having an access opening at the end opposite said bearing, a partition slidable within said cylinder and means extending into said cylinder from the

end opposite said bearing to bear against said partition and vary the position of the latter, comprising a pair of telescoping members axially slidable and carried by said shell, the outer one of said members being slidable in a bearing on said shell and the inner one slidable within said outer member, said inner member engaging said partition, means for adjustably moving said outer member, stops for limiting the relative movement of said telescoping members, spring means for urging said members to extended position, and means releasable while the cylinder is rotating for holding said spring compressed.

5. A washer of the character described comprising a shell, a cylinder mounted upon a horizontal axis within said shell, means for rotating said cylinder at a slow speed for washing and at a high speed for extracting, a partition within said shell slidable along the axis thereof, and means for retarding the acceleration from slow speed to high speed, and means for moving said partition to decrease the volume within said cylinder during said period of retarding.

6. A washer of the character described comprising a shell, a cylinder mounted upon a horizontal axis within said shell, means for rotating said cylinder at a slow speed for washing and at a high speed for extracting, a partition within said shell slidable along the axis thereof, and means for retarding the acceleration from slow speed to high speed, and means for moving said partition to decrease the volume within said cylinder by a predetermined fixed amount during said period of retarding.

7. A washer of the character described comprising a shell, a cylinder mounted upon a horizontal axis within said shell means for rotating said cylinder at a slow speed for washing and at a high speed for extracting, a partition within said shell slidable along the axis thereof, and means for retarding the acceleration from slow speed to high speed, and means for moving said partition to decrease the volume within said cylinder during said period of retarding, including means to prevent operation at high speed until said volume has been decreased.

LEO M. KAHN.

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