

Description

This invention relates to clothes washing machines of the type having a cabinet in which an agitator is mounted on a vertical axis and is oscillated back and forth within a perforated spin tub which in turn is mounted within a water tight container, the spin tub and the agitator rotating continuously in one direction to give a spin action, said cabinet containing an electric motor and driving means for the agitator and spin tub and/or clothes washing machines incorporating such drives.

A clothes washing machine of the general type described above is disclosed in USA 2,665,576. In the washing machine of USA 2,665,576 the agitator is fixed to the spin tub. When an agitating action is required the spin tub is rotated back and forth independently of the water tight container. When a spin action is required the spin tub and the water tight container are rotated together in one direction. The washing machine of USA 2,665,576 has a float chamber for effecting engagement and/or disengagement of a clutch mechanism which engages a spin tub with the water tight container. The engagement and/or disengagement of the clutch mechanism is dependant on the quantity of water present in the water tight container. The arrangement disclosed in USA 2,665,576 has the disadvantage that the agitator, spin tub and water tight container must all be rotated during the spin action. Also, since the agitator and spin tub are connected together, agitation is not as effective as it would be if the agitator was moving while the spin tub was kept stationary. Another disadvantage with the washing machine disclosed in USA 2,665,576 is that during a spin cycle there must be a hydraulic connection between the water tight container and the spin tub, which is less efficient than a direct mechanical connection between the motor and the spin tub.

It is therefore an object of the present invention to provide a clothes washing machine of the type described which goes some way towards overcoming the above disadvantages or which will at least provide the public with a useful choice.

According to the present invention there is provided a clothes washing machine having a cabinet in which an agitator is fixed to a vertical shaft so as to rotate therewith and be rotatably oscillated back and forth for a washing function within a perforated spin tub which is freely mounted on said vertical shaft, so as to be rotatable thereon, driving means to cause said rotatable oscillation or to cause rotation of said spin tub continuously in one direction, said driving means including said vertical shaft and interconnecting means provided between said vertical shaft and said spin tub, the spin tub being rotatable by said vertical shaft through said interconnecting means when said interconnecting

means are connected together so that said spin tub and said agitator then rotate continuously together in one direction to give spin action and said perforated spin tub in turn being mounted within a stationary water container, said cabinet also containing a drive system comprising an electric motor and said driving means with part of said interconnecting means mounted on or rotatably driven by said vertical shaft and a further part of said interconnecting means mounted on or drivably connected to said spin tub, said inter-connecting means including actuating means operable so that when at least a predetermined substantial amount of water is present in said container, said parts of said inter-connecting means are disconnected and when water is substantially absent from said container said interconnecting means parts are interconnected so that said perforated spin tub will rotate with said vertical shaft and with said agitator; said actuating means including a floatable chamber rotatable by said vertical shaft, the buoyancy of said floatable chamber in the presence of said predetermined substantial quantity of water in said container being such as to move said further part of said interconnecting means from engagement with said part of said interconnecting means on said vertical shaft so that said agitator is rotatable independently of said spin tub.

A washing machine according to the invention may have a drive system comprising an electric motor having a stator carrying energizable windings on poles thereof, a shaft carrying said rotor and being rotatable in frames forming part of said electric motor, said frames also mounting said stator of said motor a clothes washing agitator, a perforated spin tub mounted in a washing container in turn mounted in a cabinet, said motor, said clothes washing agitator and said spin tub being mounted co-axially on said shaft and rotatable thereon in a mode selected from an agitating mode in which said rotor said shaft and agitator are oscillated backwards and forwards over an arc of movement and said spinning tub remains substantially stationary and a spinning mode in which said rotor, said spin tub and said agitator are rotated continuously in one direction, at least one part of said spin tub and one part rotatable with the agitator are axially movable relative to each other, each said one part has a part of an interconnecting means associated therewith and interconnecting actuating means are provided operable in a washing sequence to actuate said parts of said interconnecting means by relative axial movement of said at least one part of said agitator and said at least one part of said spin tub to connect said agitator to said parts of said interconnecting means to separate by opposite relative axial movement to permit said agitation of said agitator without material relative movement of

said spin tub during a washing phase in said sequence.

A washing machine according to the invention may have a drive system including at least one part of said spin tub and one part rotatable with said agitator which are axially movable relative to each other, each said one part having a part of an interconnecting means associated therewith and interconnection actuating means are provided operable in a washing sequence to actuate said parts of said interconnecting means by relative axial movement of said at least one part rotatable with said agitator and said at least one part of said spin tub to connect said agitator to said spin tub when spin action is required and to actuate said parts of said interconnecting means to separate by opposite relative axial movement to permit said agitation of said agitator without material relative movement of said spin tub during a washing phase in said sequence.

A washing machine according to the invention may have an electric motor comprising a stator carrying energizable windings on poles thereof, a rotor, a motor frame, said frame having bearing mountings in a central disposition and having coaxial locating means near outer edges thereof arranged to hold said frame with said bearing mountings separated and axially aligned, said frame having stator locating means arranged to hold the outer cylindrical surface of a stator concentric with said bearing mounting of said frame, a pair of bearings mounted in said bearing mountings, a shaft rotatably mounted in said bearings and carrying said rotor, said rotor comprising a backing ring of a magnetic material, a series of permanent magnets spaced apart on an inner surface of said backing ring a rotatable exteriorly of said stator windings a hub mounted on said shaft, and a backing ring support holding inner faces of said permanent magnets concentric with said shaft.

To those skilled in the art to which the invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the scope of the invention as defined in the appended claims. The disclosures and the descriptions herein are purely illustrative and are not intended to be in any sense limiting.

The invention consists in the foregoing and also envisages constructions of which the following gives examples.

One preferred form of the invention will now be described with reference to the accompanying drawings, in which;

Figure 1 is a cross sectional elevation of a clothes washing machine constructed according to the invention, with some parts shown at 45° in plan to other parts,

Figure 2 is an enlarged view part in cross section of a water container, spin tub, agitator, drive and electric motor, and

Figures 3 and 4 are respectively a plan view and cross section of preferred motor frames incorporated in the invention in the preferred form,

Figure 5 is a further enlarged view of a seal shaft and bearings being part of Figure 2,

Figure 6 is a part cross section of an alternative embodiment of the invention,

Figure 7 is a part cross section of a further alternative embodiment of the invention,

Figure 8 is a scrap elevation at 45° to the view in Figure 1, and

Figure 9 is a rear view of a motor agitator forming part of the invention.

Referring to the drawings, a clothes washing machine comprises a cabinet 1 of square cross section which has mounted in it an electric motor 2 constructed according to the present invention as will be described further later. A water container 3 is suspended within the cabinet 1 by suspension rods 4 and springs 5 and for example four springs and rods are provided, and the motor and other mechanism are attached to the container 3. The springs are provided in the corners of the square cross section cabinet 1 accordingly parts of the rod are shown in sectional view in Figure 8 which is at 45° to the other sectional view of Figure 1. By water is meant washing liquid, e.g. water and detergent. Contained within the water container 3 there is a perforated spin tub 6 and within the spin tub is an agitator 7. An opening lid 9, shown only partially is provided through which clothes may be inserted into the container and within the spin tub 6 and the spin tub is partly balanced by upper balancing ring 10 shown only in the rear one side in Figure 1. The springs terminate in hooks 12 which engage in apertures 13 in the container base moulding 29. The agitator 7 is mounted on a hollow drive shaft 11 so as to rotate therewith but is slidable axially thereon. The spin tub 6 is coaxially mounted on the shaft 11 so as to be rotatably and also slidable axially thereon.

The motor 2 is constructed as follows. A rotor 15 has a backing ring 16 (Fig 2) and the backing ring is formed from a strip of magnetic material for example a silicon steel alloy and the strip of steel is coiled on edge with adjacent surfaces lightly insulated and touching each other to provide a short hollow cylinder or annular helix. Inside the helix there is provided a series of magnets 17, the backing ring 16 being expanded slightly before being placed over the magnets placed in a mould. The magnets are permanent magnets of a material capable of being magnetised to a high flux value e.g. Neodinium iron made by Magnaquench Inc. and the annulus and the magnets are held in place

by a plastics member 18 which has a hub 19, a disc or spoked connector portion 20, and substantially cylindrical element 21, the member being moulded over the backing ring and magnets so as to maintain the inner faces of the magnets 17 concentric with the axis of the hub 16.

The stator 25 of the motor has a magnetic core which comprises a strip of magnetic material again preferably a silicon steel alloy or other low hysteresis steel which is preformed to provide spaced apart pole pieces and again this strip is formed by bending on edge to form an annular helix in the form of a hollow cylinder with the poles 8 formed by the stacked pole pieces pointing outwardly. As may be seen in Figure 9 the poles 8 are connected together by a narrow band 14 so that bending on edge is relatively easily effected. To provide insulation for windings on the poles of the core a top insulating moulding 22 is placed on one side of the poles and a bottom insulating moulding 23 placed on the opposite side, meeting at a joint line 24. Windings are placed on the mouldings wound around each pole and such windings 26 are effected on the poles directly.

It is preferable that the stator be wound in a three phase star connected mode and the windings are made and connected using known techniques.

The stator 25 and the rotor 15 are mounted as will shortly be described.

The water container 3 is preferably an injection moulding and the base 29 has motor support columns 30 preferably braced with stiffening webs 31. These webs extend to the outer perimeter of the container 3 and are moulded integrally with the container.

The motor 2 includes two bearing frames 32 and 33 which comprise injection mouldings of a die cast metal or plastics material or preferably steel pressings or plastics material. Preferably the frames 32 and 33 are produced from the same mould or set of dies, thus ensuring equality of dimensions between the two frames. The frames are carefully designed and made so that the bearing mouldings 27 and 28 are concentric with locating pins or dimples 34 and corresponding holes 35 at the periphery of the frames and with the external angle 36 in which the inner corner 37 of the stator 25 fits with an interference fit.

Stiffening depressions 49 are provided to stiffen the frames and on assembly one frame is assembled rotated 45° relative to the other frame to provide correct matching of holes and dimples.

Bearings 38 and 39 fit in the bearing mountings 27 and 28 and the bearings are spaced apart by a spacing tube 40 which encircles the drive shaft 11. The hub 19 is fixed to the shaft 11 by a bolt 41 engaging a nut 41a held in the hollow of the shaft 11 by the shaft 11 being swaged down to

provide splines which engage corresponding spline spaces 42 in the hub 19. For transport purposes a further nut 43 holds the assembly supported by suspension rods and fixed to a cabinet member 44.

The spin tub 6 comprises a stainless steel perforated hollow cylinder 45 fixed to a plastics extruded base 46 e.g. by spinning the lower edge of the cylinder 45 on to the periphery of the plastics base 46. If desired a lower balancing ring 47 is provided and the upper and lower balancing rings each comprise a hollow ring with baffles and liquid container therein and the rings are each closed by an annular disc 48 and 48a respectively. One balancing ring preferably the ring 10 were found to give reasonable balance while spinning.

A plurality of bridges 50 are provided at spaced intervals with gaps between them and the bridges connect the balancing ring 47 (if fitted) to an air chamber in the form of a bell having an open mouth directed downwardly and a tube 52 integral therewith which surrounds the shaft 11. A low friction plastics bearing 53 enables the plastics base 29 and consequently the spin tub 6 to rotate and slide axially on the drive shaft 11.

A series of downwardly directed dog clutch teeth 55 (Fig 2) of a high impact duty material e.g. a high impact duty plastics material are carried by a carrier 56 riveted screwed or otherwise fixed to the air chamber 51 e.g. by screws 57. A ring 60 carries coacting dog clutch teeth 61 also of a high impact duty material and the ring 60 is rotatable by and axially slidable on the drive shaft 11 e.g. by engagement of splines on the ring 60 with splines on the drive shaft 11. The agitator 7 has a boss 62 with inner splines 63 engaging outer splines 64 on the ring 60 so that rotation of shaft 11 results in rotation of the teeth 61 and the agitator 7, and the boss 62 slides axially on the drive shaft 11 as may be seen by conforming the up position of elements on the left hand side of figures 1 and 2 with the 'down' position on the right hand side..

The air chamber 51 is designed to provide a flotation or buoyancy force resulting from the entrapment of air in the air tight air chamber 51 when water closes the perimeter of the lower edge of the air chamber 51. In the event that water enters the air chamber 51, e.g. because of turbulence during agitation, the lower face could be closed off with a disc 54.

The buoyancy force is at least sufficient to lift the spin tub 6, and the agitator 7 when a substantially predetermined volume of water is provided in the container 3, and the spin tub and agitator 7 is shown in the "up" position on the left hand side of Figures 1 and 3 and in the "down" position on the right hand side. When the spin tub 6 is in the up position, i.e. supported by floatation of the air chamber 51, the teeth 55 and the teeth 61 are

disengaged from each other and the agitator may be rotated freely over any desired rotational movement independent of the spin tub 6. When water is absent or substantially absent from the container 3 the spin tub 6 sinks until the teeth 55 and 61 are engaged. The spin tub 6 and agitator will then be rotated as one unit and this rotation will be effected continuously in one direction to spin clothes in the spin tub to a drier condition in the known way. To assist in freeing frictional contact between the axially sliding parts during up and down movement of the spin tub during filling with, and emptying of water, control means are provided controlling motor 2 to give a slow agitating action i.e. forward and reverse rotation over a small arc of movement. At each reversal the dogs will reverse contact and be free of each other for a short time due to clearances as between the dogs and spaces between the dogs.

To assist in fixing the spin tub against rotation during agitation, i.e. when the agitator is in the up position, the upper edge 67 of the spin tub may contact a frictional surface 68 on the underside of a top member 69 of the container 3.

The agitator 7 has external blades 81 thereon which extend from the surface of both column 82 and the upper surface of an upper coned disc 83. There is a space 84 between the disc 83 and the upper surface 85 of the air chamber 51 this space may be divided with radial vanes (not shown) since the purpose of the space arrangement is to provide a centrifugal impeller. Such an impeller may be otherwise provided e.g. an independent centrifugal pump could be provided.

Outlet openings 86 are provided from the space 84 at or near the outer edge of the disc 83 the outer edge 87 of which is turned downwardly and operates in close proximity to the inner edge of the balance ring 47. As a result of this construction a pumping action is given, pumping water from the centre of column 82 from apertures 88 through space 84 below balance ring 47 to space 86 between the spin tub 6 and the container 3 and lint is restrained in this space before the water re-enters the spin tub through the holes 90. If desired a container may be mounted on the column 82 such container holding a clothes conditioner in the known way.

Electronic commutation equipment 65 is provided on an annular printed circuit board in an annular container 66 mounted below the stator 25 and the electronic commutation equipment is preferably enclosed in a compound for protection and heat sinking, and is such as to enable the electric motor 2 to move in a backward and forward motion thus causing the shaft 11 to be oscillated backward and forth resulting in the agitator 7 being also rotated in a back and forth motion to give the well

known washing motion. Such electronic commutation equipment is described in copending New Zealand Patent Application No. 213489/213490 and corresponding UK Patent Application 8622289 and US Patent Application 06/908176 which are incorporated herein by reference. The electronic commutation equipment 65 is also arranged to drive the motor continuously to give a spin action, and to drive the spin tub with the agitator, the absence of water from the container 3 results in engagement of teeth 55 and 61 as above described.

However, when the agitator is preferably given a slow agitation motion and the container 3 has water in it at least to a predetermined level the flotation force of air in air chamber 51 causes the air chamber spin tub and agitator to rise. The teeth 55 are then raised out of contact with the teeth 61 and the agitator may now move independently of the spin tub and thus may be oscillated back and forth at a desired rate and over any desired angle of rotation to give a washing action without material movement of the spin tub.

To provide seals between the drive shaft 11 and the base 29 of the water container, a short cylinder 70 of e.g. steel (Fig 5) is fixed to the upper frame 32 by a screw 71 and a flange 72 holds the bearing 38 in place. The short cylinder 70 supports a seal 72 against the wall 73 of an aperture in the water container base 29 and a disc 74 holds a further seal 75 against the shaft 11, being reinforced by a backing ring 76. A played disc 77 holds a further seal 78 against the shaft 11 reinforced also by a spring 79, the flange 80 sitting within a short cylinder 81 integral with disc.

The seal 72, short cylinder 81 disc 74 and seal 75 are integral with each other and the played disc 77 seal 78 and flange 80 are integral with each other. Both units are made of Neoprene or other known flexible sealing material.

A pump 95 is provided for the purpose of draining the container 3 and the pump 95 is mounted directly about an opening 96 in a lower part of the container 3 and thus a single flexible tube can run from the pump outlet through the back of the cabinet to the user drain connection point.

It is to be noted that the bearings 38 and 39 are a slip fit on the drive tube 11 and tightening of the bolt 41 and a cap 91 by a screw 92 clamps both bearings into position. Removal of the rotor securement screw 92 and the bolt 41 can result in the drive tube 11 being removed from above and the motor rotor 16 being removed from below. The motor 2 is removable as a unit after removing also the screws 93 holding the frames 32 and 33 in position. Thus for maintenance purposes this removal can be readily effected. Furthermore following removal of the securement screw 92, the agitator and agitator hub can be removed and the spin

tub assembly then lifted off from above. Thus maintenance is very simple.

It is also to be noted that because the spin tub and its contents float during the agitation phase no thrust bearing is required. Also the bearing 53 operates under water and only under low speed condition i.e. the agitator speed relative to the substantially stationary spin tub and therefore the bearing need only be a light duty bearing.

An alternative form of interconnection means is provided as follows with reference to figure 6:

The agitator 7 has associated with it a bell 100 both being fixed to the shaft 101 by a bolt 102. The shaft 101 corresponds to the shaft 11 and is driven by an electric motor as above described.

Within the bell 100 is a rise and fall member 103 which is a plastics moulding sealably attached by a flexible bellows 105 eg. of neoprene to the outer edge 106 of the plastic member 103 and to the edge of the bell 100. A further flexible bellows 107a is sealably attached to the member 103 and to the hub of the bell 100. The member 103 has prongs or dogs 108 spaced at intervals thereon and such prongs or dogs 108 engage in the spaces between castellations 109 in the bottom of the spin tub 6. A spring (not shown) is provided which exerts a downward force from the hub 108 on the member 103 and the cavity 110 is open to atmosphere through a cross hole or notch 111 in the hub 108 and a series of holes in the shaft or drive tube 101. This arrangement is such that when the container 3 is emptying the spring moves the member 103 downwardly so that the prongs or dogs 108 engage in the spaces between the castellations and thus the spin tub will move with the agitator and be rotated with that agitator continuously for the purpose of spinning. However, when the container 3 has water in it to a predetermined level the hydrostatic water pressure on the undersurface of the member 103 causes that member to rise against the pressure of the spring air venting through the air holes abovementioned and the prongs or dogs 108 are then raised out of contact with the spin tub and the agitator may now move independently of the spin tub and thus may be oscillated back and forth to give a washing action.

In a further alternative arrangement of spin tub to agitator interconnecting means shown in figure 7 the agitator 7 is combined with a hub 110 fixed by a bolt 111 to a solid splined shaft 112. An air chamber in the form of a bell member 115 is a slideable fit on the shaft 112 and has air entrapment spaces 116 in which air is trapped by rising water in the container 3 when the latter is being filled preparatory to agitation occurring. The bell 115 then acts as a float raising detents or dogs 113 from engagement with castellations 107 as shown

on the right hand side of figure 7 to a disengaged position as shown on the left hand side of figure 7.

At least in the preferred forms the invention provides the following advantages:

- 5 1. The electric motor assembly and construction is integrated with the drive system in that a simple shaft and pair of bearings supports the rotor at one end of the agitator and spin tub at the other end advocating the need for separate shafts and bearings for the motor and for the agitator and spin tub drive.
- 10 2. The mounting of the stator and the rotor outboard of the lower motor frame enable ready replacement of the stator and/or rotor.
- 15 3. The mounting of the electronics in an annular disk associated with the stator of the motor reduces the length of interconnecting wiring and enables a compact factory wired unit to be provided.
- 20 4. The floating spin tub concept eliminates the need for springs bearings and enables ready maintenance to be carried out.
- 25 5. The complete freedom of the agitation to rotate through an unlimited angle of rotation during agitation enables any desired angle of rotation.

Claims

- 30 1. A clothes washing machine having a cabinet(1) in which an agitator(7) is fixed to a vertical shaft (11) so as to rotate therewith and be rotatably oscillated back and forth for a washing function within a perforated spin tub(6) which is freely mounted on said vertical shaft (11),so as to be rotatable thereon,driving means to cause said rotatable oscillation or to cause rotation of said spin tub(6) continuously in one direction, said driving means including said vertical shaft (11) and interconnecting means (55, 56, 108, 109) provided between said vertical shaft (11) and said spin tub(6), the spin tub (6) being rotatable by said vertical shaft (11) through said interconnecting means (55, 56, 108, 109) when said interconnecting means are connected together so that said spin tub(6) and said agitator (7) then rotate continuously together in one direction to give spin action and said perforated spin tub in turn being mounted within a stationary water container (3), said cabinet (1) also containing a drive system comprising an electric motor (2) and said driving means with part of said interconnecting means (55, 108) mounted on or rotatably driven by said vertical shaft (11) and a further part of said interconnecting means (56, 109) mounted on or drivably connected to said spin tub(6), said interconnecting means

tub assembly then lifted off from above. Thus maintenance is very simple.

It is also to be noted that because the spin tub and its contents float during the agitation phase no thrust bearing is required. Also the bearing 53 operates under water and only under low speed condition i.e. the agitator speed relative to the substantially stationary spin tub and therefore the bearing need only be a light duty bearing.

An alternative form of interconnection means is provided as follows with reference to figure 6:

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In a further alternative arrangement of spin tub to agitator interconnecting means shown in figure 7 the agitator 7 is combined with a hub 110 fixed by a bolt 111 to a solid splined shaft 112. An air chamber in the form of a bell member 115 is a slideable fit on the shaft 112 and has air entrapment spaces 116 in which air is trapped by rising water in the container 3 when the latter is being filled preparatory to agitation occurring. The bell 115 then acts as a float raising detents or dogs 113 from engagement with castellations 107 as shown

on the right hand side of figure 7 to a disengaged position as shown on the left hand side of figure 7.

At least in the preferred forms the invention provides the following advantages:

1. The electric motor assembly and construction is integrated with the drive system in that a simple shaft and pair of bearings supports the rotor at one end of the agitator and spin tub at the other end advocating the need for separate shafts and bearings for the motor and for the agitator and spin tub drive.
2. The mounting of the stator and the rotor outboard of the lower motor frame enable ready replacement of the stator and/or rotor.
3. The mounting of the electronics in an annular disk associated with the stator of the motor reduces the length of interconnecting wiring and enables a compact factory wired unit to be provided.
4. The floating spin tub concept eliminates the need for springs bearings and enables ready maintenance to be carried out.
5. The complete freedom of the agitation to rotate through an unlimited angle of rotation during agitation enables any desired angle of rotation.

Claims

1. A clothes washing machine having a cabinet(1) in which an agitator(7) is fixed to a vertical shaft (11) so as to rotate therewith and be rotatably oscillated back and forth for a washing function within a perforated spin tub(6) which is freely mounted on said vertical shaft (11),so as to be rotatable thereon,driving means to cause said rotatable oscillation or to cause rotation of said spin tub(6) continuously in one direction, said driving means including said vertical shaft (11) and interconnecting means (55, 56, 108, 109) provided between said vertical shaft (11) and said spin tub(6), the spin tub (6) being rotatable by said vertical shaft (11) through said interconnecting means (55, 56, 108, 109) when said interconnecting means are connected together so that said spin tub(6) and said agitator (7) then rotate continuously together in one direction to give spin action and said perforated spin tub in turn being mounted within a stationary water container (3), said cabinet (1) also containing a drive system comprising an electric motor (2) and said driving means with part of said interconnecting means (55, 108) mounted on or rotatably driven by said vertical shaft (11) and a further part of said interconnecting means (56, 109) mounted on or drivably connected to said spin tub(6), said interconnecting means



(55,56,108,109) including actuating means operable so that when at least a predetermined amount of water is present in said container, said parts of said interconnecting means (55, 108) are disconnected and when water is substantially absent from said container said interconnecting means parts (55, 108) are interconnected so that said perforated spin tub (6) will rotate with said vertical shaft (11) and with said agitator (7); said actuating means including a floatable chamber (51,110) rotatable by said vertical shaft (11), the buoyancy of said floatable chamber in the presence of said predetermined quantity of water in said container being such as to move said further part of said interconnecting means (56, 109) from engagement with said part of said interconnecting means (55, 108) on said vertical shaft (11) so that said agitator is rotatable independently of said spin tub.

2. A clothes washing machine as claimed in Claim 1 wherein said spin tub (6) is also lifted by said floatable chamber (51, 110).
3. A clothes washing machine as claimed in Claim 1 or Claim 2 wherein said floatable chamber (51) is compartmented and has an open mouth on the bottom of the air chamber.
4. A clothes washing machine as claimed in Claim 1 wherein said airtight chamber (110) comprises a bell (100) having within it a movable member (106) flexibly and sealably attached to said bell.
5. A clothes washing machine as claimed in Claim 4 wherein said interconnecting means (108, 109) comprise a series of dog clutch teeth (108) on said movable member engageable with corresponding tooth members (109) on the base of said perforated spin tub.
6. A clothes washing machine as claimed in Claim 5 wherein said perforated spin tub (6) has a castellated base (107) with a series of radial ribs (109) and radial grooves and said tooth members (108) engage in said grooves and against said ribs.
7. A clothes washing machine as claimed in Claim 1 wherein said electric motor (2) comprises a stator (25) carrying energizable windings (26) on poles (8) thereof, a rotor (15), a bearing housing having a pair of bearing mountings (27, 28) in a central disposition and having locating means arranged to hold said bearing mountings separated and axially

aligned, said bearing housing having stator locating means (32, 33) arranged to hold said stator concentric with said bearing mountings (27, 28), a single pair of bearings (38, 39) mounted in said bearing mountings (27, 28), said vertical shaft (6) being rotatably mounted in said bearings (38, 39) and carrying said rotor (15), said rotor comprising a backing ring (16) of a magnetic material, a series of permanent magnets (17) spaced apart on an inner surface of said backing ring (16) and rotatable exteriorly of said stator windings (26), a hub (19) mounted on said shaft, and a backing ring support holding inner faces of said permanent magnets concentric with said shaft.

8. A clothes washing machine as claimed in Claim 7 wherein said stator is disposed outboard of said housing and said rotor has a connecting portion between said hub (19) and a rim (18) thereof, said connecting portion being outboard of said stator (25).
9. A clothes washing machine as claimed in Claim 8 wherein said stator (25) comprises an annular helix of a magnetic material, said helix (25) having said poles (8) extending outwardly from the circumferential surface of the annulus, said annular helix being mounted on said stator locating means (32, 33).
10. A clothes washing machine as claimed in Claim 7 wherein insulation (22, 23) to insulate said windings from said poles is provided and comprises a pair of mouldings (22, 23) each moulding being in the form of an annulus with insulation covering one part of each pole (8), there being a division intermediate of the thickness of each pole between the two mouldings.
11. A clothes washing machine as claimed in Claim 1 wherein said spin tub (6) has a hollow tubular mounting (53) within said spin tub (6) and said vertical shaft (11) or said tubular mounting (53) has an anti friction coating thereon, surfaces of said shaft (11) or said tubular mounting (23) rubbing on said anti friction coating to provide a bearing between the spin tub (6) and the vertical shaft (11) during agitation.
12. A clothes washing machine as claimed in Claim 1 wherein said vertical shaft (11) and said motor (2) are removable downwardly by unfastening said agitator (7) from said shaft and unfastening said motor (2) from said container (3).



13. A clothes washing machine as claimed in Claim 1 wherein said agitator (7) and said spin tub (6) are removable from said container upwardly through an upper opening in said container (3) after freeing said agitator(7) from said shaft (11).

Patentansprüche

1. Eine Wäschewaschmaschine mit einem Gehäuse (1), in dem ein Rührwerk (7) auf einer vertikalen Welle (11) befestigt ist, um sich mit dieser zu drehen und für eine Waschfunktion innerhalb einer durchlöcherten Schleudertrommel (6), die auf der vertikalen Welle (11) freimontiert ist, hin- und Zurückschwingend drehbar ist, Antriebsmitteln zur Bewirkung der Drehschwingung oder zur Verursachung einer kontinuierlichen Drehung der Schleudertrommel (6) in eine Richtung, wobei die Antriebsmittel die vertikale Welle (11) und Verbindungsmittel (55, 56, 108, 109) aufweisen, die zwischen der vertikalen Welle (11) und der Schleudertrommel (6) vorgesehen sind, die Schleudertrommel (6) von der vertikalen Welle (11) über die Verbindungsmittel (55, 56, 108, 109) in Drehung versetzt werden kann, wenn die Verbindungsmittel miteinander verbunden sind, so daß die Schleudertrommel (6) und das Rührwerk (7) sich dann kontinuierlich gemeinsam in eine Richtung drehen, um ein Schleudern zu bewirken, und die gelöcherte Schleudertrommel wiederum in einem ortsfesten Wasserbehälter (3) montiert ist, wobei das Gehäuse (1) weiter ein Antriebssystem mit einem Elektromotor (2) aufweist und die Antriebsmittel mit einem Teil der Verbindungsmittel (55, 108) auf der vertikalen Welle (1) montiert sind oder aber von diesen drehbar angetrieben werden, und ein weiterer Teil der Verbindungsmittel (56, 109) auf der Schleudertrommel (6) montiert sind oder aber antreibbar mit dieser verbunden sind, die Verbindungsmittel (55, 56, 108, 109) Betätigungsmittel aufweisen, die betrieben werden können, so daß dann, wenn wenigstens eine vorgegebene Menge von Wasser in dem Behälter vorgesehen ist, die Teile der Verbindungsmittel (55, 108) voneinander gelöst sind und dann, wenn Wasser im wesentlichen in dem Behälter fehlt, die Verbindungsmittelteile (55, 108) miteinander verbunden sind, so daß die perforierte Schleudertrommel (6) mit der vertikalen Welle (11) und mit dem Rührwerk (7) drehen wird, wobei das Betätigungselement eine aufschwimmende Kammer (51, 110) aufweist, die von der vertikalen Welle (11) gedreht werden kann, und die den Auftrieb der schwimmenden Kammer bei

dem Vorhandensein der vorgegebenen Wassermenge in dem Behälter derart ist, um den weiteren Teil des Verbindungsmittels (56, 109) aus dem Eingriff mit dem Teil des Verbindungsmittels (55, 108) auf der vertikalen Welle (11) zu bringen, so daß das Rührwerk unabhängig von der Schleudertrommel gedreht werden kann.

2. Eine Wäschewaschmaschine nach Anspruch 1, wobei auch die Schleudertrommel (6) von der schwimmenden Kammer (51, 110) angehoben wird.
3. Eine Wäschewaschmaschine nach Anspruch 1 oder Anspruch 2, wobei die schwimmende Kammer (1) aufgeteilt ist, und einen offenen Mund an dem Boden der Luftkammer hat.
4. Eine Wäschewaschmaschine nach Anspruch 1, wobei die luftdichte Kammer (110) eine Glocke (100) mit einem beweglichen Element (106) in diesem, welches nachgiebig und dichtend an der Glocke befestigt ist, aufweist.
5. Eine Wäschewaschmaschine nach Anspruch 4, wobei die Verbindungsmittel (108, 109) eine Reihe von Klauenkupplungszähnen (108) auf dem beweglichen Element aufweisen, die mit entsprechenden Zahnelementen (109) auf der Basis der gelöcherten Schleudertrommel in Eingriff gebracht werden können.
6. Eine Wäschewaschmaschine nach Anspruch 5, wobei die gelöcherte Schleudertrommel (6) eine gezahnte Basis (107) mit einer Reihe von radialen Rippen (109) und radialen Kerben aufweist und die Zahnelemente (108) in die Zähne und gegen die Rippen eingreifen.
7. Eine Wäschewaschmaschine nach Anspruch 1, wobei der Elektromotor (2) einen Stator (25), der erregbare Windungen (26) auf dessen Polen (8) trägt, einen Rotor (15), ein Lagergehäuse mit einem Paar von Lagerbefestigungen (27, 28) in einer zentralen Anordnung und mit Befestigungsmitteln, die angeordnet sind, um die Lagerbefestigungen getrennt und axial ausgerichtet zu halten, wobei das Lagergehäuse ein Statoranordnungsmittel (32, 33) aufweist, das angeordnet ist, um den Stator konzentrisch mit den Lagerbefestigungen (27, 28) zu halten, und ein einzelnes Paar von Lagern (38, 39), die in den Lagerbefestigungen (27, 28) montiert sind, aufweist, wobei die vertikale Welle (26) drehbar in den Lagern (38, 39) befestigt ist und den Rotor (15) trägt, wobei der Rotor einen Stützring (16) aus einem magnetischen



Material, eine Reihe von Permanentmagneten (17), die auf einer Innenfläche des Stützrings (16) beabstandet sind und außerhalb der Statorwindungen (26) drehbar sind, eine Nabe (19), die auf der Welle befestigt ist und eine Stützringhalterung, die die inneren Flächen der mit der Welle konzentrischen Permanentmagneten hält, aufweist.

8. Eine Wäschewaschmaschine nach Anspruch 7, wobei der Stator außerhalb des Gehäuses angeordnet ist und der Rotor einen Verbindungsabschnitt zwischen der Nabe (19) und dessen Rand (18) aufweist, wobei der Verbindungsabschnitt außerhalb des Stators (25) ist.

9. Eine Wäschewaschmaschine nach Anspruch 8, wobei der Stator (25) eine Ringwendel aus einem magnetischen Material aufweist, wobei die Wendel (25) sich nach außen von der kreisförmigen Fläche des Ringes erstreckende die Pole (8) hat und die ringförmige Wendel auf dem Statoranordnungsmittel (32, 33) befestigt ist.

10. Eine Wäschewaschmaschine nach Anspruch 7, wobei eine Isolation (22, 23) zum Isolieren der Wicklungen von den Polen vorgesehen ist und ein Paar von Kehlungen (22, 23) aufweist, wobei jede Kehlung in der Form eines Ringes ist mit einer Isolation, die einen Teil jedes Pols (8) abdeckt, und wobei ein Teilungselement von der Dicke jedes Pols zwischen den beiden Kehlungen vorgesehen ist.

11. Eine Wäschewaschmaschine nach Anspruch 1, wobei die Schleudertrommel (6) ein hohles rohrförmiges Befestigungselement (53) innerhalb der Schleudertrommel (6) aufweist und die vertikale Welle (11) oder das rohrförmige Befestigungselement (53) auf diesem eine Anti-Reibbeschichtung haben, wobei die Flächen der Welle (11) oder des rohrförmigen Befestigungselements (23) auf der Anti-Reibbeschichtung laufen, um während der Bewegung ein Lager zwischen der Schleudertrommel (6) und der vertikalen Welle (11) zu schaffen.

12. Eine Wäschewaschmaschine nach Anspruch 1, wobei die vertikale Welle (11) und der Motor (2) durch Lösen des Rührwerks (7) von der Welle und Lösen des Motors (2) von dem Behälter (3) nach unten entfernbar sind.

13. Eine Wäschewaschmaschine nach Anspruch 1, wobei das Rührwerk (7) und die Schleudertrommel (6) von dem Behälter nach oben

durch eine obere Öffnung in dem Behälter (3) nach Freigeben des Rührwerks (7) von der Welle (11) entfernbar sind.

5 Revendications

1. Machine de nettoyage de vêtements incluant une armoire (1) dans laquelle un agitateur (7) est fixé à un arbre vertical (11) de manière à tourner avec lui et à être mis en oscillation de rotation en va-et-vient, en vue d'une fonction de nettoyage, à l'intérieur d'une cuve tournante perforée (6) qui est montée librement sur ledit arbre vertical de façon à pouvoir tourner sur celui-ci, un moyen d'entraînement servant à provoquer ladite oscillation de rotation ou à provoquer une rotation de ladite cuve tournante (6) en continu dans un sens, ledit moyen d'entraînement incluant ledit arbre vertical (11) et des moyens d'interconnexion (55, 56, 108, 109) disposés entre ledit arbre vertical (11) et ladite cuve tournante (6), la cuve tournante (6) pouvant être entraînée à rotation par ledit arbre vertical (11) à l'aide desdits moyens d'interconnexion (55, 56, 108, 109) lorsque lesdits moyens d'interconnexion sont connectés entre eux d'une manière telle que ladite cuve tournante (6) et ledit agitateur (7) tournent alors ensemble de façon continue dans un sens de façon à engendrer un effet de rotation, et ladite cuve tournante perforée étant elle-même montée à l'intérieur d'un récipient stationnaire d'eau (3), ladite armoire (1) contenant également un système d'entraînement comprenant un moteur électrique (2) et ledit moyen d'entraînement monté avec une partie desdits moyens d'interconnexion (55, 108) sur ledit arbre vertical (11) ou entraîné à rotation par ce dernier et une autre partie desdits moyens d'interconnexion (56, 109) montés sur ladite cuve tournante (6) ou reliés à celle-ci de façon à pouvoir l'entraîner, lesdits moyens d'interconnexion (55, 56, 108, 109) incluant un moyen d'actionnement qui peut être mis en oeuvre d'une manière telle que lesdits éléments des moyens d'interconnexion (56, 108) sont déconnectés lorsqu'au moins une quantité prédéterminée d'eau est présente dans ledit récipient, et que lesdits éléments (55, 108) de moyen d'interconnexion sont interconnectés lorsque l'eau est sensiblement absente dudit récipient, d'une manière telle que ladite cuve tournante perforée (6) tourne avec ledit arbre (11) et avec ledit agitateur (7); ledit moyen d'actionnement incluant une chambre flottante (51, 110) qui peut être entraînée à rotation par ledit arbre vertical (11); la force ascensionnelle de ladite chambre flottante en présence de



- ladite quantité prédéterminée d'eau dans ledit récipient étant apte à déplacer ledit autre élément desdits moyens d'interconnexion (5, 109) pour le dégager dudit élément desdits moyens d'interconnexion (55, 108) situé sur ledit arbre vertical (11) de façon que ledit agitateur puisse tourner indépendamment de ladite cuve tournante.
2. Machine à laver les vêtements selon la revendication 1, dans laquelle ladite cuve tournante (6) est elle aussi soulevée par ladite chambre flottante (51, 110).
 3. Machine à laver les vêtements selon la revendication 1 ou la revendication 2 dans laquelle ladite chambre flottante (51) est compartimentée et présente un débouché ouvert sur le bas de la chambre d'air.
 4. Machine à laver les vêtements selon la revendication 1 dans laquelle ladite chambre étanche à l'air (110) comprend une cloche (100) à l'intérieur de laquelle est inclus un élément mobile (106) attaché à ladite cloche de façon flexible et susceptible d'être étanche.
 5. Machine à laver les vêtements selon la revendication 4 dans laquelle lesdits moyens d'interconnexion (108, 109) comprennent une série de dents (108) de manchon à endentures, sur ledit élément mobile, qui peuvent venir en prise avec des éléments correspondants (109) de dents sur la base de ladite cuve tournante.
 6. Machine à laver les vêtements selon la revendication 5 dans laquelle ladite cuve tournante perforée (6) comprend une base crénelée (107) qui inclut une série de nervures radiales (109) et d'encoches radiales et lesdits éléments (108) de dents viennent en prise dans lesdites rainures et contre lesdites nervures.
 7. Machine à laver les vêtements selon la revendication 1 dans laquelle ledit moteur électrique (2) comprend un stator (25) qui porte sur ses pôles des enroulements excitables (26), un rotor (15), un logement de paliers qui inclut une paire de supports (27, 28) de paliers situés dans une position centrale et inclut des moyens de positionnement agencés de manière à tenir lesdits supports de palier séparés et alignés axialement, ledit logement de paliers incluant un moyen de positionnement (32, 33) de stator agencé de manière à tenir ledit stator concentrique avec lesdits supports (27, 28) de paliers, une paire unique de paliers (38, 39) montés dans lesdits supports (27, 28) de paliers, ledit arbre vertical (11) étant monté à rotation dans lesdits paliers (38, 39) et portant ledit rotor (15), ledit rotor comprenant une bague auxiliaire (16) en matière magnétique, une série d'aimants permanents (17) espacés les uns des autres sur la surface intérieure de ladite bague de renfort (16) et susceptibles de tourner à l'extérieur desdits enroulements (26) de stator, un moyeu (19) monte sur ledit arbre et un support de bague auxiliaire qui tient des faces intérieures desdits éléments permanents concentriques audit arbre.
 8. Machine à laver les vêtements selon la revendication 7 dans laquelle ledit stator est disposé à l'extérieur du logement et ledit rotor comprend une partie de liaison entre ledit moyeu (19) et un rebord (18) de rotor, ladite partie de liaison étant à l'extérieur dudit stator (25).
 9. Machine à laver les vêtements selon la revendication 8 dans laquelle ledit stator (25) comprend une hélice annulaire en matière magnétique, ladite hélice (25) comportant lesdits pôles (8) qui s'étendent à l'extérieur de la surface circonférentielle de l'anneau, ladite hélice annulaire étant montée sur ledit moyen de positionnement (32, 33) de stator.
 10. Machine à laver les vêtements selon la revendication 7, dans laquelle un isolant (22, 23) est prévu pour isoler desdits pôles lesdits enroulements et comprend une paire de moulages (22, 23), la forme de chaque moulage étant celle d'un anneau et l'isolant couvrant une partie de chaque pôle (8), une division étant disposée de façon intermédiaire sur l'épaisseur de chaque pôle entre les deux moulages.
 11. Machine à laver les vêtements selon la revendication 1 dans laquelle ladite cuve tournante (6) comprend à l'intérieur de ladite cuve tournante (6) un support tubulaire creux (53), et ledit arbre vertical (11) ou ledit support tubulaire (53) est pourvu d'un revêtement anti-friction, des surfaces dudit arbre (11) ou dudit support tubulaire (23) frottant sur ledit revêtement anti-friction afin de constituer un palier entre la cuve tournante (6) et l'arbre vertical (11) pendant l'agitation.
 12. Machine à laver les vêtements selon la revendication 1 dans laquelle ledit arbre vertical (11) et ledit moteur (2) sont amovibles vers le bas en démontant ledit agitateur (7) dudit arbre et en démontant ledit moteur (2) dudit récipient (3).



13. Machine à laver les vêtements selon la revendication 1, dans laquelle ledit agitateur (7) et ladite cuve tournante (6) sont amovibles dudit récipient vers le haut à travers une ouverture supérieure dudit récipient (3) quand ledit agitateur (7) a été libéré dudit arbre (11).

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