May 25, 1965 R. S. GAUGLER 3,184,933

WASHING MACHINE WITH A RECIPROCATABLE AND ROTATABLE DRIVE MOTOR

Filed March 11, 1963 2 Sheets-Sheet 1

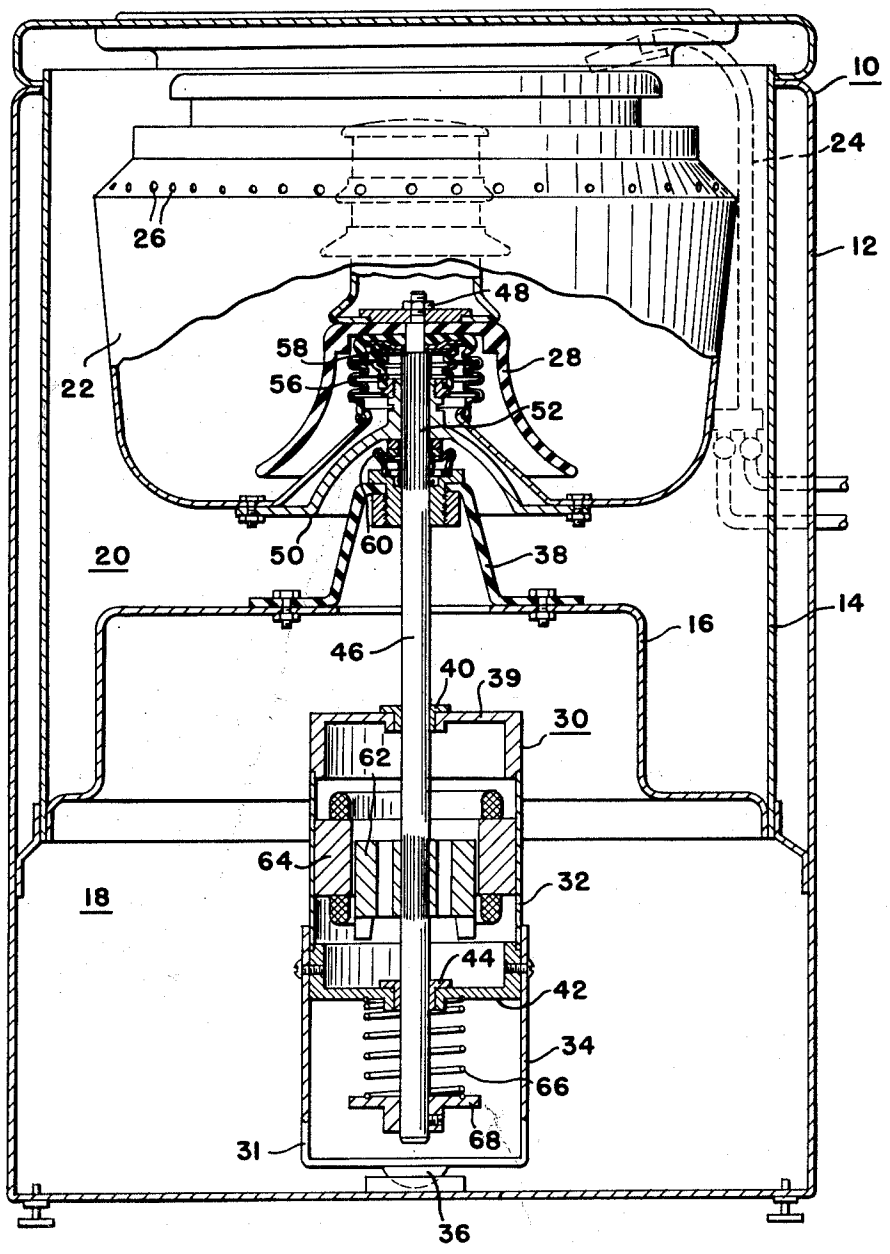

Fig. 1

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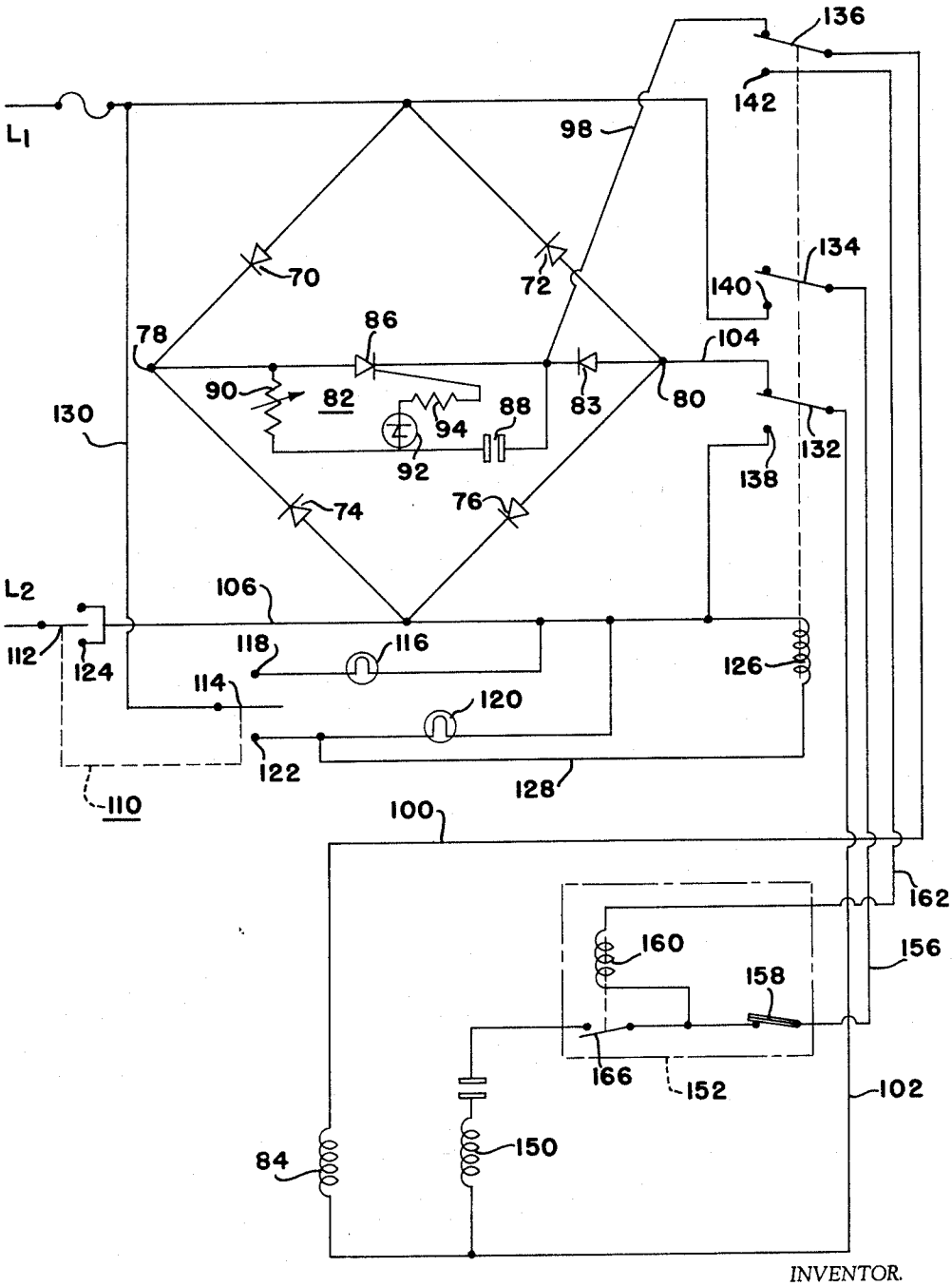

Fig. 2

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United States Patent Office 3,184,933 Patented May 25, 1965

3,184,933

WASHING MACHINE WITH A RECIPROCATABLE AND ROTATABLE DRIVE MOTOR

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Filed Mar. 11, 1963, Ser. No. 264,356
7 Claims. (Cl. 68—23)

This invention relates to a domestic appliance and more particularly to an agitating and spinning mechanism for a clothes washer.

Prime mover systems in prior art clothes washers have included many types of mechanisms to produce agitating in the spin tub and spinning of the tub itself. Some of these prior art devices include sealed units in which the elements are bathed in oil while others require complicated motion translating mechanism to convert the rotational motion of a motor to the oscillatory or pulsating motion of the agitator. This invention is directed to a simplified agitating and spinning mechanism wherein the motor itself is energizable to produce directly either agitation or spin.

Accordingly, it is an object of this invention to provide a clothes washer tub and agitator with an improved motor means for directly selectively moving the agitator or spinning the tub.

A more specific object of this invention is to provide a clothes washer having a prime mover means for selectively actuating a spin tub or an agitator wherein said prime mover means includes a stator portion which is stationary relative to the clothes washer cabinet and a rotor portion directly connected to the agitator and both relatively axially slidably connected and drivably rotatably connected to the tub, said stator portion being selectively energizable to cause the rotor portion to move either relatively axially or relatively rotatably to said stator portion.

Another object of this invention is to provide a prime mover means including a stator portion and a rotor portion, said rotor portion being movable relative to said stator portion in both an axial and a rotational direction thereby to effect a reciprocating drive or a rotational drive.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a sectional view, partly in elevation, of a clothes washer provided with this invention; and

FIGURE 2 is a schematic wiring diagram for operating this invention.

In accordance with this invention and with reference to FIGURE 1, a clothes washer **10** is illustrated. The clothes washer includes an outer cabinet means **12** for supporting a water container **14**. The lower portion of the water container is closed by a bulkhead **16** which divides the cabinet into a mechanism compartment **18** and a spin tub compartment **20**. Within the water container **14** is a spin tub **22** adapted to receive water through a water supply line **24** and adapted to centrifuge water therefrom when rotated through a plurality of outflow ports **26**. An agitator or pulsating means **28** resides within the spin tub **22** and is adapted for vertical reciprocation to produce a washing action within the spin tub. In general, an agitating and spinning mechanism or prime mover means **30** is disposed in the machinery compartment **18** and is adapted to either rotate the spin tub **22** or vertically reciprocate the agitator or pulsator **28**, as will be described more fully next following.

The agitating and spinning mechanism **30** includes a support frame **31** in which a cylindrical motor casing **32** is carried at the upper portion of a snubber bracket **34**. Note that the snubber bracket is pivoted at **36** on the bottom of the clothes washer casing so that movement of the tub **22** due to unbalance is permitted by a flexible, inverted cup-like support **38** on the bulkhead **16**. The mechanism frame includes a top bearing support portion **39** above the motor casing which carries a bearing **40**. Similarly, a lower bearing support portion **42** below the motor casing has a bearing **44**. An agitate and spin shaft or drive shaft means **46** extends through the bearings **40** and **44** and is connected at its upper end **48** with the agitator **28**. The spin tub **22** includes a tub support casting **50** having an internally splined central portion for receiving the splined end **52** of the drive shaft **46**. Thus, it can be seen that the shaft **46** can reciprocate axially relative to the spin tub **22** to produce a vertically reciprocating action at the pulsator **28**. On the other hand, when the drive shaft **46** is rotated, the splined connection between the shaft and the tub support **50** will cause the spin tub **22** to be rotated. Suitable seals **56** and **58** are included between the tub **22** and the agitator **28** to prevent water leakage from the tub at this point. An additional water seal **60** is included between the yieldable support **38** and the tub support casting **50** or the shaft **46** to prevent water leakage from the water container into the mechanism compartment.

The agitating and spinning mechanism **30** will consist of a motor rotor portion **62** affixed directly to the drive shaft **46** and a motor stator portion **64** supported in the mechanism frame **31** which is, in turn, pivotally carried by the bottom of the clothes washer casing **12**. When the stator **64** is not energized, the motor rotor **62** is either above or below its magnetic center in the stator. In FIGURE 1, the rotor **62** is shown below its magnetic center in a first position. This lower position is established by gravity and a compression spring **66** which acts between an annular flanged stop or spring retainer **68** on the end of the drive shaft **46** and the lower bearing support **42**.

The vertical reciprocating or pulsating action is obtained by energizing the motor stator **64** in a manner which causes the rotor **62** to be pulled directly to an upper or second position in the magnetic center of the stator without rotating. This is similar to a solenoid action. Note that the pulling in of the rotor **62** compresses the spring **66** storing energy therein for returning the rotor to its lower or first position when the stator **64** is deenergized.

For spinning the tub **22** the motor is continuously energized. The energized stator **64** will then pull the rotor into its magnetic center and rotate it there for the duration of spin.

The manner in which the stator **64** is selectively energized to produce either tub spin or agitator reciprocation will now be described with reference to FIGURES 1 and 2. In general, the energy supplied to the stator for pulsing the agitator will be handled through a silicon controlled rectifier, hereinafter referred to as SCR, and a timing circuit—the frequency of agitator pulsing being controlled by the timing circuit. More particularly, this control is effected by connecting the timing circuit to the gate of the SCR.

In the circuit of FIGURE 2, diodes **70**, **72**, **74** and **76** form a bridge rectifier that supplies full wave voltage to a SCR circuit between junction points **78** and **80**. The SCR circuit, shown generally as **82**, is selectively connected in power supply relationship to the motor run winding **84** which is actually a load across another diode **83** and controlled by the SCR circuit **82**. The object of the SCR circuit **82** is to supply several consecutive half cycles of voltage to the run winding **84** at a predetermined interval, thereby to reciprocate the agitator **28**. In operation,

the run winding current increases or is turned on with each half cycle of voltage and approaches a limit value determined by dividing the run winding resistance into the voltage before it is turned off. It should be noted that the pull-in or solenoid force is much greater than that which would be obtained by applying A.C. voltage for the same length of time.

The length of time that the SCR 86 is off is determined by the length of time required for a capacitor 88 to charge through a variable resistance or agitate speed control 90 to a voltage equal to or greater than the break-over voltage of a four-layer diode 92. When the voltage across the capacitor 88 reaches the break-over voltage of the four-layer diode 92, the capacitor 88 will discharge through the diode 92, a resistance 94 and the gate circuit of the SCR 86. This, in effect, turns the SCR on and passes current from L_1, diode 70, SCR 86, conductors 98 and 100, run winding 84, conductor 102, conductor 104, diode 76, and conductor 106 to the other side of the line L_2. Of course, selector relay switches 132 and 136 would be in their upper position (FIGURE 2) to establish this agitate circuit.

The length of time that the SCR 86 is on is determined by the length of time required for capacitor 88 to discharge through the four-layer diode 92, resistance 94 and the gate of the SCR 86. As soon as this discharge current reduces to the minimum current (holding current) required to keep the four-layer diode 92 in the conducting state, the four-layer diode 92 turns off and the gate of the SCR 86 turns off as well.

In addition to the foregoing circuit for establishing the pulsating or reciprocating action for the agitator 28, the mechanism control circuit may include a manual master control or wash function selector switch 110 having DPDT selector switch portions 112 and 114. Thus, a lamp 116 will be illuminated when the selector switch portion 114 engages the agitate contact 118 to indicate an agitate function. On the other hand, an indicating lamp 120 will be illuminated to indicate spin when the selector switch portion 114 engages a tub spin or motor run contact 122.

Both selector switch portions 112 and 114 are moved together—the switch portion 112 controlling a selector relay 126. If the master selector switch 110 is moved to its lower position for spin, switch portion 114 engaging the spin contact 122 and switch portion 112 engaging a selector relay contact 124, the selector relay coil 126 will be energized from L_2 through conductor 106, selector relay coil 126, conductor 128, switch portion 114 and conductor 130 to the other side of the line L_1. The energization of the relay coil 126 will move the relay switch portions 132, 134 and 136 to their spin position on lower relay contacts 138, 140 and 142, respectively. In this relationship the motor run winding 84 and motor start winding 150 will be energized to pull the rotor 62 into the magnetic center of the stator 64 thereby to rotate the spin tub 22.

For dropping out the start winding 150 during spin, a relay 152 is incorporated in the circuit and energized when the selector relay 126 moves the relay switch 134 to its spin contact 140. In this relationship power is supplied to the relay 152 from L_1, relay switch 134, conductor 156, an overload switch 158, holding coil 160, conductor 162, relay switch 136, conductor 100, run winding 84, conductor 102, relay switch 132, spin contact 138 and conductor 106 to the other side of the line L_2. Start winding relay coil 160 will pull in the relay switch 166 and hold it in to energize the start winding 150 so long as a large starting current is present. As the motor comes up to speed, current through the relay holding coil 160 will drop off and the relay switch 166 will open to disconnect the start winding. Thus, the motor coil 84 is energized in a continuous manner for spinning the tub 22. It should be understood that the manual selector switch 110 could be controlled by a conventional clothes washer timer to selectively move the switch for effecting a desired agitating cycle or spinning cycle in accordance with conventional clothes washing practice.

It should now be seen that an improved agitating and spinning mechanism has been provided for a clothes washer wherein both tub spin and agitator pulsation are accomplished directly with a single motor needing no auxiliary motion translating mechanism.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a washing machine, tub means, agitating means in said tub means for agitating, means for rotatably supporting said tub means, and prime mover means for selectively rotating said tub means and for reciprocating said agitating means, said prime mover means including a stationary motor stator means, a motor rotor means rotatably drivably connected to said tub means and reciprocatingly drivably connected to said agitating means and supported in said motor stator means for rotational and axial movement relative to said motor stator means, said motor rotor means having a first position below the motor stator means and a second position at the magnetic center of said motor stator means, and spring means for biasing said motor rotor means to said first position, said motor stator means being energizable in one manner to pull said motor rotor means to said second position thereby to store energy in said spring means for return movement of said motor rotor means to said first position when said motor stator means is deenergized thereby to reciprocate said agitating means, said motor stator means being energizable in another manner to rotate said motor rotor means in said second position thereby to rotate said tub means, and means for periodically energizing said motor stator means in said one manner to facilitate the continuous reciprocation of said agitating means.

2. In a washing machine, tub means, means for agitating in said tub means, means for rotatably supporting said tub means, and prime mover means for selectively rotating said tub means and for moving said means for agitating, said prime mover means including a stationary motor stator means, a motor rotor means selectively drivably connected to said tub means and said means for agitating and supported in said motor stator means for rotational and axial movement relative to said motor stator means, said motor rotor means having a first position outside the motor stator means and a second position substantially at the magnetic center of said motor stator means, means for biasing said motor rotor means to said first position, said motor stator means being energizable in a first manner to repeatedly move said motor rotor means to said second position thereby to store energy in said biasing means for return movement of said motor rotor means to said first position when said motor stator means is deenergized thereby to continuously reciprocate said means for agitating, said motor stator means being energizable in a second manner to rotate said motor rotor means in said second position thereby to rotate said tub means, and control means in power supply relationship to said motor stator means and operable to energize said motor stator means in said first or second manner.

3. The washing machine of claim 2 wherein said control means includes a solid state switching device and a timing circuit operatively associated with said device for periodically passing power to said motor stator means in said first manner to effect the movement of said means for agitating.

4. The washing machine of claim 3 wherein said control means includes means in shunt relationship to said solid state switching device and said timing circuit for continuously passing power to said motor stator means in said second manner to effect the rotation of said tub means.

5. In a washing machine, tub means, means for agitat-

ing in said tub means, means for rotatably supporting said tub means, and prime mover means for selectively rotating said tub means and for moving said means for agitating, said prime mover means including a stationary motor stator means having a substantially vertical axis, a motor rotor means selectively drivably connected to said tub means and said means for agitating and supported in said motor stator means for rotational and axial movement relative to said motor stator means, said motor rotor means having a first position outside the motor stator means and a second position at the magnetic center of said motor stator means, said motor stator means being energizable in a first manner to repeatedly pull said motor rotor means to said second position thereby to store gravitational energy in said motor rotor means for repeated return movement of said motor rotor means to said first position when said motor stator means is deenergized thereby to continuously reciprocate said means for agitating, said motor stator means being energizable in a second manner to rotate said motor rotor means in said second position thereby to rotate said tub means, and control means in power supply relationship to said motor stator means and operable to energize said motor stator means in said first or second manner.

6. In a washing machine, tub means, agitating means for agitating in said tub means, means for rotatably supporting said tub means, and prime mover means for selectively rotating said tub means and for moving said agitating means, said prime mover means including a stationary motor stator means, a motor rotor means selectively drivably connected to said tub means and said agitating means and supported in said motor stator means for rotational and axial movement relative to said motor stator means, said motor rotor means having a first position displaced from the magnetic center of the motor stator means and a second position closer to said magnetic center than said first position, means for biasing said motor rotor means to said first position, said motor stator means being energizable in a first manner to repeatedly move said motor rotor means to said second position thereby to repeatedly store energy in said biasing means for return movement of said motor rotor means to said first position when said motor stator means is deenergized thereby to continuously reciprocate said agitating means, said motor

stator means being energizable in a second manner to rotate said motor rotor means in said second position thereby to rotate said tub means, and control means in power supply relationship to said motor stator means and operable to energize said motor stator means in said first or second manner.

7. In a washing machine, tub means, means for agitating in said tub means, means for rotatably supporting said tub means, and prime mover means for selectively rotating said tub means and for moving said means for agitating, said prime mover means including a stationary motor means, a rotatable motor means selectively drivably connected to said tub means and said means for agitating and supported adjacent said stationary motor means for rotational and axial movement relative to said stationary motor means, said rotatable motor means having a first position displaced from the magnetic center of the stationary motor means and a second position closer to said magnetic center than said first position, means for biasing said rotatable motor means to said first position, one of said motor means being energizable in a first manner to repeatedly move said rotatable motor means to said second position thereby to store energy in said biasing means for return movement of said rotatable motor means to said first position when said one of said motor means is deenergized thereby to continuously reciprocate said means for agitating, said one of said motor means being energizable in a second manner to rotate said rotatable motor means in said second position thereby to rotate said tub means, and control means in power supply relationship to said one of said motor means and operable to energize said one of said motor means in said first or second manner.

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