Feb. 22, 1949. J. W. McNAIRY 2,462,657

CLUTCH AND BRAKE MECHANISM

Filed Dec. 8, 1945

Fig. 2.

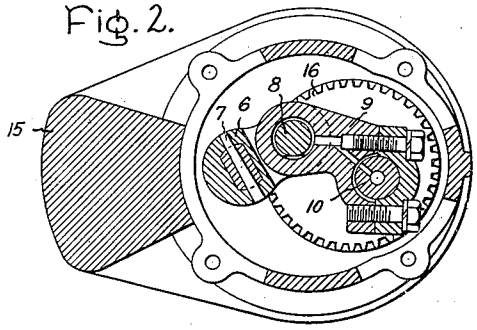


Fig. 1.

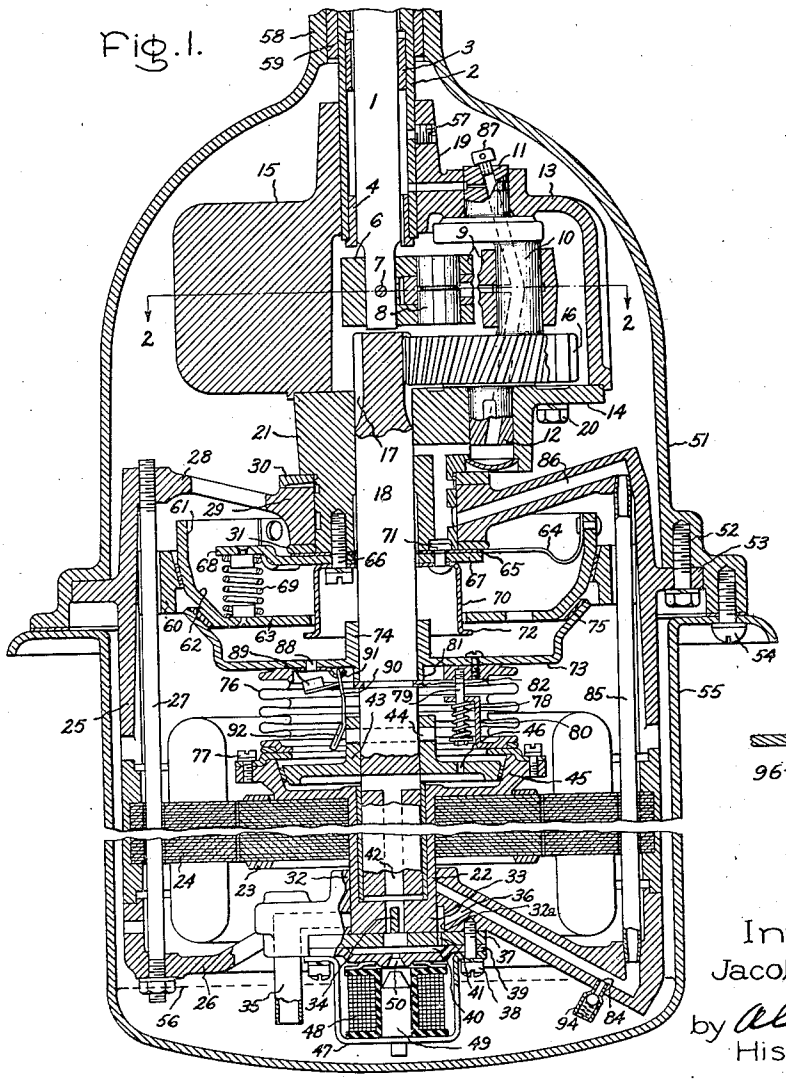
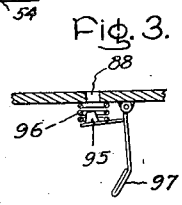


Fig. 3.



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CLUTCH AND BRAKE MECHANISM

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2 Claims. (Cl. 192—18)

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The present invention relates to clothes washing machines of the type comprising a tub, a spin basket in the tub, and a washing mechanism in the spin basket, the spin basket being disconnected from the driving motor and held stationary while the washing mechanism is operated to perform the washing operation and being then connected to the driving motor and rotated at relatively high speed to extract water from the clothes. It relates particularly to such machines wherein the electric motor for the machine is connected to the spin basket by a fluid actuated clutch. Such a machine is shown in my application, Serial No. 551,105, filed August 25, 1944; also in the application of Thomas T. Woodson, Serial No. 551,096, filed August 25, 1944, both assigned to the same assignee as my present invention.

The object of my invention is to provide certain improvements hereinafter described in a washing machine of the above referred to type, and for a consideration of what I believe to be novel, and my invention, attention is directed to the following specification and to the claims appended thereto.

In the drawing, Fig. 1 is a sectional view, partly broken away, of a washing machine mechanism embodying my invention; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; and Fig. 3 is a detail view of a modification.

Referring to the drawing, 1 and 2 indicate inner and outer shafts respectively, shaft 1 being the shaft which drives the washing mechanism, an oscillating agitator in the present instance, and shaft 2 being the shaft which drives the spin basket. Shaft 1 is journaled in suitable bearings in shaft 2, two of which are shown at 3 and 4. At its upper end, it is suitably connected to the washing machine agitator (not shown). At its lower end, it is fixed to a crank arm 6 by a pin 7. The free end of crank arm 6 is connected by a pin 8 to the free end of a second crank arm 9 journaled on a crank pin 10. Crank pin 10 has stub shafts 11 and 12 journaled in the upper and lower walls 13 and 14 of a gear housing or frame 15. On crank pin 10 is a gear wheel 16 which meshes with gear teeth 17 formed on the upper end of a shaft 18. Upper wall 13 is an integral part of the frame 15 and is provided with an upwardly projecting neck 19. Lower wall 14 is attached to the frame by a ring of bolts 20 and is provided with a downwardly extending neck 21 in which the upper end of shaft 18 is journaled. The lower end of shaft 18 projects into and is journaled in a tubular shaft 22 which is the shaft of the electric motor for the washing machine. Carried by shaft 22 is the motor armature 23. The stator of the motor

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is indicated at 24. The stator comprises a frame 25 having a lower head 26 fixed in place by suitable rods 27.

Formed integral with the upper end of stator frame 25 is a wall 28 provided at its central portion with a bearing sleeve 29 in which the lower end of neck 21 is journaled. At 30 and 31 are upper and lower thrust collars which engage the upper and lower surfaces of bearing sleeve 29. Thrust collar 30 serves to take the downward thrust of neck 21 and the parts carried thereby. Thrust ring 31 serves to take upward vertical thrust.

Formed integral with lower head 26 of the motor frame are walls which define a bearing 32 in which the lower end of shaft 22 is journaled and below bearing 32 are walls which define a pump cavity 32a into which projects the lower end 33 of motor shaft 22. In the present instance, a pump of the positive displacement, eccentric type, is illustrated, the pump housing being eccentric to shaft end 33 and the shaft end being provided with suitable pump blades 34 which are movable radially and which sweep along the inner surface of the eccentric pump housing. The inlet conduit for the pump is indicated at 35 and the discharge conduit is indicated at 36. This is a known type of pump the operation of which is well understood. The lower side of the pump housing is closed by cover plate 37 fastened in position by screws 38 which serve also to fasten in place a dished plate 39 which defines beneath cover plate 27 a chamber 40 which is connected to the discharge side of the pump by a passage 41 in cover plate 37. Chamber 40 is connected by a vertical passage 42 formed in head 33 and the lower end of shaft 18 to the underside of a clutch disk 43 connected to the shaft 18 by a pin 44. Clutch disk 43 has on its tapered edge a clutch facing adapted to engage a clutch face on a clutch ring 45 carried by the rotor 23 of the motor, it being formed integral with motor shaft 22. In clutch disk 43 is a relatively small opening 46, the purpose of which is hereinafter described.

Attached to the underside of disk 39 by screws 38 is a yoke 47 which serves to hold in place an electromagnet 48 provided with a plunger 49 which serves as a valve adapted to close an opening 50 in disk 39. When plunger 49 is in the position shown in the drawing, fluid pressure which enters chamber 40 from the discharge side of the pump through passage 41 flows out through opening 50 so that pressure is not built up in chamber 40. When the electromagnet 48 is energized, plunger 49 seats against opening 50, closing the same and permitting the building up of pres-

sure in chamber 40 to effect flow of fluid under pressure through the passage 42 to the space beneath clutch disk 43.

Motor frame 25 is attached to the upper portion 51 of a housing which encloses the operating parts of the mechanism by a ring of screws 52 which attach a flange 53 on the motor frame to housing portion 51. Attached to housing portion 51 by a ring of screws 54 is a lower housing portion 55 which encloses the lower portion of the mechanism. In the bottom of housing portion 55 is a suitable supply of fluid, such as oil, the level of which is indicated at 56. The admission conduit 35 for the eccentric type pump projects down beneath the level of the oil in the bottom of housing portion 55.

Tubular shaft 2 is fixed in neck 19 on wall 13 by a set screw 57 so that it is rigidly attached to the gear housing or frame 15. It is journaled in a neck 58 which forms a part of upper casing portion 51, a bearing lining for the tubular shaft being indicated at 59. At its upper end, tubular shaft 2 is suitably connected to the spin basket (not shown).

Gear housing or frame 15 is normally held stationary by a brake structure comprising a stationary brake ring 60 formed integral with the motor frame with which engages a brake lining carried by a movable brake and clutch member 61 which is in the form of a dished plate having a side wall 62 and a bottom wall 63. Brake and clutch member 61 is connected to the lower end of neck 21 by a plurality of radially extending, axially yieldable, spring driving arms 64 formed integral with a central ring 65 attached to neck 21 by a ring of screws 66. Screws 66 serve to hold in place also a disk 67 having a plurality of spaced radial arms 68 located between arms 64. Three arms 64 and three arms 68 are indicated in the drawing and form a satisfactory number. Arranged between arms 68 and the inner surface of wall 63 are springs 69 which serve to bias brake and clutch member 61 downward into engagement with brake ring 60. Screws 66 serve to hold in place also a cup 70 which is riveted to ring 65 and disk 67 as is indicated at 71. Cap 70 extends through an opening in wall 63 and is provided with a flange 72 which is positioned beneath the wall. Cup 70 is utilized in assembling the mechanism. It performs no function after the mechanism has been assembled. In manufacture, brake and clutch member 61, ring 65, disk 67, springs 69 and cup 70 are assembled and connected together by rivets 71, thus providing a unitary structure for connection to neck 21. Springs 69 are placed under initial tension during the assembling of these parts and the flange 72 on cup 70 serves to hold the assembly together until it is positioned in the mechanism.

Slidably mounted on drive shaft 18 is a clutch disk 73, it having an integral collar 74 adapted to slide on shaft 18 and a clutch lining 75 adapted to engage brake and clutch member 61. It is fixed to and carried by the upper movable end of a corrugated bellows 76, the lower end of which is fixed to clutch ring 45, i. e., the motor rotor, by a ring of screws 77. It encloses clutch disk 43 as is shown clearly in the drawing. When bellows 76 is expanded by fluid pressure admitted to its interior, clutch member 73 is moved vertically to bring the friction clutch lining 75 into engagement with brake and clutch member 61 to connect the motor armature through the corrugated bellows 76, clutch member 73, brake and clutch member 61 and flexible arms 64 to frame 15 which in turn is connected to spin basket shaft 2. At the same time, the vertical movement of clutch member 73 serves to lift brake and clutch member 61 from engagement with brake ring 60. Clutch member 73 is biased to a position out of engagement with brake and clutch member 61 by a suitable number of compression springs 78 arranged between the heads of depending bolts 79 fixed to clutch member 73 and inturned flanges at the upper ends of brackets 80 fixed to the motor rotor. On the lower end of clutch collar 74 is an extension 81 which engages a snap ring 82 which is fixed to and forms an abutment on shaft 18 and which serves to force clutch disk 43 into positive engagement with its seat on clutch ring 45 and to limit collapsing movement of the bellows. Thus springs 78 serve both to move clutch member 73 from engagement with clutch member 61 and to seat clutch disk 43.

The eccentric oil pump is used also for supplying lubricant to the several bearings and to this end discharge conduit 36 is connected with a passage 84 which by a vertical pipe 85 is connected to passages 86 leading to the several bearings. Oil is also sprayed from a head 87 against the interior of casing portion 51 to effect cooling of the oil.

Normally, when the motor is not running, the parts stand in the positions shown in the drawing, clutch disk 43 being in engagement with clutch ring 45, clutch member 73 being out of engagement with brake and clutch member 61, and clutch and brake member 61 being in engagement with the brake ring 60. The engagement of brake and clutch member 61 with brake ring 60 serves to hold stationary the frame 15. Electromagnet 48 is deenergized so that plunger 49 stands in a position in which passage 50 is uncovered. If now the circuit on the motor is closed, the motor rotates and through clutch disk 43 rotates the shaft 18 which in turn through gear wheel 16 and crank arms 9 and 6 oscillates shaft 1 to effect the washing operation. At this time, the eccentric pump operates to supply oil under pressure through passage 84, pipe 85 and passages 86 to the several bearings which require lubrication.

When the washing operation is completed, an electric circuit is closed on electromagnet 48 energizing it to effect movement of plunger 49 to close passage 50, thus shutting off the by-pass from chamber 40. Pressure now builds up in chamber 40 effecting flow of oil under pressure through passage 42 to the underside of clutch disk 43. The pressure effects vertical movement of clutch disk 43 thus moving shaft 18 axially to disconnect clutch disk 43 from clutch ring 45 to disconnect the motor armature from the agitator shaft 1. Axial movement of shaft 18 is limited by the upper end of the shaft engaging the lower end of shaft 1. Oil now flows around the periphery of clutch disk 43 to the interior of bellows 76, tending to effect expansion of the bellows to lift clutch member 73 into engagement with brake and clutch member 61, thus connecting the motor armature to shaft 2 through bellows 76, clutch member 73, brake and clutch member 61, spring arms 64 and frame 15. At the same time, expansion of the bellows lifts brake and clutch member 61 from engagement with brake ring 60. By friction between members 75 and 61 the motor now rotates the mechanism as a unit to turn the spin basket at high speed to extract the water from the clothes.

My invention has to do particularly with a mechanism which prevents the building up of fluid pressure in the bellows to effect expansion of the bellows until the motor has reached a predetermined high speed, for example, full speed, and which thereafter functions to regulate the pressure in the bellows to prevent overloading of the motor both while the load (i.e. the spin basket), is being brought up to speed and also thereafter. To this end, I provide in clutch member 73 a passage 88 which communicates with the interior of bellows 76 and is normally open for escape of fluid pressure from bellows 76 and which is automatically closed after the motor has reached a predetermined high speed, for example, full speed, to effect quickly the building up of pressure in the bellows; and which is thereafter opened and closed or adjusted and positioned by variations in motor speed to prevent overloading of the motor.

The means for closing opening 88 may be in the form of a centrifugally operated valve which is biased to open position and is closed when the speed of the motor reaches a predetermined high value. In the present instance, the centrifugally operated valve comprises a valve member 89 carried by an arm 90 pivoted on clutch member 73 as is indicated at 91. The valve is biased to open position by a weight 92. When the speed reaches a predetermined high value, weight 92 is thrown out by centrifugal force to bring valve member 89 into position to close the opening 88 and effect quickly the building up of pressure inside the bellows 76. The initial movement of bellows 76 lifts clutch member 73 into engagement with brake and clutch member 61 and lifts the brake and clutch member from engagement with brake ring 60. The pressure between clutch member 73 and brake and clutch member 61 is now controlled by the pressure in bellows 76 acting against springs 69 and this pressure in turn is controlled by valve member 89. The load to be rotated, i.e., the basket of clothes and water, must be started into rotation and gradually accelerated until full speed is reached. During acceleration of the load, clutch slippage is depended upon to prevent overloading of the motor. When the motor load exceeds a predetermined high value, the motor speed decreases and valve member 89 opens somewhat to permit escape of fluid pressure from bellows 76. This serves to decrease the pressure between the clutch members and permit increased slippage, thus decreasing the load on the motor. By this arrangement, variations in the speed of the motor are utilized to regulate the pressure in the bellows and through such pressure regulation, the load on the motor. The maximum pressure built up within the bellows may be limited by a suitable pressure relief valve 94 connected with the discharge side of the pump.

In Fig. 3 I have shown a modification of the centrifugally operated valve. In this modification, the valve member 95, corresponding to valve member 89 of Fig. 1, is cone-shaped and is biased to open position by a spring 96, the valve member 95 being closed against the action of the spring by weight 97.

After the extraction operation is completed, the circuits on the motor and on electromagnet 48 are opened. Opening the circuit on electromagnet 48 permits plunger 49 to move away from passage 50 permitting oil pressure to escape quickly from bellows 76. Springs 69 and 78 then operate to bring brake and clutch member 61 into engagement with the brake ring 60, separate clutch member 73 from brake and clutch member 61, and seat clutch disk 43 against clutch ring 45. The function of the opening 46 in clutch disk 43 is to insure complete seating of the clutch disk, it serving to permit oil to escape from beneath the clutch disk at the instant the clutch disk makes contact with its seat, thus preventing any trapping of oil which would prevent proper seating from taking place. The opening 46 is small enough that escape of oil through it will not prevent building up of pressure beneath clutch disk 43 when the clutch is to be released.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a washing machine or the like, the combination of a driven shaft, a driven brake and clutch member, axially yieldable arms connecting the driven brake and clutch member to the driven shaft, a brake ring, spring means opposing axial movement of said driven brake and clutch member which holds it in engagement with the brake ring, a driving shaft, a second clutch member, an axially expansible corrugated bellows connected at one end to said second clutch member and at the other end to said driving shaft, a fluid pump driven by the driving shaft for supplying fluid pressure to said bellows to effect expansion of the bellows to bring said second clutch member into engagement with said brake and clutch member to close the clutch and move the brake and clutch member axially from engagement with the brake ring, a discharge port for the bellows, a centrifugally operated valve for closing said port when the driving shaft speed reaches a predetermined high value, and means controlling the flow of fluid from the discharge side of the pump to the bellows.

2. In a washing machine or the like, the combination of a driven shaft, a driven brake and clutch member, axially yieldable arms connecting the driven brake and clutch member to the driven shaft, a brake ring, spring means opposing axial movement of said driven brake and clutch member, which holds it in engagement with the brake ring, a driving shaft, a second clutch member, an axially expansible corrugated bellows connected at one end to said second clutch member and at the other end to said driving shaft, a fluid pump driven by the driving shaft for supplying fluid pressure to said bellows to effect expansion of the bellows to bring said second clutch member into engagement with said brake and clutch member to close the clutch and move the brake and clutch member axially from engagement with the brake ring, means controlling the flow of fluid from the pump to the bellows, a motor for driving the driving shaft, walls defining a passage for flow of fluid from the bellows, a valve for closing said passage, and a speed responsive member connected to the valve which is biased to hold the valve normally in open position and effects closing of the valve when the speed of the driving shaft reaches a predetermined high value to regulate flow of fluid pressure from within the bellows.

JACOB W. McNAIRY.

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Certificate of Correction

Patent No. 2,462,657. February 22, 1949.

JACOB W. McNAIRY

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows:

Column 2, line 33, for the numeral "27" read *37*; column 6, line 52, claim 2, after the syllable "ber" strike out the comma;

and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of August, A. D. 1949.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.