

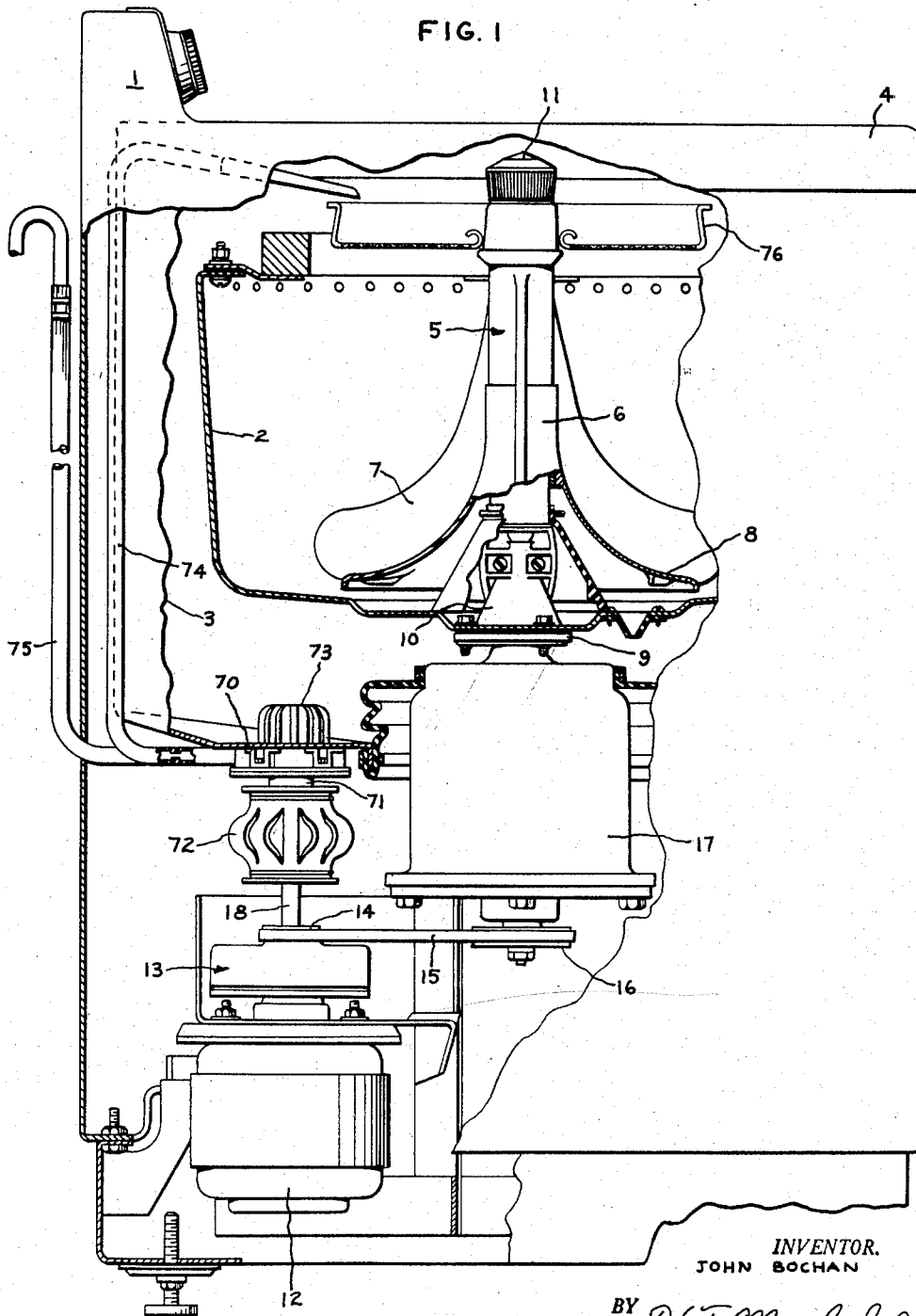
Jan. 20, 1959

J. BOCHAN
TWO SPEED DRIVE

2,869,699

Filed Dec. 12, 1956

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 2

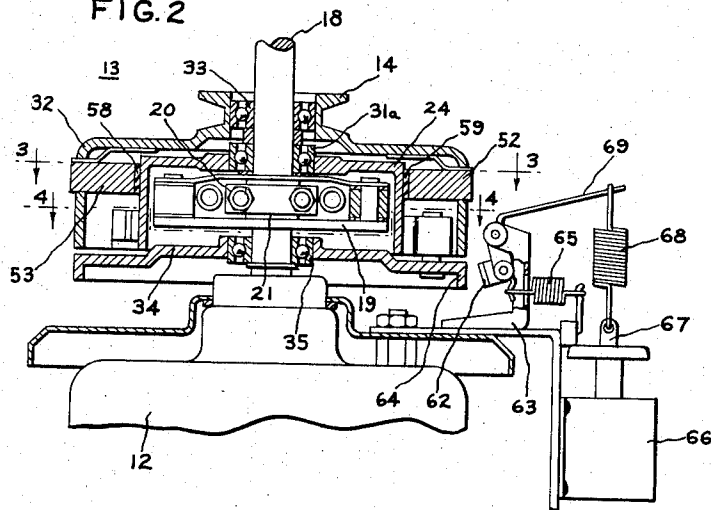


FIG. 3

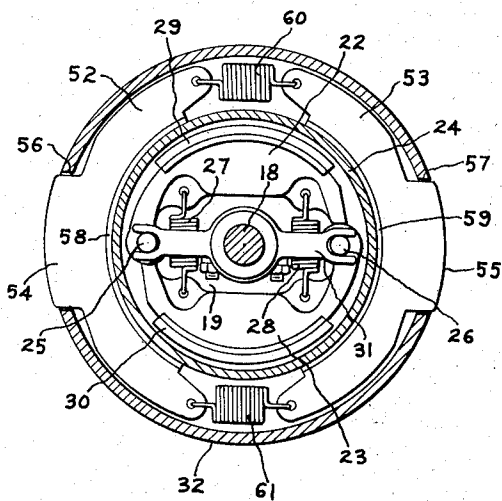
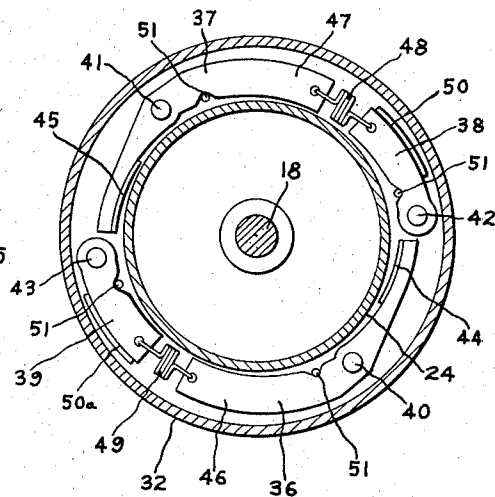


FIG. 4



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2,869,699

TWO SPEED DRIVE

John Bochan, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Application December 12, 1956, Serial No. 627,817

8 Claims. (Cl. 192—48)

My invention relates to drive mechanisms and more particularly to two speed drive mechanisms of the type intended particularly for use in washing machines.

In order to provide the proper washing and extracting actions for the various types of fabrics handled in domestic washing machines, it is desirable that the machines be capable of two different speeds of operation. In particular, in a vertical axis machine it is desirable that the agitator be moveable at two different speeds and that the wash or spin basket be rotatable at two different speeds. The high or normal speed operation of the agitator provides a strong washing action whereas the slower speed operation produces a more delicate washing action. Similarly the high speed rotation of the spin basket provides a strong centrifugal or drying action whereas the slower rotation of the basket provides a more delicate drying action. These two actions or speeds of the agitator and the spin basket are desirable because the same actions are not suitable for all types of fabrics. For example, the strong washing and drying actions required to wash and dry a load of heavy fabrics such as cotton materials are likely to cause rapid wearing or even tearing if applied to a load of delicate synthetic fabrics such as Orlon, nylon and the like. For such delicate fabrics the gentle actions provided by the slow speed agitation and the slow speed spin are much more suitable. On the other hand these gentle actions would not produce satisfactory results if applied to the load of heavy fabrics.

My invention is particularly directed to a new and improved drive arrangement for providing this two speed operation in a washing machine; and it has as its general object the provision of a drive arrangement which is effective to produce two different washing speeds and two different centrifugal extraction speeds of the machine from a drive motor having only a single speed.

Another object of my invention is to provide a new and improved clutch and governor mechanism for use in washing machines, which is effective at the selection of the operator to produce two different output speeds from a single input speed.

A further object of my invention is to provide an improved clutch and governor mechanism for use in automatic washing machines of the vertical axis type, which not only is effective to produce two different speeds of operation of the agitator and the spin basket but also produces a torque limiting action during the acceleration of the spin basket thus limiting the load on the drive motor.

My invention also has as its object the provision of an improved clutch and governor mechanism which is effective to produce two different output speeds from a single input speed solely through the means of speed responsive clutch members without any gears whatsoever being required.

In carrying out my invention in one form thereof, I provide a washing machine which includes suitable washing means and a drive motor for driving the washing means. In order to produce two different speeds of operation of

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the washing means a combination clutch and governor mechanism is connected between the washing means and the drive motor. This mechanism includes an input shaft which is driven by the motor and an output member which is arranged for driving the washing means. The output member is driven at its two different speeds by means of a rotatable drive member which is rotated by the input shaft. For driving the output member at its higher speed the mechanism includes coupling means which, when effective, couple the output member continuously to the drive member whereby the output member is driven at the speed of the input shaft. The coupling means may, however, be rendered inoperative at the selection of the operator, and when it is rendered inoperative, the output member is then driven at a predetermined reduced speed through governor means included in the mechanism. The governor means comprises speed responsive clutch means which normally clutch the output member to the drive member but which are unable to accelerate the output member beyond the predetermined reduced speed. With this acceleration limit the governor means is thereby effective to drive the output member at the reduced speed when the drive is through it. Thus depending upon the selection of the operator the mechanism may drive the washing means at either of two different speeds, the washing means being driven at a higher speed by the coupling means if the coupling means is released for operation and being driven at a lower speed by the governor or clutch means if the coupling means is rendered inoperative.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. My invention, however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side elevational view of a clothes washing machine including a preferred embodiment of my new and improved drive arrangement, the view being partially broken away and partially in section to show details;

Fig. 2 is a fragmentary elevational view showing the combination clutch and governor mechanism included in the drive arrangement, the mechanism being shown in section to illustrate details;

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 2.

Referring now to Fig. 1 I have shown therein an agitator type clothes washing machine 1. The machine 1 includes a clothes basket 2 which is disposed within an outer imperforate tub or casing 3. The tub 3 is in turn mounted within an appearance cabinet 4 which includes a hinged cover (not shown) for providing access to the clothes basket. At the center of the basket 2 there is positioned a vertical axis agitator 5 which includes a center post 6 and a plurality of radially extending vanes 7. The agitator is further provided with outwardly and downwardly flanged skirt 8 to which the vanes 7 are joined at their lower ends.

Both the clothes basket 2 and the agitator 5 are rotatably mounted. The basket is mounted on a flange 9 of a rotatable hub 10 and the agitator 5 is mounted on a shaft (not shown) which extends upwardly through the hub 10 and the center post 6. The agitator is secured to the shaft by means of an internally threaded nut or cap 11 at the top of the center post. During the cycle of operation of the machine 1, the agitator is first oscillated back and forth within the basket 2 to wash the clothes therein. Then after a predetermined period of this washing action, the basket 2 is rotated at high speed to extract centrif-

usually the washing liquid and discharge it into the outer tub 3. Following this extraction operation a supply of clean liquid is introduced into the wash basket for rinsing the clothes and the agitator is again oscillated. Finally, the basket is once more rotated at high speed to extract the rinse water and discharge it into the outer tub.

By my invention a new and improved drive arrangement is provided within the machine whereby both the agitator 5 and the clothes basket 2 may be driven at two different speeds. Specifically, the agitator 5 may be driven at a higher speed to produce a strong washing action and at a lower speed to produce a more delicate washing action. Similarly the wash basket 2 may be rotated at a high speed to produce a strong extraction operation and a somewhat slower speed to produce a more delicate extraction operation. As is pointed out hereinafter the operator may select whichever of these actions, strong or delicate, is suitable for the type of clothes she is washing.

In this drive arrangement the basket 2 and the agitator 5 are driven from a reversible motor 12. The motor 12 is provided with only a single set of run windings and always rotates at the same speed when energized, but the polarity of its starting winding may be reversed so as to cause the direction of rotation of the motor to reverse. In order to obtain two different speeds of operation for the agitator 5 and the basket 2, there is connected to the drive motor a combination clutch and governor mechanism 13. The mechanism 13 includes an output pulley 14 and depending upon the selection of the operator, the mechanism is effective to drive the pulley 14 at either the speed of the motor 12 or at a predetermined lower speed. In other words the mechanism is effective to provide a direct drive between the motor 12 and the output pulley 14 or alternately is effective to produce a reduced speed drive of the pulley 14. The construction and arrangement of the mechanism 13 to produce this action form an important aspect of my invention and are described hereinafter in detail.

The output pulley 14 of the two speed combination clutch and governor 13 is connected by means of a belt 15 to the input pulley 16 of a transmission assembly 17. The transmission 17 is so arranged that it supports and drives both the agitator drive shaft and the basket mounting hub 10. When the pulley 16 is driven in one direction by the output pulley 14 of the mechanism 13, the transmission causes the agitator 5 to oscillate within the basket 2. Conversely when the pulley 16 is driven in the opposite direction, the transmission drives the wash basket 2 and the agitator 5 together at a high speed for centrifugal extraction. Thus, the operation carried out, i. e., agitation or centrifugal extraction, is controlled by the direction of rotation of the drive motor, agitation occurring when the motor turns in one direction and centrifugal extraction occurring when it turns in the other direction. Whether the agitation and centrifugal extraction will be low speed or high speed depends upon the action of the mechanism 13. If the mechanism 13 provides a direct drive between the motor and pulley 14, high speed agitation and centrifugal extraction are effected, but if the mechanism provides a reduced speed drive, a lower speed agitation and centrifugal extraction are effected. The mechanism 13 incidentally is unaffected by the direction in which the drive motor is turning; it produces the same action no matter in which direction the drive motor is rotating.

With regard to the transmission assembly 17, it will be understood that this assembly forms no part of the present invention, and that any suitable transmission assembly may be used. However, reference is made to the copending application of James R. Hubbard et al. S. N. 420,594, filed April 2, 1954, and assigned to the same assignee as the present invention. That application discloses in detail the structural characteristics of a transmission assembly suitable for use in the illustrated machine.

Referring now to Figs. 2, 3, and 4 I have shown therein

the construction and arrangement of the two speed clutch and governor mechanism 13. The mechanism 13 as shown in Fig. 2 is mounted on the output shaft 18 of the drive motor 12 and it is driven directly by that shaft. In order to take off the motion of the drive shaft 18 for transmission to the output pulley 14, either directly or at a reduced speed, the mechanism includes a clutch carrier plate or member 19 which is attached to the drive shaft 18 for rotation therewith. The carrier plate 19, which comprises a generally horizontally extending oblong member, may be secured to the shaft 18 in any suitable manner but is shown in Fig. 2 as being secured to the shaft by means of a clamp 20. Specifically the carrier plate 19 is provided with an upwardly extending hub 21 and the clamp 20 clamps this hub 21 securely to the shaft 18.

The carrier plate 19 has mounted on it a pair of speed responsive or centrifugally operated clutch shoes 22 and 23 which are adapted to clutch the carrier plate 19 to an intermediate, independently rotatable, drum member 24 which is journaled on the shaft 18. This drum member 24 comprises an intermediate drive member of the mechanism 13 and, as is explained hereinafter, it is effective to drive the output member of the mechanism at two different speeds depending upon which of two alternately operable drive means is employed between them. As shown in Fig. 3 the clutch shoes 22 and 23 for driving the drum 24 are mounted respectively on the carrier plate 19 by means of mounting pins 25 and 26, and they are biased inwardly toward each other by means of a pair of tension springs 27 and 28 connected between them. Specifically, the tension springs 27 and 28 hold the shoes 22 and 23 in their illustrated position when the plate 19 is stationary so that the friction pads 29 and 30 provided on their outer surfaces do not engage the drum 24. In other words when the input shaft 18 is not rotating, the springs 27 and 28 prevent the clutch shoes 22 and 23 from clutching the input shaft to the drum 24. It will be noted incidentally that the clutch shoes 22 and 23 are positively held on their respective pivot pins 25 and 26 by means of a retainer member 31 which is mounted on the shaft 18 and which includes forked end portions fitted around the pivot pins and over the clutch shoes.

When the carrier plate 19 is rotated by the shaft 18, at that time the clutch shoes 22 and 23 tend to pivot outwardly on the pins 25 and 26 due to the centrifugal force created by their rotation. This tendency of the shoes to pivot outward is restrained by the springs 27 and 28 until such time as the centrifugal force becomes greater than the holding force of the springs. Then, however, the clutch shoes do pivot outwardly so that their friction surfaces 29 and 30 engage the drum 24. The drum 24 as shown in Fig. 2 is journaled on the shaft 18 by means of a ball bearing mount 31a and thus when it is engaged by the shoes 23 and 24, it begins to rotate with them and the carrier plate 19. If the load driven from the drum 24 is relatively light, as when the agitator 5 is being driven, then the shoes 22 and 23 will lock together the plate 19 and the drum 24 substantially immediately. If however, the load to be driven is a relatively heavy one, as when the spin basket 2 is to be accelerated from a dead stop with a full load of water, then slippage will occur between the clutch shoes and the drum. In other words the drum 24 will not be immediately rotated at the speed of the shaft 18 but rather will gradually pick up speed. This gradual acceleration provided by the slippage between the clutch shoes and the drum 24 limits the torque required from the motor and thereby prevents the motor from being overloaded as it accelerates the spin basket.

Positioned around the intermediate drive drum 24 is a second cup shaped drum 32 which comprises the output member of the mechanism 13. The output drum 32 includes the output pulley 14 as an integral part thereof and it is journaled on the shaft 18 by means of a ball bearing mount 33. The output drum 32 thus can rotate

relative to the shaft 18 so that it may be driven at a reduced speed as well as at shaft speed. As will now be explained, the output drum 32 is driven from the intermediate drum 24 and the manner of the drive means employed between the two drums determines whether the drum 32 is driven at input shaft speed or at a reduced speed.

In order to drive the drum 32 at shaft speed there is provided within the mechanism 13 a coupling means which is effective when operative, to couple the two drums 24 and 32 continuously together. This coupling means comprises a carrier plate 34 which is journaled on the shaft 18 by means of a ball bearing mount 35, and a plurality of speed responsive or centrifugally operated clutch shoes which are pivotally mounted on the plate 34. The carrier plate 34 being journaled on the shaft 18 may move relative to the shaft and in fact may be held stationary as it rotates, but normally due to friction in the bearing 35 it rotates with the shaft 18. This rotation, as will now be explained, results in the clutch means mounted on the carrier plate coupling together the intermediate drum 24 and the output drum 32 so that the drum 32 is driven at shaft speed.

To explain this action in detail it will be seen by reference to Fig. 4 that the clutch means mounted on the carrier plate 34 comprise four different shoes 36, 37, 38, and 39, these shoes being pivoted respectively on the plate 34 by mounting pins 40, 41, 42 and 43 attached to the plate. The clutches 36 and 37 are curved members including clutch surfaces 44 and 45 disposed on the opposite sides of their respective pivots from the heavier portions or weights 46 and 47 of the shoes. The friction surfaces 44 and 45 as shown are arranged to engage the outer surface of the intermediate drum 24 and upon rotation of the carrier plate 34 that engagement takes place. The weights 46 and 47 of the shoes 36 and 37 being thrown outwardly by the centrifugal force created by the rotation of carrier plate 34 cause the entire shoes 36 and 37 to pivot around their respective mounting pins so that the friction surfaces 44 and 45 engage the intermediate drum 24. This of course has the result of providing a positive drive between the drum 24 and the plate 34 so that the plate is positively driven at shaft speed. The friction surfaces of shoes 36 and 37 however engage the drum 24 only when the carrier plate 34 is initially rotated due to the friction of the bearing 35. When the carrier plate 34 is held stationary, the shoes 36 and 37 are then held in their normal position out of engagement with the drum 24 by means of the tension springs 48 and 49 which are connected respectively between the shoes 37 and 38 and the shoes 36 and 39.

The other two clutch shoes 38 and 39 on the carrier plate 34 are adapted to provide a positive connection between the carrier plate 34 and the output drum 32 upon the rotation of the carrier plate by the shoes 36 and 37. Specifically the shoes 38 and 39 are provided with friction pads 50 and 50a on their outer surfaces and upon the rotation of the carrier plate 34 the shoes are pivoted by centrifugal force so as to bring these friction pads into engagement with the inner surface of the drum 32. This, of course, firmly locks the output drum 32 to the carrier plate 34, and since the carrier plate is in turn locked to the intermediate drum 24 through the shoes 36 and 37, it has the result that the output drum is driven at shaft speed. It will be noted, however, that just as the clutch shoes 36 and 37 are normally maintained out of engagement with the drum 24 by the springs 48 and 49 when the carrier plate 34 is stationary, so the springs 48 and 49 are also effective to maintain the clutch shoes 38 and 39 normally out of engagement with the output drum 32. In other words only when the drum 24 rotates the carrier plate 34 through the clutch shoes 36 and 37 are the clutch shoes 38 and 39 pivoted to engage the output drum. When the carrier plate 34 is stationary, the shoes 38 and 39 do not contact the output drum 32 and it thereby may

rotate freely with respect to the carrier plate. It will be noted that suitable upstanding lugs 51 are provided on the carrier plate 34 to limit the movement of all of the shoes 36, 37, 38 and 39 under the force of the springs 48 and 49 when the carrier plate is stationary. These lugs specifically prevent the shoes from rubbing against the inner drum 24 when the carrier plate is stationary.

In summary with regard to the direct drive through the mechanism 13 whereby the output pulley 14 is driven at the same speed as the input shaft 18, it will be seen that the shaft 18 drives the clutch carrier 19 directly. The rotation of the carrier plate 19 is transmitted to the intermediate drum 24 by means of the centrifugally operated clutch shoes 22 and 23 mounted on the plate 19, and the movement of the intermediate drum 24 is in turn transmitted to the output drum 32 by means of the centrifugal clutch means mounted on the lower carrier plate 34. As pointed out above the carrier plate 34, unless restrained by control means, normally tends to rotate with the shaft 18 due to bearing friction in the bearing 35, and upon this rotation the speed responsive clutch shoes 36, 37, 38 and 39 mounted on the plate 34 act to clutch the output drum 32 to the intermediate drum 24. Specifically the shoes 36 and 37 clutch the intermediate drum 24 to the carrier plate 34 and the shoes 38 and 39 clutch the carrier plate 34 to the output drum 32. Thus, the intermediate drum 24, the carrier plate 34 and the output drum 32 all rotate as a unit and at shaft speed, so that a direct continuous drive is provided between the input shaft and the output drum causing the output drum and pulley to rotate at input shaft speed. This rotation of the output pulley 14 is, of course, transmitted to the transmission 17 to provide the normal or high speed drive for the agitator 5 and the spin basket 2.

In order to provide a reduced speed drive for the output pulley 14 and thereby for the agitator 5 and the spin basket 2, the combination clutch and governor 13 includes governor means whereby the output drum 32 may be driven from the intermediate drum 24 at a reduced speed instead of being driven at input shaft speed by the clutches mounted on the carrier 34. Specifically this governor means, whereby a reduced speed operation is provided, comprises a pair of speed responsive or centrifugally operated clutch shoes 52 and 53 which are carried by the output drum 32. The clutch shoes 52 and 53 comprise curved members which are positioned between the drum 32 and the intermediate drum 24 and they include respectively outwardly extending tabs 54 and 55 which fit into slots 56 and 57 in the wall of the outer drum. The engagement between the tabs 54 and 55 and their respective slots serve not only to mount the shoes 52 and 53 on the output drum but also provide a positive driving connection whereby the shoes may drive the outer drum. The fit between the tabs and the mounting slots 56 and 57 is, however, loose enough that the shoes 52 and 53 may slide inwardly or outwardly with regard to the outer drum. It will be noted that the two shoes each include a friction surface on their inner sides, the shoe 52 having a friction surface 58 and the shoe 53 having a friction surface 59, and that the shoes are normally biased by means of tension springs 60 and 61 connected between them so that these friction surfaces engage the intermediate drum 24. In other words when the inner drum 24 is at rest, it is contacted by the clutch shoes 52 and 53 so that as the inner drum begins to pick up speed, the outer drum 32 is driven from it through the clutch shoes 52 and 53.

As the output drum 32 accelerates, the centrifugal force created by its rotation begins to reduce the pressure with which the clutch shoes 52 and 53 engage the inner drum 24. The higher the speed of the output drum becomes, the smaller is the pressure between the clutch shoes and the inner drum, and the smaller is the torque which they can transmit to the outer drum. The shoes, in fact, begin to slip with regard to inner drum. When

a certain speed of the output drum is reached, the slippage between the shoes 52 and 53 and the inner drum 24 becomes such that the shoes are ineffective to increase the speed of the output drum 32 and its connected load any further. In other words they can supply the torque necessary to keep the output drum rotating at the same speed but they cannot supply any additional torque to increase the speed of the output drum any further. The output drum and its load thus stop accelerating and begin to rotate steadily at that particular speed. This point where the clutch shoes 52 and 53 slip sufficiently with regard to the intermediate drum 24 so that they stop accelerating the output drum 32 occurs at a speed well below the input shaft speed, and specifically occurs at the predetermined reduced speed of the output drum 32 which it is desired to transmit to the pulley 14 for the delicate operations of the agitator 5 and the basket 2. The speed of the output drum at which the shoes 52 and 53 so slip relative to the input drum may be controlled by proper selection of the springs 60 and 61 as compared with the weight of the clutch shoes. For example, in one embodiment of my two speed clutch and governor mechanism adapted for use in a washing machine having a 1750 R. P. M. drive motor, the shoes 52 and 53 stop accelerating the output drum 32 and begin to drive it at a steady speed when output drum reaches a speed of approximately 910 R. P. M. Thus a reduced speed drive of about 52% of the speed of the normal or high speed drive is provided.

During the direct or high speed drive of the output drum 32 through the clutches mounted on the carrier plate 34, the governor shoes 52 and 53 simply disengage from the intermediate drum 24 so that there is no drive through them. Thus in order for the governor shoes 52 and 53 to act as the driving means for the output drum 32, some means must be provided for rendering the direct coupling means inoperative i. e., for rendering inoperative the plate 34 and the clutches mounted thereon. In the illustrated embodiment this means for rendering the direct coupling means inoperative comprises a pivoted latch member 62 which is mounted on a stationary frame member of the machine 1 by means of a bracket 63. The latch member 62 is adapted to engage the peripheral flange 64 of the carrier plate 34 but is normally held out of engagement with the carrier plate by means of a biasing spring 65. So long as the latch 62 is held out of engagement with it, the carrier plate 34 will initially rotate due to bearing friction in the bearing 35 and the continuous, direct coupling will be provided between the intermediate drum 24 and the output drum 32 as described above. But when the latch 62 engages the flange 64 of the carrier plate, the carrier plate is held stationary and the direct coupling means are rendered inoperative so that the drive of the output drum is through the governor means.

In order to move the latch 62 into engagement with the carrier plate 34 there is provided a solenoid 66 whose armature 67 operates the latch through a spring 68 and a connecting arm 69. When the solenoid 66 is in its deenergized position illustrated in Fig. 2, the latch due to the tension of the spring 65 is held in its disengaged position. However, when the solenoid is energized, at that time the armature 67 is pulled downwardly causing pivoting of the arm 69 and the latch 62 so that the latch engages the flange 64 of the carrier plate 34. This engagement of the latch with the carrier plate holds the carrier plate stationary. In other words it locks the carrier plate so that it will not rotate due to bearing friction when the motor shaft 18 begins to rotate.

With the latch 62 holding the carrier plate 34 stationary, the coupling means mounted on the carrier plate remain inoperative. In other words the clutch shoes 36, 37, 38 and 39 remain in their normal positions illustrated in Fig. 4 wherein they engage neither the output drum 32 nor the intermediate drum 24. Thus no drive

can be provided through them, and the drive of the output drum must be through the shoes 52 and 53 mounted on it. The shoes 52 and 53, as pointed out above, provide a governing action when the drive is through them so that the output drum is driven at a predetermined speed lower than the input shaft speed. The shoes 52 and 53, of course, normally engage the intermediate drum 24 under the pressure of the spring 60 and 61 to drive the output drum 32. But as the shoes accelerate the output drum, the centrifugal force created by their rotation progressively reduces the pressure with which they contact the intermediate drum 24. Specifically, as the speed of the output drum becomes greater and greater, the pressure between the shoes 52 and 53 and the input drum 24 becomes less and less until the shoes actually begin to slip with regard to the drum 24. As the contact pressure decreases and the shoes begin to slip, the amount of torque which the shoes can transmit to the output drum 32 also decreases. The greater the speed of the output drum 32 becomes, the less is the torque which the clutch shoes 52 and 53 can transmit to it. Thus a point or speed of the output drum is ultimately reached at which the torque transmitted by the shoes 52 and 53 is equal to the torque needed to drive the drum at that speed with no additional torque being available to accelerate the output drum any further. In other words the shoes are transmitting enough torque to maintain the output drum at that particular speed but cannot transmit any additional increment of torque to increase its speed. The shoes thus act as speed governing means whereby the output drum and its connected load are driven at this speed in a steady state condition. The speed at which this speed limiting or governing action of the shoes 52 and 53 occurs, is well below the input shaft speed so that the result is that a reduced speed operation of the output pulley and its connected load is produced.

Summing up with regard to the reduced speed operation of the clutch, it will be seen that in order for this drive to be effected the solenoid 66 must be energized so as to lock the carrier plate 34. With the carrier plate 34 held stationary the coupling means or centrifugal clutches mounted thereon are ineffective to provide a continuous direct drive between the inner drum 24 and the output drum 32. Thus the drive instead of being through the carrier plate 34, occurs through the governor shoes 52 and 53 mounted on the output drum. These shoes in the manner pointed out above provide a governing action causing the output drum to be driven at the desired reduced speed. This reduced speed drive of the output drum is, of course, transmitted to the transmission 17 to produce the low speed action of the agitator 5 and the spin basket 2. With regard to the electrical control circuit for controlling the solenoid 66 it will be understood that any suitable circuit may be used since the circuit forms no part of the present invention. One particularly suitable control circuit is, however, described and claimed in the copending application of Wallace H. Henshaw, Jr., S. N. 627,821 filed concurrently herewith and assigned to the same assignee as the present invention.

It will be noted incidentally that since the drive is through carrier plate 19 and drum 24 during the reduced speed drive as well as during the direct drive, that the clutch means 22 and 23 mounted on the carrier plate 19 are effective to provide a motor protective, torque limiting action during the reduced speed operation just as in the high speed operation. When the spin basket is accelerated for a reduced speed spin operation, just as when accelerated for a high speed spin operation, slippage will occur between the clutch shoes 22 and 23 and the intermediate drum 24 so as to limit the torque required from the motor. In other words, it will prevent an overload from being applied to the motor.

In summation with regard to the mechanism 13 as a whole it will thus be seen that it includes coupling means

whereby a continuous direct drive may be provided between the input shaft 18 and the output member 32, and it further includes governing means whereby a reduced speed drive may be provided between the input shaft and the output member. If the solenoid 66 is de-energized so that the carrier plate 34 is not held stationary, in that case the direct coupling means are operative so that the output drum is driven directly from the input shaft at shaft speed. On the other hand if the solenoid 66 is energized so as to latch the carrier plate 34 in place, in that case the drive is through the governing means so that a reduced speed operation is obtained. During both the reduced speed operation and the high speed operation the torque limiting means included within the clutch are effective so that the motor cannot be overloaded. Also, it will be particularly noted that both the high speed drive and the reduced speed drive are provided without the use of any gears whatsoever. Rather both drives are provided solely through the means of speed responsive or centrifugally operated clutch members.

As pointed out above, the operation of the mechanism 13 is unaffected by the direction in which the input shaft 18 is turning. In whichever direction the shaft is turning, the operation of the speed responsive clutch shoes is the same so that the same mechanical connections are provided through the mechanism.

Besides driving the two-speed combination clutch and governor mechanism 13, the drive motor 12 also serves to drive a pump 70 which is secured to the bottom wall of the tub 3 of the washing machine (see Fig. 1). Specifically the motor shaft 18 extends upwardly through the clutch 13 and is connected to the input shaft 71 of the pump by means of a flexible coupling 72. With this direct coupling between the motor and the pump 70, the pump is, of course, driven whenever the motor is in operation. The pump 70 during its operation withdraws liquid from the tub 3 through a suitable strainer assembly 73 mounted over its inlet.

In the illustrated embodiment the pump 70 is a bi-directional pump which discharges into one of two outlets depending upon the direction of pump rotation. A bi-directional pump of this sort is described in detail and claimed in my copending application S. N. 468,460, filed November 12, 1954, and assigned to the same assignee as the present invention. In the machine 1 one of the two outlets of the pump 70 is connected to a recirculation hose or conduit 74 for returning the liquid withdrawn from the tub to the basket 2; and the other of the outlets of the pump is connected to a drain hose 75 which is adapted to be connected or disposed for discharging the liquid to a stationary tub or drain line. During the direction of the motor rotation corresponding to the driving of the agitator 5, the pump output is discharged through the one outlet to the conduit 74 for return to the basket 2 through a filter 75 mounted on the agitator post. Conversely, upon rotation of the motor in the reverse direction for spinning the basket 2, the liquid is pumped through the other outlet to the conduit 75 and the drain. Thus, during the agitation the pump 70 causes a continuous overflowing of the basket 2 so that a continuous recirculation and filtering action is provided, whereas during spin or centrifugal extraction the pump empties the machine to the drain line.

Since the pump 70 is driven directly from the motor 12 rather than through the output pulley 14 of the mechanism 13, it will be seen that the pump 70 is driven at the same speed no matter whether the agitator 5 and the wash basket 2 are operating at normal speed or at reduced speed. The operation of the pump is thus completely unaffected by the speed at which the agitator and the spin basket are driven. At high speed or at reduced speed of these components the pump operates with equal effectiveness at motor speed. It would, of course, be very undesirable for the speed of the pump to be changed with the speed of the agitator and the spin basket since the pump obvious-

ly could not operate with good efficiency at both a high speed and a low speed.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and I, therefore, aim in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

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

1. A two-speed clutch and governor mechanism comprising an input shaft, an output member, an intermediate rotatable drive member, means for clutching said input shaft to said intermediate member upon the rotation of said shaft, coupling means for selectively coupling said output member to said intermediate member thereby to drive said output member at the speed of said input shaft, means for rendering said coupling means inoperative, and governor means for driving said output member at a predetermined reduced speed lower than input shaft speed when said coupling means are rendered inoperative, said governor means comprising speed responsive clutch means normally clutching said output member to said intermediate member but ineffective to accelerate said output member above said predetermined reduced speed, whereby said governor means prevent said output member from being driven above said predetermined reduced speed when said coupling means are inoperative.

2. A two-speed clutch and governor mechanism comprising an input shaft, an output member, direct drive means including a plurality of centrifugally operated clutches for connecting said output member directly to said input shaft thereby to drive said output member at a first speed, control means for selectively rendering said direct drive means inoperative, and governor means for driving said output member from said input shaft at a predetermined reduced speed lower than said first speed when said direct drive means are rendered inoperative, said governor means including speed responsive clutch means effective to accelerate said output member until said output member reaches said reduced speed and ineffective to accelerate said output member above said reduced speed whereby said output member is driven at said reduced speed by said clutch means.

3. A two-speed combination clutch and governor mechanism comprising an input shaft, an output drum, an intermediate rotatable drum, centrifugally operated clutch means for clutching said intermediate drum to said input shaft upon the rotation of said shaft, coupling means including a plurality of centrifugally operated clutches for selectively clutching said output drum to said intermediate drum thereby to drive output drum at the speed of said input shaft, control means for rendering said coupling means inoperative, and governor means for driving said output drum at a predetermined reduced speed lower than the input shaft speed when said coupling means are rendered inoperative, said governor means comprising centrifugally operated clutch means normally clutching said output drum to said intermediate drum but ineffective to accelerate said output drum above said reduced speed, whereby said output drum is driven at said reduced speed.

4. A two-speed combination clutch and governor mechanism comprising an input shaft, an output drum, an intermediate rotatable drum, centrifugally operated clutch means for clutching said intermediate drum to said input shaft upon the rotation of said shaft, coupling means for selectively coupling said output drum to said intermediate drum thereby to drive said output drum at the speed of said input shaft, said coupling means including a clutch carrier rotatably mounted on said input shaft and normally rotating with said shaft, and a plurality of said centrifugally operated clutches mounted

on said carrier for clutching said intermediate drum to said output drum upon the rotation of said carrier, control means for selectively holding said carrier stationary during the rotation of said input shaft thereby to render said coupling means inoperative, and speed responsive clutch means mounted on one of said drums for driving said output drum at a predetermined reduced speed when said clutch carrier is held stationary, said speed responsive clutch means normally clutching said output drum to said intermediate drum but reducing the clutching pressure as said output drum accelerates, whereby said speed responsive clutch means are ineffective to drive said output drum above said predetermined reduced speed.

5. A two-speed combination clutch and governor mechanism comprising an input shaft, an output drum, an intermediate rotatable drum, a first clutch carrier mounted on said input shaft and secured to said shaft for rotation therewith, a plurality of speed responsive clutch shoes mounted on said first carrier and arranged to engage said intermediate drum for clutching said intermediate drum to said input shaft upon the rotation of said shaft, coupling means for selectively coupling said output drum to said intermediate drum thereby to drive said output drum at the speed of said input shaft, said coupling means comprising a second clutch carrier journaled on said input shaft and normally rotating with said shaft, and a plurality of speed responsive clutches mounted on said second clutch carrier arranged to engage both of said drums upon the rotation of said second carrier, solenoid operated latch means for selectively holding said second clutch carrier stationary as said input shaft rotates, and governor means for driving said output drum at a predetermined reduced speed lower than input shaft speed when said second clutch carrier is held stationary, said governor means comprising speed responsive clutch means mounted on said output drum and normally engaging said intermediate drum, with said speed responsive clutch means being arranged to decrease the clutching pressure as the speed of the said output drum increases, whereby said speed responsive clutch means are ineffective to drive said output drum above said predetermined reduced speed.

6. A two-speed clutch mechanism including an input shaft, an output drum, a second rotatable drum driven from said input shaft at shaft speed, coupling means for selectively coupling said output drum to said second drum thereby to drive said output drum at the speed of said input shaft, said coupling means including a clutch carrier rotatably mounted on said input shaft and normally rotating with said shaft and a plurality of centrifugally operated clutches mounted on said carrier for clutching said output drum to said second drum upon the rotation of said carrier plate, control means

for selectively holding said carrier plate stationary during the rotation of said input shaft thereby to render said coupling means inoperative, and speed responsive clutch means mounted on one of said drums for driving said output drum at a predetermined reduced speed when said carrier plate is held stationary, said speed responsive clutch normally clutching said drums together but reducing the clutching pressure as said output drum accelerates, whereby said speed responsive clutch means are ineffective to drive said output drum above said predetermined reduced speed.

7. A two-speed clutch mechanism having an input member and an output member, said clutch mechanism including coupling means for driving said output member at the speed of said input member and governor means for driving said output member at a speed lower than the speed of said input member, said governor means comprising speed responsive clutch means normally connecting said output member to said input member but ineffective to connect said output member to said input member above said lower speed, and control means movable between two positions for controlling said clutch mechanism, said control means in one of said positions rendering said coupling means ineffective whereby said governor means drives said output member at the lower speed, and in the other of said positions rendering said coupling means operative whereby said coupling means drives said output member at the speed of said input member.

8. A two-speed clutch having an input member and an output member, said clutch mechanism including coupling means for driving said output member at the speed of said input member and governor means for driving said output member at a speed lower than the speed of said input member, said governor means comprising speed responsive clutch means normally connecting said output member to said input member but ineffective to connect said output member to said input member above said lower speed, and a solenoid movable between energized and de-energized positions for controlling said clutch mechanism, said solenoid in one of said positions holding said coupling means inoperative whereby said governor means drives said output member at the lower speed, and in the other of said positions releasing said coupling means for operation whereby said coupling means drives said output member at the speed of said input member.

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