

April 17, 1962

T. H. FOGT

3,029,624

WASHING MACHINE HAVING A PIVOTALLY MOUNTED PRIME  
MOVING SYSTEM WITH BELT TENSION ADJUSTING MEANS

Filed June 25, 1959

4 Sheets-Sheet 1

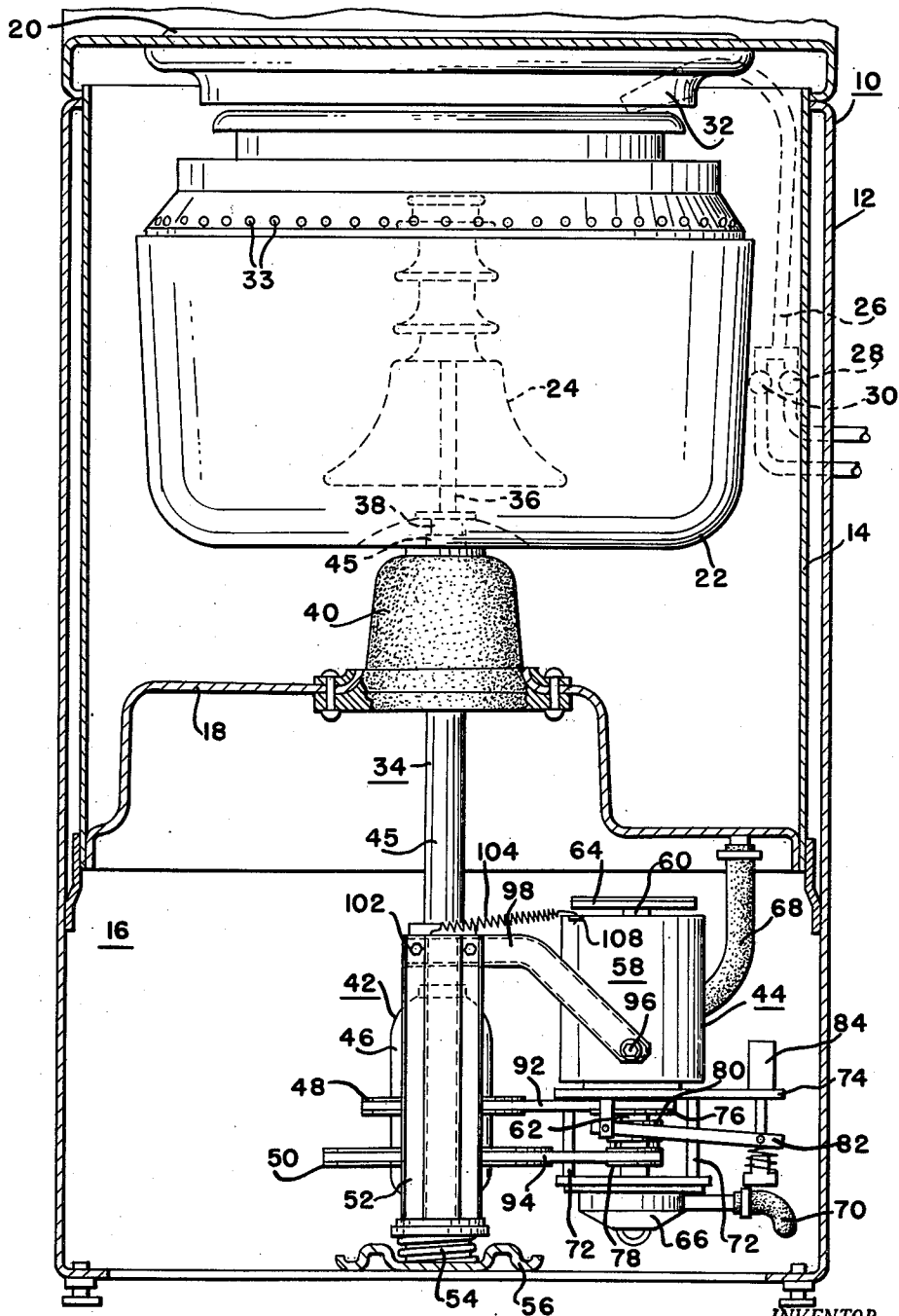


Fig. 1

INVENTOR.

Thomas H. Fogg

BY

*Frederick M. Ritchie*  
His Attorney

April 17, 1962

T. H. FOGT  
 WASHING MACHINE HAVING A PIVOTALLY MOUNTED PRIME  
 MOVING SYSTEM WITH BELT TENSION ADJUSTING MEANS

3,029,624

Filed June 25, 1959

4 Sheets-Sheet 2

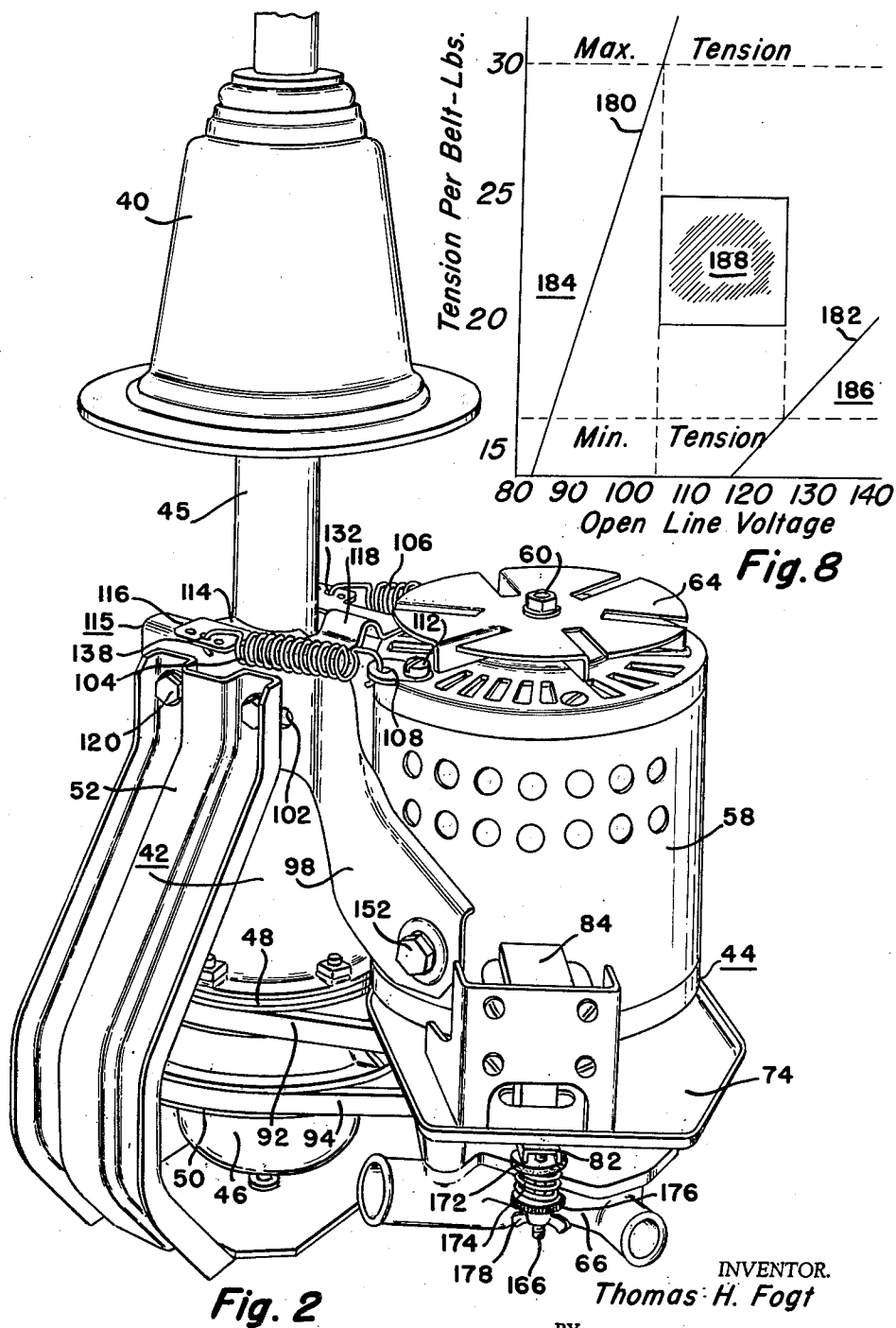


**Fig. 2**

**Fig. 8**

INVENTOR.  
 Thomas H. Fogg  
 BY  
 Frederick M. Ritchie  
 His Attorney

April 17, 1962

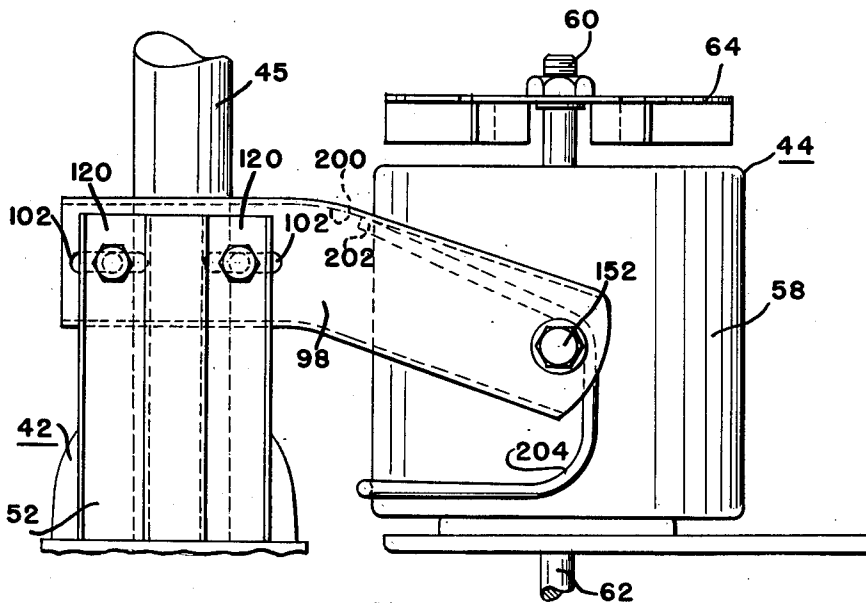
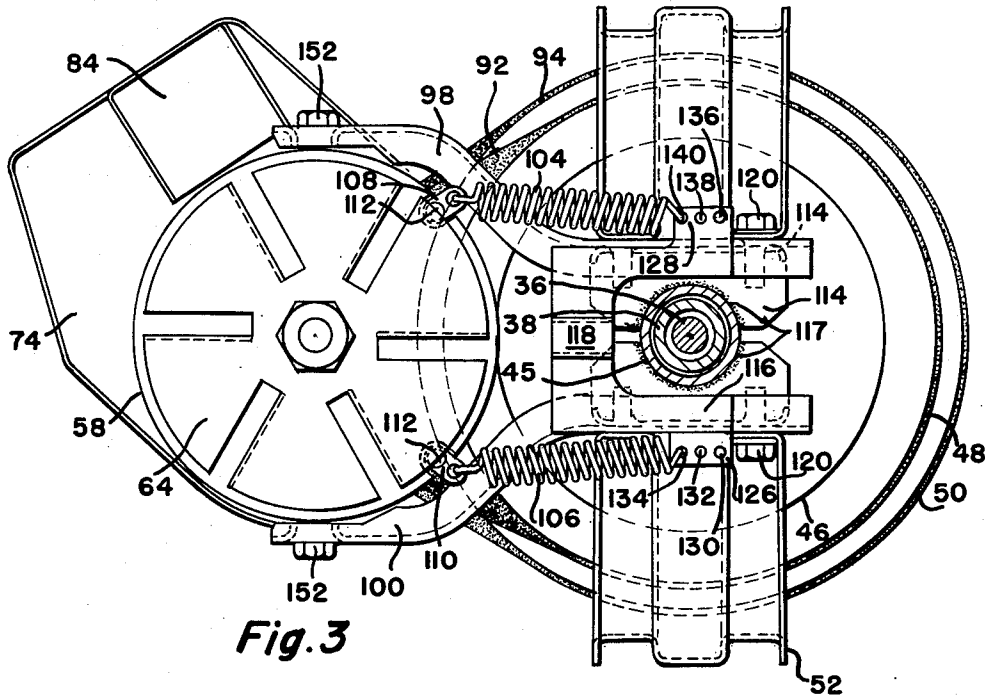
T. H. FOGT

3,029,624

WASHING MACHINE HAVING A PIVOTALLY MOUNTED PRIME  
MOVING SYSTEM WITH BELT TENSION ADJUSTING MEANS

Filed June 25, 1959

4 Sheets-Sheet 3



INVENTOR.  
Thomas H. Focht

BY  
*Frederick M. Ritchie*  
His Attorney

April 17, 1962

T. H. FOGT

3,029,624

WASHING MACHINE HAVING A PIVOTALLY MOUNTED PRIME  
MOVING SYSTEM WITH BELT TENSION ADJUSTING MEANS

Filed June 25, 1959

4 Sheets-Sheet 4

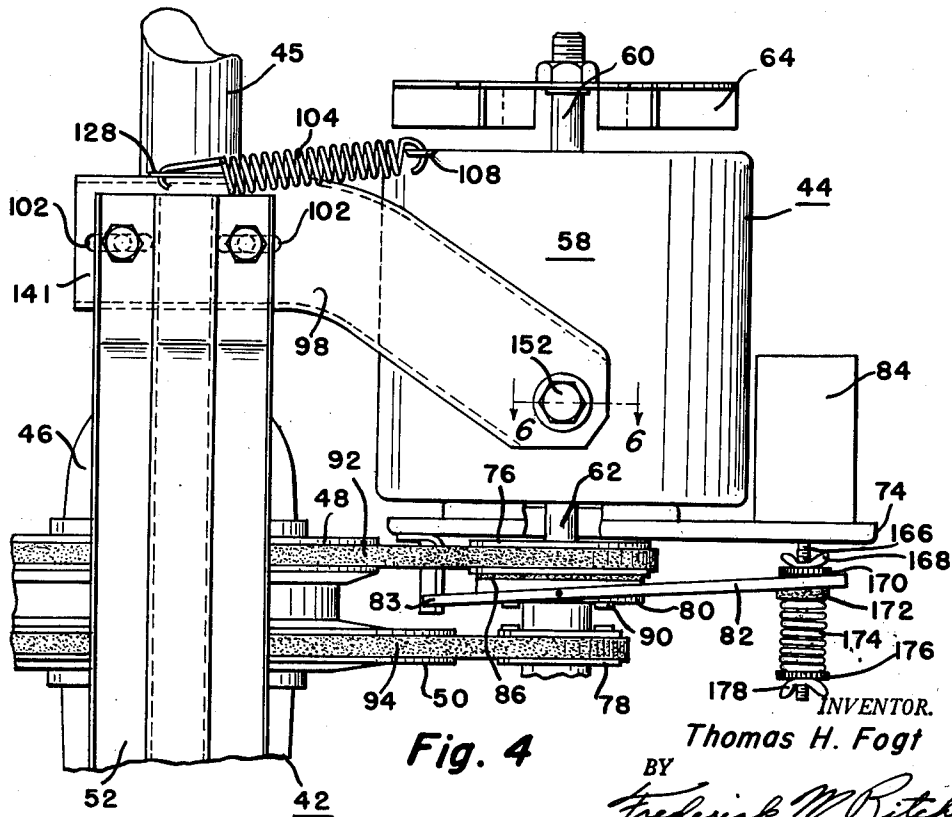
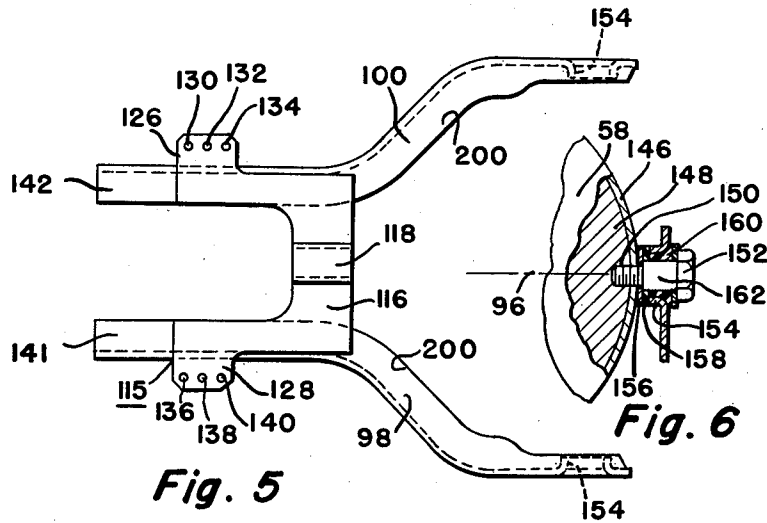


Fig. 4

INVENTOR.  
Thomas H. Fogg  
BY  
Frederick M. Ritchie  
His Attorney

1

3,029,624

## WASHING MACHINE HAVING A PIVOTALLY MOUNTED PRIME MOVING SYSTEM WITH BELT TENSION ADJUSTING MEANS

Thomas H. Fogt, Dayton, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Filed June 25, 1959, Ser. No. 822,877  
7 Claims. (Cl. 68—23)

This invention relates to a domestic appliance and more particularly to an improved prime moving system for a washing machine.

With the development of the many manmade fabrics, it is necessary to provide multiple speed operation for clothes washing apparatus. Consequently, many washing machines now provide two speeds of agitation and two speeds of spin. In this way, the delicate fabrics may be handled at the speed most suitable therefor. The addition of multiple speed action to washing machines has given rise to problems in the prime moving system of the machine. Where the motor is connected directly as by belts to the mechanism which actuates either agitate or spin, the problems attending motor acceleration are especially pronounced. It is important that maximum torque be exerted during the initial phases of agitate and spin acceleration. This requires that the start winding of a motor must be energized to meet this maximum torque and not dropped out until sufficient inertia is obtained to permit the motor to accelerate to its selected running speed. However, the requirement for a plurality of washing machine operating speeds has necessitated the use of differently sized pulleys in the prime moving system, for instance, a large pulley for high speed spin and a small pulley for low speed spin. Small pulleys, however, do not have sufficient diameter to provide enough wrap for the pulley belt to prevent slip during motor acceleration. This slipping in the past has been erratic and has resulted in undesirable cycling of the motor at its start winding cutout point, thereby causing excessive switch wear, a general delay in bringing the spin tub up to speed and overheating of the motor. It is to the solution of these problems that this invention is directed.

Accordingly, it is an object of this invention to provide a prime moving system which may be adjustably connected to an agitating and spinning mechanism.

It is also an object of this invention to provide a prime moving system for operating an agitate and spinning mechanism at a plurality of speeds and wherein said system is directly connected to said mechanism.

A further object of this invention is the provision of a prime moving system mounted adjacent an agitate and spinning mechanism and having a vertically mounted motor adjustably horizontally pivoted to said mechanism.

Another object of this invention is to provide an actuating mechanism for a clothes washer with a prime moving system including a vertically mounted power shaft and a pair of driving pulleys relatively rotatably mounted on said shaft and wherein one of said pulleys is adapted to slippingly drive said mechanism and the other of said pulleys is adapted to nonslippingly drive said mechanism.

A still further object of this invention is the provision for a multi-speed driving system adapted for belt connection to a driven agitate and spinning mechanism and wherein said system may be adjusted to vary selectively the tension on said belts.

A more specific object of this invention is the provision of an actuating mechanism for a clothes washer including an agitating and spinning mechanism and a prime moving system for said mechanism, said mechanism being adapted to produce a spinning operation when rotated in

2

one direction and an agitating operation when rotated in another direction, and said prime moving system having a vertically mounted motor horizontally pivoted on brackets adjustably connected to said mechanism, a pair of pulleys selectively rotated by said motor, a pair of driving belts engaging said pulleys and a pair of springs for pivoting said prime moving system in a manner to adjust selectively the tension on said belts and to compensate for belt wear or stretch.

Another object of this invention is the provision of adjusting means for a pair of belts connecting an agitate and spin mechanism to a prime moving system whereby one of said belts is slippingly interposed between said system and said mechanism and the other of said belts is nonslippingly interposed between said mechanism and said system.

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

In the drawings:

FIGURE 1 is a sectional view of a clothes washer adapted for use with this invention;

FIGURE 2 is a fragmentary perspective view of the actuating mechanism for the above clothes washer;

FIGURE 3 is a top elevational view of the actuating mechanism;

FIGURE 4 is an enlarged fragmentary side elevational view of the clothes washer actuating mechanism;

FIGURE 5 is an enlarged view of the motor mounting bracket assembly;

FIGURE 6 is a sectional view taken along line 6—6 in FIGURE 4 showing the pivot connection between the motor and motor mounting bracket;

FIGURE 7 is a fragmentary side elevational view of another embodiment of this invention; and

FIGURE 8 is a graph of belt tension versus open line voltage to determine desired areas of belt tensioning for accomplishing either slipping or nonslipping belt drive.

In accordance with this invention and with reference to FIGURES 1 and 2, the clothes washer 10 is shown as having an outer cabinet 12, an inner water container 14, an actuating mechanism compartment 16 and a bulkhead 18 separating in water tight relationship said water container 14 from said compartment 16. A top loading door 20 is hingedly mounted to said cabinet for access to the interior thereof. Within the clothes washer 10 a spin tub 22 is rotatably mounted. An agitator 24 is included within the tub 22 and adapted for vertical reciprocation. The clothes washer 10 may include a hot and cold water supply conduit 26 which is directed selectively by valves 28, 30 to a nozzle 32 overlying the top opening of the spin tub. Tub 22 also includes outlet ports 33 through which water may be centrifuged from the tub. Thus, the clothes washer 10 is provided with facilities to contain the clothes, to wash the clothes and to spin or centrifuge the water from the clothes at the conclusion of washing.

The compartment 16 is used to house an actuating mechanism 34 which is effective to reciprocate or pulse the agitator 24 at either 220 pulses per minute or 330 pulses per minute. Similarly, the actuating mechanism 34 may selectively rotate the spin tub 22 at either 330 revolutions per minute or 850 revolutions per minute. The actuating mechanism 34 is interconnected by a central solid shaft 36 to the agitator and by a concentric tubular shaft 38 to the spin tub 22. A resilient housing 40 aids in supporting the actuating mechanism 34 and provides a water-tight seal between the water container 14 and the actuating mechanism compartment 16.

The actuating mechanism 34 is comprised of an agi-

tate and spinning mechanism 42 and a prime moving system 44 for motivating the mechanism 42. More particularly, the agitate and spinning mechanism 42 includes a rotatable housing 46 which carries a high speed spin driven pulley 48 and a relatively larger pulley 50 which is driven in effecting selectively low speed spin (330 r.p.m.), low speed agitate (220 pulses per minute) and high speed agitate (330 pulses per minute). For partially supporting the agitate and spinning mechanism 42 and damping the vibrations thereof, a snubber bracket 52 substantially circumscribes the rotatable housing 46 on two sides. The snubber bracket 52 is mounted on a snubbing spring 54 to a channel 56 mounted in the bottom of the clothes washer 10. Thus, the mechanism 42 is carried by both the resilient mount 40 and the snubber bracket 52 to effect a resilient quietly operating support arrangement. For additional details relating to the agitate and spin mechanism 42, reference may be had to the Patent 2,758,685, issued August 14, 1956, to K. O. Sisson. It should be noted, however, that the teachings of this invention are not necessarily limited to the particular Sisson mechanism.

In addition to the agitate and spinning mechanism 42, the actuating mechanism 34 includes a prime moving system 44. This prime moving system 44 includes a reversible 4 pole, 6 pole, two speed, capacitor start motor 58 having an upper motor shaft extension 60 and a lower motor shaft extension 62. The motor shaft extension 60 extends upwardly to receive an impeller 64 which aids in the cooling of motor 58. The lower shaft extension 62 extends downwardly into a centrifugal pump 66 where it is utilized to pump water carried from the water container 14 through a conduit 68 to a discharge conduit 70. The pump 66 is supported at the lower terminus of support columns 72 affixed to a motor support bracket 74. On the motor shaft extension 62 between the motor support bracket 74 and the pump 66 are mounted the selectively operated drive pulleys 76 and 78. The top pulley 76 is utilized to rotate the housing 46 of the agitate and spinning mechanism 42 through the driven pulley 48 on said housing for high speed spin. The remaining functions of low speed spin, and high and low speed agitate are accomplished through the lower smaller drive pulley 78. Both pulleys 76 and 78 are relatively rotatably mounted on the motor shaft extension 62. A shifter clutch 80 is interposed between the upper pulley 76 and the lower pulley 78, the clutch being adapted to slide axially along the motor shaft but keyed thereto for rotation with the motor shaft 62. The clutch 80 is moved upwardly into engagement with the high speed spin drive pulley 76 or downwardly into engagement with the lower low speed spin, high and low speed agitate pulley 78 by a shifter yoke 82 operated by a solenoid 84. The clutch 80 includes a frictional material 86 (see FIGURE 4) on its upper surface to engage the lower surface of pulley 76. When the clutch 80 is raised, the frictional material 86 provides a locking frictional drive between clutch 80 and pulley 76. On the bottom, however, the clutch 80 is formed with dogs 90 to effect a dogged engagement with the lower agitate and low speed spin pulley 78. Thus, the energization of solenoid 84 will lift the shifter yoke 82 and the clutch to frictionally engage the upper high speed spin pulley 76, and the agitate and spin housing 46 will be rotated through high speed spin driven pulley 48. Conversely, the deenergization of solenoid 84 will cause the clutch 80 to be placed into dogged engagement with pulley 78 to rotate the housing 46 through agitate and low speed spin driven pulley 50. Interconnecting the upper pulleys 76 and 48 is a V-belt 92 and interposed between the lower pulleys 78 and 50 is a V-belt 94. For additional details relating to the construction of the shifter clutch 80, reference may be had to copending application Serial No. 738,330, filed May 28, 1958, now Patent No. 2,974,542, and assigned to a common assignee. For the purpose of this invention,

however, the general description of the clutch 80 is believed adequate.

The prime moving system 44 is pivoted for rocking movement about a horizontal axis 96 at one end of motor mounting or pivot brackets 98, 100. It is desirable that the horizontal axis extend through the center of mass for the prime moving system 44. In this way out-of-balance stresses are minimized and the life of the actuating mechanism 34 increased. The brackets 98, 100 are horizontally adjustable by means of slots 102 to position laterally the prime moving system 44 with reference to the agitate and spinning mechanism 42. The details of this adjustable arrangement will be described more fully hereinafter. For more critical adjustment of the prime moving system 44 relative to the agitate and spinning mechanism 42 and in particular the belt tensioning thereof, a pair of belt tension adjusting springs 104, 106 are adjustably interposed between the system 44 and mechanism 42.

The adjusting springs 104 and 106 are more clearly seen in FIGURES 2 and 3. The motor 58 is shown with a pair of ported tabs 108, 110 fastened as at 112 to the motor housing. A prime moving system attachment platform 114 is welded as at 117 to the fixed tubular housing 45 of the agitate and spinning mechanism 42. The motor mounting or system pivot brackets 98 and 100 are joined by a spring tension adjusting bracket 116 (FIGURE 5). The bracket 116 has an arcuate rise or rib 118 to compensate for tolerances between the motor mounting brackets 98 and 100 when fastened as by bolts 120 to the attachment platform or bracket 114 of the agitate and spinning mechanism. The tension spring adjusting bracket 116 is formed with side extension portions 125, 128. Spring adjusting ports 130, 132 and 134 are included in the bracket extension 126. Similarly, adjusting ports 136, 138 and 140 are formed in the bracket extension 128. As will be more clearly understood hereinafter, these ports are utilized to selectively tension the springs 104 and 106 to achieve the desired slipping characteristic between the lower drive belt 94 and the lower, relatively small agitate and low speed spin drive pulley 78. FIGURE 5 shows the motor mounting bracket assembly—the tension spring adjusting bracket 116 connecting the motor mounting brackets 98 and 100 as by any suitable fastening means, such as welding. It will be seen that the bracket 98 has an end portion 141 which overlies the mechanism affixed attachment platform bracket 114 at one side thereof. At the other side of the mechanism bracket 114, an end portion 142 is formed on the mounting bracket 100 to cooperate therewith. It is the extended motor mounting bracket portions 141 and 142 that have formed therein the prime moving system adjusting slots 102. Thus, the following steps are used to assemble the snubber bracket 52, the agitate and spinning mechanism 42 and the motor mounting bracket assembly 115.

As aforesaid, the agitate and spin mechanism 42 has attached to its fixed tubular housing 45 the mounting bracket 114. The mounting bracket 114 runs longitudinally along the shaft 45 for the depth of the attachment portions 141 and 142 of the pivot brackets 98 and 100. The snubber bracket 52 is placed in position around the rotatable housing 46 of the mechanism 42 and bolts 120 are inserted through ports at the top of the snubber bracket, through the slots 102 and then are threadedly engaged in a vertical wall of the mechanism mounting bracket or platform 114. As the bolts 120 are drawn tight, it may be seen that the arcuate hump 118 in the tension spring adjusting bracket 116 will provide the play necessary to compensate for any tolerance in the width of the mounting bracket 114 to which the pivot bracket extensions 141 and 142 are juxtaposed. Since the motor mounting bracket assembly 115 is secured to the mechanism 42 by means of the slots 102, the bracket assembly may be effectively moved laterally away from the fixed

tubular shaft 45 of the agitate and spinning mechanism 42. This is one means for adjusting the relative position of prime moving system 44 and agitate and spinning mechanism 42, as well as tensioning the belts 92 and 94 therebetween.

As pointed out in connection with FIGURE 1, the prime moving system 44 is pivoted at its center of mass 96. The details of this pivotal connection are seen in FIGURE 6. The motor 58 is shown as having an outer casing 146 enclosing the stator iron 148. A hole 150 is tapped into the stator iron to receive a pivot bolt 152. At each end of the motor, pivot brackets 98 and 100 are formed in turned flanged openings 154 through which bolts 152 insert. In assembling the motor 58 to the pivot brackets 98 and 100, a metal washer 156 is placed adjacent the motor casing 146 about the tapped opening 150. A resilient washer 158 is interposed between the steel washer 156 and the pivot bracket flanged opening 154. A resilient bushing 160 circumscribes an enlarged shank portion 162 of the bolt 152 to minimize vibration noise and wear transmitted from the motor 58 to the pivot brackets 98 and 100. The pivot assembly may be drawn tight by threading the bolt 152 into the tapped opening 150, the enlarged bolt portion 152 forming a shoulder which sets solidly on the metal washer 156. In this way, the prime moving system 44 is free for limited pivotal movement about the horizontal pivot axis 96 extending through the motor 58 between the mounting pivot bolts 152. By positioning the pivot axis at the center of mass for the prime moving system 44, there are no oscillations and, thus, the torque forces which could cause a relative lateral rocking movement between the prime moving system 44 and the agitate and spin mechanism 42 are eliminated.

It is also desirable to minimize vibration and noise at the shifter clutch 80. Reference may be had to FIGURE 4 wherein the clutch 80 is shown motivated by a clutch shifter yoke 82 pivoted at 83 by the solenoid 84. Service adjustments may be necessary on the shifter yoke 82 to position correctly the upper and lower face of the shifter clutch 80 in relation to the drive pulleys 76 and 78. For this purpose, the armature of the solenoid 84 acts on a threaded rod 166 which transmits solenoid motion to the shifter yoke 82. Yoke adjustment is accomplished by a wing nut 168, a knurled edge disc nut 170, a rubber washer 172, a spring 174, a knurled edge disc nut 176 and a wing nut 178. Thus, the position of the shifter yoke 82 along the threaded actuating arm 166 may be adjustably and resiliently positioned by the selective movement of nuts 168, 170, 176 and 178.

As aforesaid, the motor 58 is a reversible 4 pole, 6 pole, two speed induction motor. The motor includes a phase or start winding which is dropped out by the action of a centrifugal device of the type shown in the patent to Werner 2,182,977 issued December 12, 1939. When a motor of the type described is used in the prime moving system 44 and the washing machine 10 controlled in accordance with the automatic washing cycle taught in copending application Serial No. 748,412, now Patent No. 2,976,710, to Sisson et al., it is desirable that the start winding be cut out at approximately eighty percent of the selected running speed for the motor 58. This problem is made more critical in an actuating mechanism wherein the prime moving system 44 is directly connected through a plurality of belts to an agitate and spinning mechanism 42. Since the desired washing machine operating speeds are accomplished through the proper size selection of pulleys 76 and 48 and 78 and 50, it is necessary that the motor 58 be properly accelerated with the start winding properly dropped out under any of the speed conditions faced with two speed agitate and two speed spin. It will be noticed that the upper pulley 76 is greater in diameter than the lower pulley 78 and, thus, has more of the belt 92 in contact therewith than does the smaller pulley 78

with belt 94. In view thereof, a pulley-belt design which effects a correct driving relationship between clutch 80, spin drive pulley 76 and belt 92 will not produce a similar satisfactory driving connection between clutch 80, relatively small pulley 78 and belt 94. If a common pulley-belt design is used, inconsistent washer operation and unwanted cycling of the start winding cutout switch frequently results when the motor 58 is driving the agitate and spinning mechanism 42 through the smaller pulley 78 for high and low speed agitate and especially low speed spin. It should be stated that both the tub spin speeds of 330 r.p.m. and 850 r.p.m. are accomplished with the motor 58 operating in one direction and connected for 4 pole high speed operation. The difference is merely in the positioning of the clutch 80. When the clutch 80 is moved upwardly into engagement with pulley 76, the tub 22 is rotated at high speed or 850 r.p.m. When the clutch 80 is dropped into dogged relation with pulley 78, the tub 22 is rotated at 330 r.p.m.—the difference in spin speeds being accomplished solely due to the difference in size between drive pulleys 76 and 78 and their respective driven pulleys 48 and 50. Note also that at the initiation of each spinning operation, high or low speed, substantially the same torque is transmitted from the tub 22 to the prime moving system 44.

The problem which this invention is designed to overcome arises in a belt and pulley system wherein the size of a high speed spin drive pulley 76 permits a non-slipping engagement with its respective belt 92, but wherein the relatively small size of the low speed spin drive pulley 78 promotes a slipping engagement (uncontrolled and unpredictable) with its driven belt 94 due to insufficient belt wrap on the small pulley. On low speed spin as the motor 58 and, thus, the pulley 78 accelerate, the slip between pulley 78 and belt 94 continues. At the point where the centrifugal speed of the motor indicates a start winding cutout, the motor 58 is shifted solely onto its 4 pole run winding. As soon as the start winding is dropped out in a prime moving system 44 without this invention, the motor torque decreases to the point where it frequently is unable to continue accelerating the tub 22 into the selected low speed 330 r.p.m. speed. Thus, the motor 58 decelerates until the start winding is cut back in. This intermittent cycling on the start winding switch creates undesirable wear on the switch and slow undependable operation of the low speed spin. This invention, therefore, proposes a method for improving the prime moving system 44 and for controlling the slippage existing between the small pulley 78 and the belt 94 without altering the nonslipping drive connection between the high speed spin pulley 76 and its belt 92, and without placing the belt 92 in such tension that the motor 58 will be overburdened therefrom.

With reference to FIGURE 8, belt tension in pounds is plotted on the ordinate against the open line voltage available to the motor 58 along the abscissa. For the purposes of this invention, a nonslipping engagement is desired between the belt 92 and its drive pulley 76. To insure nonslip a raw edge V-belt 92 is selected. It is also determined to select a lower belt 94 which would provide a slipping engagement between belt 94 and pulley 78—a slipping engagement, however, that can be controlled by the concepts of this invention. For this purpose a neoprene coated belt 94 is selected, whose slipping or wear characteristics are substantially unchanged throughout its belt life. A straight line curve 180 is plotted on the graph to show the effect of the tensioning on the lower slipping belt 94. Similarly, curve 182 is symbolic of the effect of upper nonslipping belt 92 tensioning on the voltage draw of motor 58. In solving the above described problem, a belting arrangement is sought for a prime moving system 44 which could accomplish a controlled slipping drive through one of its belts and a nonslipping drive through another of its belts. It is also desired that the prime moving sys-

tem 44 be operated satisfactorily within ten percent under normal line voltage and ten percent over line voltage.

Utilizing the above system criteria and with reference to the lower belt curve 180, it should be noted that the graph area 184 indicates the operating conditions wherein the lower belt will cause undesirable start winding switch cycling, i.e. insufficient belt tension to accelerate the agitate and spin mechanism at a given line voltage. Similarly, an area 186 shows graphically the operating conditions in which the upper belt 92 will slip in spite of its raw edge characteristic, i.e. insufficient belt tension to transmit full motor power at excessive voltage to the agitate and spin mechanism 42. By extending the line indicative of ten percent under line voltage into engagement with the lower belt curve 180, a maximum tension of approximately thirty pounds is established for the lower belt. Conversely, by extending a line indicative of ten percent over line voltage into engagement with the upper belt curve 182, a minimum tension of approximately 16 pounds is established. With this graphic analysis, it was learned that a recommended operating range in which the slip of the lower belt 94 could be controlled lay between the belt tension curves 180 and 182 for the lower and upper belts respectively. The plus or minus ten percent voltage figures were selected as indicative of those conditions most likely to occur in normal domestic service and during clothes washer operation. To provide for additional factors of safety, a recommended range 188 was selected wherein the lower belt would slip in a predictable fashion and the top belt would effect a nonslipping drive. It should also be noted that a graph of motor wattage draw versus belt tension would also be a straight line function similar to that plotted in FIGURE 8. With this understanding, the upper and lower limits of the recommended range 188 were selected to provide a belt tension on the lower belt 94 which would neither produce too much slip nor too little slip. In the case of too much slip, for instance, the vertical reciprocating pulses of the agitator 24 would be less than the desired high speed agitate of 330 pulses per minute. Conversely, insufficient slip, i.e. belt tension too tight, would cause cycling on the start winding cut-out switch during low speed spin at under voltage conditions. These limiting factors were, thus, correlated into a recommended range 188 for the lower slipping belt 94 which would provide the desired pulse rate (330 pulses per minute) for agitation plus the desired low speed spin (330 r.p.m.) without repeated start winding switch cycling during motor acceleration. The graphic analysis of FIGURE 8, thus, permits us to select a belt tension which would provide a controlled slip after the motor start winding is cut out until tub load requirements are less than the transmission of the belt. Thereafter, the pulley 78 is effective to drive the agitate and spin mechanism 42 in a nonslipping manner to effect a low speed 330 r.p.m. spin.

The aforementioned components of this novel actuating mechanism 34 are correlated as follows to accomplish the desired results of this invention. The prime moving system 44 including the motor 58, the pulleys 76 and 78 and the pump 66 are mounted within the pivot brackets 98 and 100 at the system's center of mass established as along an axis 96 through the motor 58. The motor mounting bracket assembly 115 is loosely bolted to the mechanism affixed platform bracket 114 in juxtaposition to the snubber bracket 52. The nonslipping raw edged belt 92 is assembled about the pulleys 43 and 76. Similarly, the neoprene coated slipping belt 94 is placed about the pulleys 50 and 78. The belt adjusting springs 104 and 106 are placed with one of their ends connected respectively with the motor mounting tabs 108 and 110. The opposite ends of the springs 104 and 106 are placed in the center adjusting port 138 and 132 respectively. Thus, the prime moving system 44 is resiliently secured to the agitate and spin mechanism 42 by the springs 104 and 106 pivoting the system about the pivot bolts 152.

Next, with the bolts 120 loosened, the prime moving system 44 and the motor mounting bracket assembly 115 is moved laterally away from the agitate and spin mechanism 42. The slots 102 in the pivot brackets 98 and 190 permit this lateral movement. At the point where the tension on the top belt 92 is between 30 and 35 pounds, the four bolts 120 are tightened to securely position the prime moving system 44 with lateral reference to the agitate and spin mechanism 42. At this point, the bottom belt 94 will also be tensioned to a lesser extent than was top belt 92. However, the 30 to 35 pound tensioning of the top belt is the determining factor. The lateral outward movement of the prime moving system 44 to initially tension the top belt 92 also serves to accommodate any slight tolerance in belt size or matching between belts 92 and 94. Lastly, the springs 104 and 106 are selectively positioned in any remaining combination of the tension spring adjusting bracket ports 130, 132, 134 for spring 106 and ports 136, 138 and 140 for spring 104. With this last spring adjustment the proportion of tension on bottom to top belt is placed at about 2 to 3-20 pounds on the slipping belt 94 and 30 pounds on the non-slipping belt 92. It has been determined that a motor wattage draw of from 750 watts to 1000 watts during initial slipping accelerating drive between pulley 78 and belt 94 is satisfactory to produce the desired pulsing speeds of 220 and 330 pulses per minute, as well as the low speed tub spin of 330 r.p.m. It should also be observed that the wattage draw during slipping engagement of pulley 78 and belt 94 is increased by tightening the tensioning of springs 104 and 106. Conversely, a loosening of the springs 104 and 106 will reduce the wattage draw. The six ports in the tension spring adjusting bracket 116 permit five adjustment settings for the tension on lower belt 94.

A second embodiment of the applicant's invention is shown in FIGURE 7, wherein only the belt tension spring is shown. Both the prime moving system 44 and the agitate and spin mechanism 42 are the same in this embodiment as with that first described. In this arrangement, the motor mounting brackets 98 and 100 are also the same as in the preferred embodiment. Similarly, the brackets include the same adjusting slots 102 through which the bolts 120 act to adjust the lateral positioning of agitate and spin mechanism 42 from the drive motor 58. In this second embodiment, flanges 200 are used on the brackets 98 and 100 to support the ends 202 of a spring rod 204. From one pivot bracket flange 200 spring rod 204 is bent around the pivot bolt 152 and wrapped around the cylindrical casing of the motor 58 to the opposite side of the motor where it engages a similar flange 200 on the opposite motor mounting bracket 100. It should be pointed out that the spring rod 204 is a single piece and merely operates to bias the motor 58 in a counterclockwise pivoting direction, as seen in FIGURE 7. The continuous biasing effect of the spring rod 204 operates to maintain both the slipping and nonslipping belts under a different tension in the ratio of their distances from the pivot point through bolts 152. It is important to maintain this tension on the belts so that a controlled slip is effected during spin acceleration for the life of the belts 92, 94. The brackets 98 and 100 in this embodiment also may be moved in and out to get the desired initial belt tensioning as with the preferred embodiment. Note, however, that the FIGURE 7 arrangement does not have the sensitive adjustable spring belt tensioning which the preferred embodiment provides through the springs 104, 106.

It should now be seen that an improved prime moving system has been disclosed for an agitate and spinning mechanism, where such mechanism and such system are connected directly as by belts. A driving combination is utilized wherein a slipping engagement may be utilized to cushion acceleration shocks and wherein such slipping can be controlled at a desired slipping motor wattage by

the adjusting means of this invention. Further, resilient mounts are utilized to effect quiet operation. Still further, the prime moving system is mounted in a manner at its center of mass to eliminate the possibility of operating torques which could stress the mechanism. Lastly, this invention teaches a combined agitate and spinning mechanism and prime moving system therefor which is compact, easy to manufacture, simple to adjust and easily serviced.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In combination with a washing machine having a spin tub, an agitator, and an agitate and spin mechanism for rotating said tub and reciprocating said agitator, said agitate and spin mechanism having a spin driven pulley and an agitate and spin driven pulley connected thereto, a bracket for snubbing said mechanism, said bracket being attached to a portion of said mechanism, a prime moving system adjacent said agitate and spin mechanism and rockingly movable relative to said mechanism, said system having a motor, a motor shaft, a spin drive pulley relatively rotatably mounted on said shaft, an agitate and spin drive pulley relatively rotatably mounted on said shaft, a clutch on said shaft and interposed between said drive pulleys and a clutch operator for manipulating said clutch selectively into engagement with one of said drive pulleys, a prime moving system mounting bracket slidably attached at one end to said mechanism and pivotally mounted at the other end to said prime moving system about a horizontal axis, a nonslipping belt connecting said spin drive pulley and said spin driven pulley, a slipping belt connecting said agitate and spin drive pulley and said agitate and spin driven pulley, and means for selectively adjusting the tension on said belts.

2. An adjustable prime moving system horizontally pivotally connected at its center of mass to an agitate and spin mechanism comprising, a high and low speed motor having a start winding, a shaft for said motor, a pair of selectively powered drive pulleys on said motor shaft, one of said drive pulleys being relatively large and powered by said motor on high speed and the other of said drive pulleys being relatively small and powered on either high or low speed, a pair of driven pulleys on said agitate and spin mechanism in juxtaposition to said drive pulleys, a first belt interconnecting said relatively large drive pulley with one of said driven pulleys, a second belt interconnecting said relatively small drive pulley with the other of said driven pulleys, and means for selectively varying the tension on each of said belts to control the amount of slipping on one of said belts.

3. The prime moving system of claim 2 wherein said last named means includes means for laterally adjusting said system relative to said mechanism, and resilient means for pivotally adjusting said system relative to said mechanism.

4. In combination with a washing machine having a spin tub, an agitator, and an agitate and spin mechanism for rotating said tub and reciprocating said agitator, said agitate and spin mechanism having a spin driven pulley and an agitate and spin driven pulley connected thereto, a bracket for snubbing said mechanism, said bracket being attached to a portion of said mechanism, a prime moving system adjacent said agitate and spin mechanism and rockingly movable relative to said mechanism, said system having a motor, a motor shaft, a spin drive pulley relatively rotatably mounted on said shaft, an agitate and spin drive pulley relatively rotatably mounted on said shaft, a clutch axially slidably mounted on said shaft and interposed between said drive pulleys and a clutch

operator for manipulating said clutch selectively into engagement with one of said drive pulleys, a prime moving system mounting bracket slidably attached at one end to said mechanism and pivotally mounted at the other end to said prime moving system, a non-slipping belt connecting said spin drive pulley and said spin driven pulley, a slipping belt connecting said agitate and spin drive pulley and said agitate and spin driven pulley, and means for selectively adjusting the tension on said belts, whereby the prime moving system may be pivoted on said mounting bracket to effect a controlled amount of slip between said agitate and spin drive pulley and said slipping belt.

5. The combination of claim 4 wherein said belt tension adjusting means includes a selectively positioned spring between said system and said mechanism.

6. In combination with a washing machine having a spin tub, an agitator, and an agitate and spin mechanism for rotating said tub and reciprocating said agitator, said agitate and spin mechanism having a spin driven pulley and an agitate and spin driven pulley connected thereto, a bracket for snubbing said mechanism, said bracket being attached to a portion of said mechanism, a prime moving system adjacent said agitate and spin mechanism and rockingly movable relative to said mechanism, said system having a reversible, two speed, phase winding start motor, a motor shaft, a spin drive pulley relatively rotatably mounted on said shaft, an agitate and spin drive pulley relatively rotatably mounted on said shaft, a clutch axially slidably mounted on said shaft and interposed between said drive pulleys and a clutch operator for manipulating said clutch selectively into engagement with one of said drive pulleys, a prime moving system pivot bracket having one end slidably attached to said mechanism and another end pivotally mounting said prime moving system about a horizontal axis, a raw edged non-slipping belt connecting said spin drive pulley and said spin driven pulley, a neoprene coated slipping belt connecting said agitate and spin drive pulley and said agitate and spin driven pulley, a belt tension adjusting bracket attached to said pivot bracket and having a plurality of adjusting holes therein, and a belt tension adjusting spring connecting said motor to said adjusting bracket whereby the prime moving system may be pivoted on said pivot bracket to effect a controlled amount of slip between said agitate and spin drive pulley and said neoprene coated slipping belt.

7. An adjustable prime moving system horizontally pivotally connected to an agitate and spin mechanism comprising, a high and low speed motor, a shaft for said motor, a pair of selectively powered drive pulleys on said motor shaft, one of said drive pulleys being relatively large and powered by said motor on high speed and the other of said drive pulleys being relatively small and powered on either high or low speed, a pair of driven pulleys on said agitate and spin mechanism in juxtaposition to said drive pulleys, a first belt interconnecting said relatively large drive pulley with one of said driven pulleys, a second belt interconnecting said relatively small drive pulley with the other of said driven pulleys, and means for selectively varying the tension on each of said belts to control the amount of slipping on one of said belts.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |                 |               |
|-----------|-----------------|---------------|
| 1,648,178 | Hull            | Nov. 8, 1927  |
| 2,699,683 | Castner         | Jan. 18, 1955 |
| 2,709,908 | Altorfer et al. | June 7, 1955  |
| 2,823,534 | Loehle          | Feb. 18, 1958 |

##### FOREIGN PATENTS

|         |         |               |
|---------|---------|---------------|
| 637,324 | Germany | Oct. 26, 1936 |
|---------|---------|---------------|