Nov. 14, 1967 R. W. BRUNDAGE 3,352,176

LAUNDRY EQUIPMENT POWER PACKAGE

Filed April 30, 1965 4 Sheets-Sheet 1

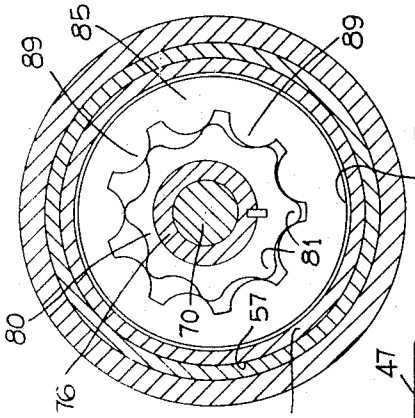


Fig 2

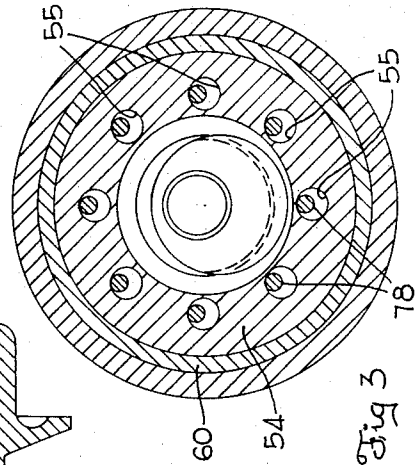


Fig 3

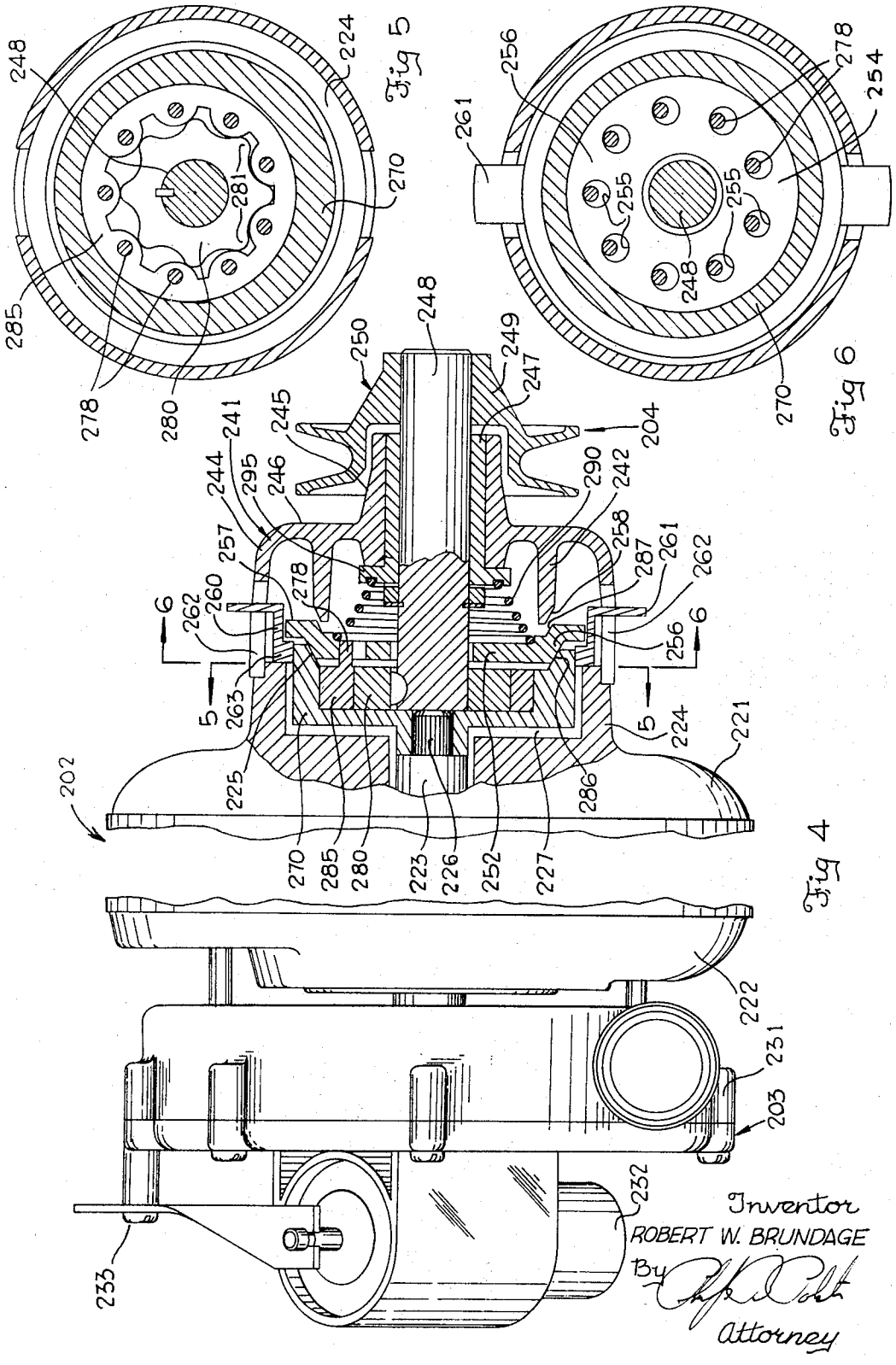
Fig 1

Inventor
ROBERT W. BRUNDAGE
By
Attorney

Nov. 14, 1967 R. W. BRUNDAGE 3,352,176

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LAUNDRY EQUIPMENT POWER PACKAGE

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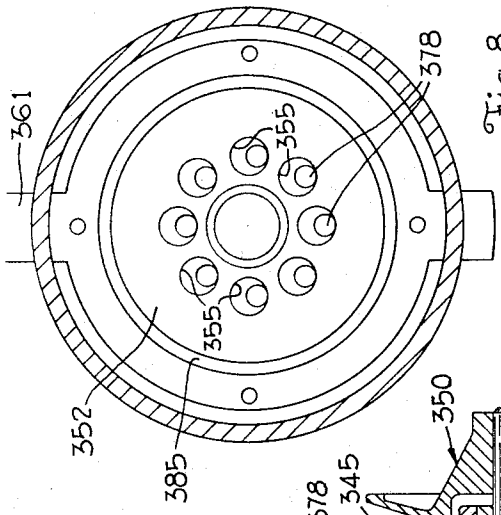


Fig 8

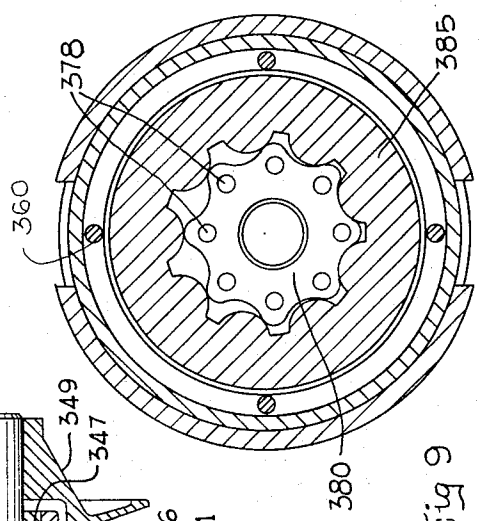


Fig 9

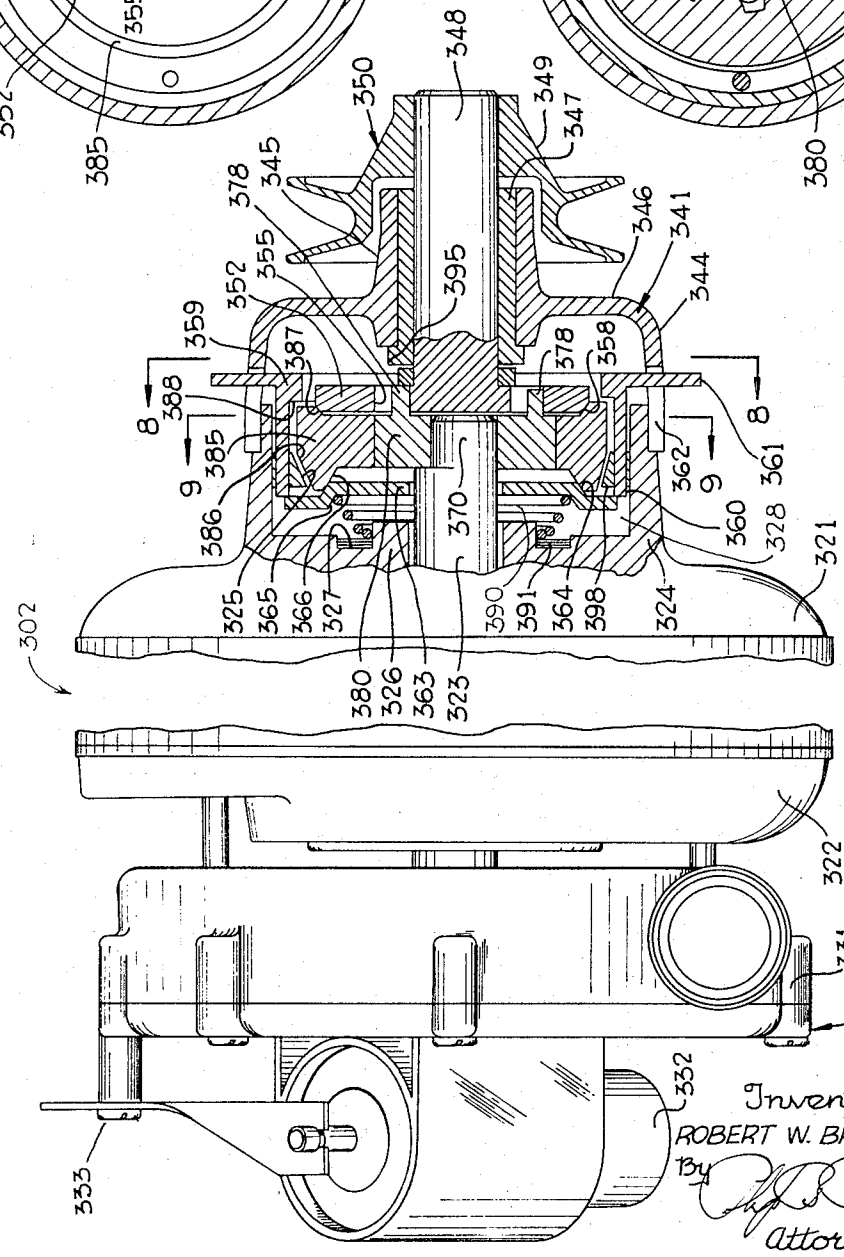


Fig 7

Inventor
ROBERT W. BRUNDAGE
By
Attorney

Nov. 14, 1967 R. W. BRUNDAGE 3,352,176

LAUNDRY EQUIPMENT POWER PACKAGE

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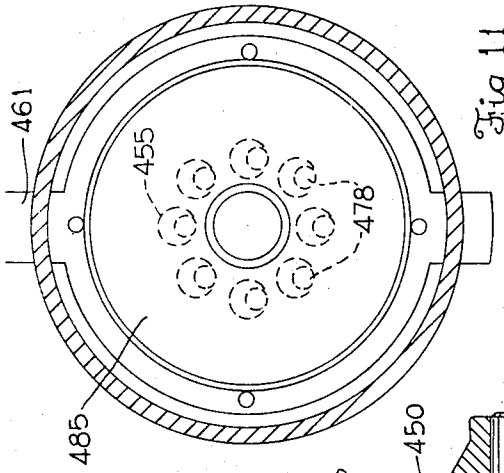


Fig 11

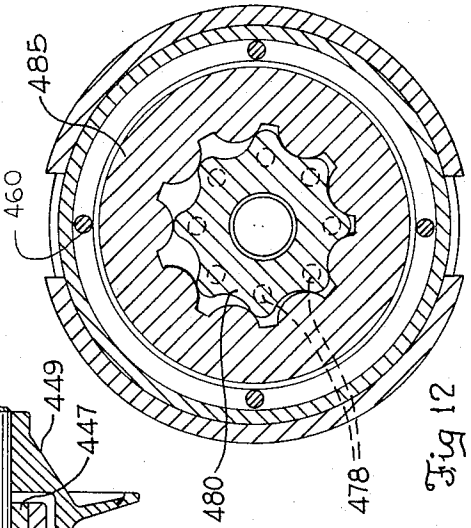


Fig 12

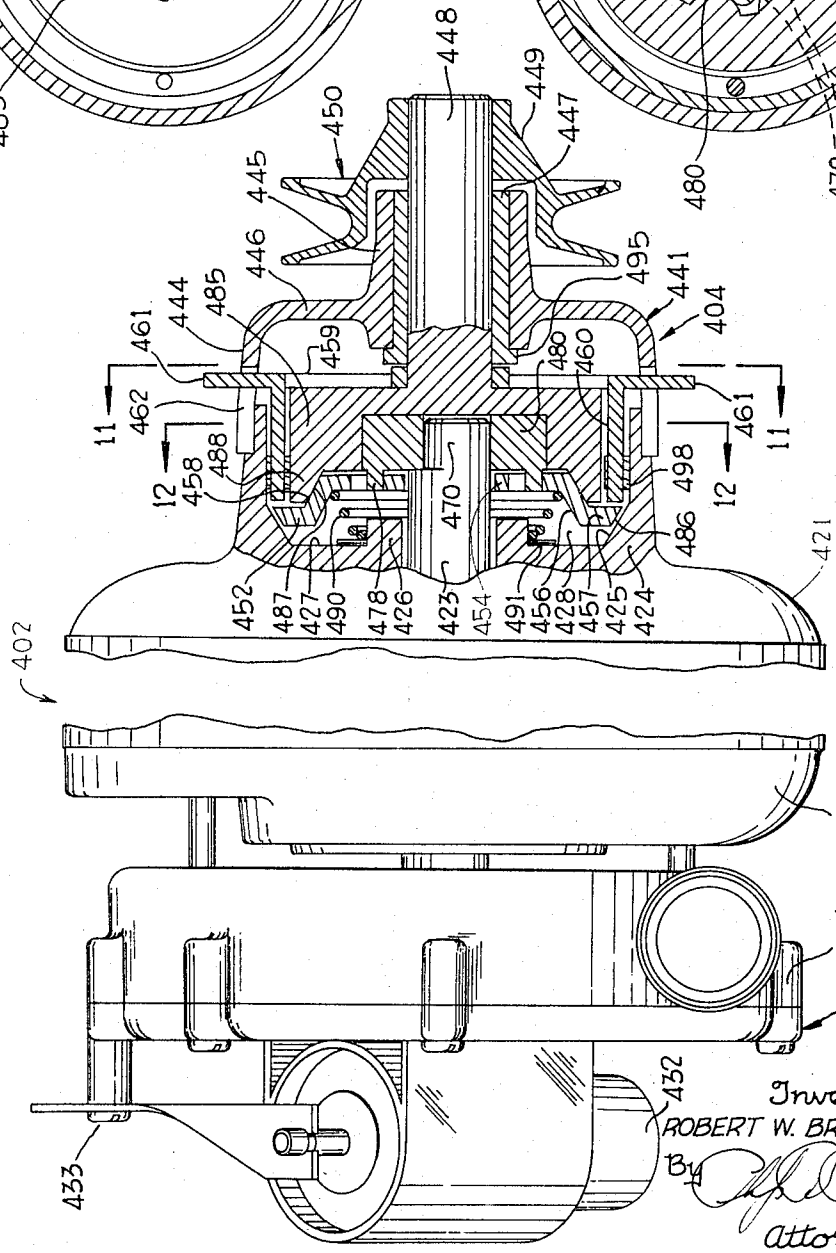


Fig 10

Inventor
ROBERT W. BRUNDAGE
By
Attorney

United States Patent Office 3,352,176
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3,352,176

LAUNDRY EQUIPMENT POWER PACKAGE

Robert W. Brundage, Belnor, Mo., assignor to Emerson Electric Co., St. Louis, Mo., a corporation of Missouri

Filed Apr. 30, 1965, Ser. No. 452,194
9 Claims. (Cl. 74—785)

ABSTRACT OF THE DISCLOSURE

An electric motor with a rotor shaft connected to one of a ring gear and pinion driven eccentrically with respect to one another, the other being operatively connected to a transmission shaft, and sliding mechanism for selectively locking the ring gear and pinion together in one position for rotation together and, in another position, for locking one against rotation relative to a fixed housing. The driving force from the rotor shaft is transmitted to the transmission shaft through a transmission plate. One of the ring gear and pinion is operatively connected to the transmission plate by fixed drive pins on one, extending into holes in the other large enough to accommodate the eccentricity of the ring gear and pinion with respect to one another. A single speed motor with a water pump mounted on one end and the described transmission on the other.

Cross reference to related application

U.S. application Ser. No. 535,543, filed March 18, 1966, is a continuation-in-part of the present application.

This invention relates to laundry equipment, particularly of the character of wash machines, in which at least two speeds of operation are required. It has particular, but not exclusive, application to wash machines in which a cylindrical tub or basket is rotated about a horizontal axis. In many parts of the world, particularly in continental Europe, the standard automatic wash machine designed to include a spin cycle, is of the horizontal type. A tub or basket, mounted for rotation on a horizontal shaft, is driven at a slow speed during the wash cycle, and a much higher speed during the spin cycle. In order to obtain these differences in speed, European wash machines particularly have been provided with multipole electric motors, commonly ranging from 2 pole-12 pole to 2 pole-24 pole. Such electric motors are expensive to manufacture. Their use also makes it necessary to provide a separate electric motor for a water pump.

Other methods of obtaining different speeds of rotation of the tub have been proposed, such, for example, as the use of change gears, variable speed belt drives, and the like, but these devices have heretofore proved even more expensive and space consuming than the multi-speed motors.

One of the objects of this invention is to provide a laundry equipment power package which is more compact, economical to build and maintain, simple and effective than the power devices known heretofore.

Another object is to provide such a power package which includes a single speed motor to which a water pump is directly coupled.

Still another object of this invention is to provide a laundry equipment power package in which the ratio of speeds can be varied widely by the simple interchange of parts.

Other objects will become apparent to those skilled in the art in the light of the following description and accompanying drawing.

Summary of the invention

In accordance with this invention, generally stated, a laundry equipment power unit is provided which includes a transmission which has a pinion, a ring gear encompassing the pinion and having a different number of teeth from the pinion, teeth of the pinion being meshed with teeth of the ring gear in one area and totally unmeshed in another area, means for driving one of the pinion and ring gear eccentrically with respect to the other, means for transmitting a rotational force from one of the ring gear and pinion while the other is held against rotation, and means for selectively connecting the pinion and ring gear together for common rotation.

In the preferred embodiment, the power unit includes a single speed motor and a water pump to which the motor is directly coupled.

In the preferred embodiment, the transmission has a housing and a power take off all mounted on one axial end of the motor.

Brief description of the drawing

In the drawing, FIGURE 1 is a view partly in plan, partly broken away, and partly in section, showing one illustrative embodiment of power unit of this invention, the sectional view being a longitudinal section;

FIGURE 2 is a sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a sectional view taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a view of the same description as FIGURE 1, showing another illustrative embodiment of this invention;

FIGURE 5 is a sectional view taken along the line 5—5 of FIGURE 4;

FIGURE 6 is a sectional view taken along the line 6—6 of FIGURE 4;

FIGURE 7 is a view of the same description as FIGURE 1, showing still another embodiment of this invention;

FIGURE 8 is a sectional view taken along the line 8—8 of FIGURE 7;

FIGURE 9 is a sectional view taken along the line 9—9 of FIGURE 7;

FIGURE 10 is a view of the same description as FIGURE 1, showing still a fourth illustrative embodiment of this invention;

FIGURE 11 is a sectional view taken along the line 11—11 of FIGURE 10; and

FIGURE 12 is a sectional view taken along the line 12—12 of FIGURE 10.

Description of the preferred embodiments

Referring now to the drawing, and particularly to FIGURES 1–3, for one illustrative embodiment of laundry equipment power package of this invention, reference numeral 1 indicates a complete package, which includes a single speed electric motor 2, a water pump 3, and a transmission 4.

The motor 2, in the embodiments shown, is a capacitor start fractional horsepower motor with end shields 21 and 22. The end shields 21 and 22 are provided with bearing bosses to accommodate sleeve bearings through which a shaft 23 extends and in which it is journalled for rotation. The shaft 23 projects beyond the end shields at both axial ends of the motor. Beyond the end shield 22, the shaft 23 is keyed to an impeller within a pump casing 31 of the pump 3. The casing 31 may be mounted directly on the outside of the end shield 22. A solenoid 32 is mounted on the outside of the casing 31, and is connected to operate a valve 33 in a drain line from the laundry equipment to the suction side of the pump 3.

The end shield 21 has an annular flat face 93 on its outside surface, concentrically within the compass of which is an annular, axially outwardly extending wall 24, the radially outer face of which is perpendicular to the

plane of the surface 93, and the upper portion of the radially inner face of which is chamfered to form a clutching, or, more properly, braking face 25. The wall 24 is concentric with the axis of rotation of the shaft 23. The axially inner part of the radially inner face of the wall 24 forms, with the radially outer face of a bearing boss 26, and a bottom wall 27, a spring receiving well 28. An annular channel 29 in the radially outer face of the wall 24 serves to receive an O-ring, to form a fluid tight seal between the outer face of the wall 24 and a portion of the inner face of a transmission housing 41.

The transmission housing 41 has a radially extending flange 42, an axially inner radial face of which rests on the surface 93. The flange 42 has axial holes in it, through which bolts 43 extend. The bolts 43 are threaded into tapped holes in the end shield, as shown in FIGURE 1. The housing 41 has a cylindrical body 44, a bearing-supporting nose section 45, and a web section 46, connecting the radially larger body section 44 with the nose section 45. The nose section 45 carries a sleeve bearing 47, within which a shaft 48 is journalled for rotation. The shaft 48 projects beyond the bearing 47 at each end. At its axially outer end, the shaft 48 has a hub 49 of a sheave 50 keyed to it. The hub 49 is bell shaped, so that the pully belt engaging part of the sheave 50 is positioned around and axially inwardly of the nose section 45.

At its axially inner end, the shaft 48 has keyed to it a transmission plate 52. The transmission plate 52 has a hub 53, by which it is keyed to the shaft 48, a radially extending circular disk 54, with holes 55 extending axially through it, and an inwardly axially extending annular flange 56 at the perimeter of the disk. The flange 56 has a cylindrical outer surface 57 and a conical inner surface 58. The inner surface 58 is convergent axially outwardly from the motor.

The flange 56 extends along, within, and in revolving relation to a sleeve 60, which in turn is within and in slidably journalled relation to the inner surface of the cylindrical body portion 44 of the housing 41. A push rod 61, slidably mounted in an opening 62 in a thickened section of the connecting web 46 of the housing 41, has an axially inner end bearing against the axially outer edge of the sleeve 60. The push rod 61 has an annular groove 63, in which a packing ring 64 is seated, to form a liquid tight, but slidable seal. The push rod 61 projects axially outwardly from the housing 41, so that it can be moved, from outside the housing, by a power means, not here shown.

The axis of rotation of the shafts 23 and 48 are in direct axial alignment. However, the axially outer portion of the shaft 23, which extends from the bearing boss 26, is made cylindrical but is offset from the axis of rotation of the shaft 23, to form a crank pin 70. The crank pin 70 has mounted on it, for rotation with respect to it, a drive pin element 75, which, in this embodiment, includes a bearing sleeve 76, a radially extending stepped pin disk 77, and circumferentially spaced pins 78. The pins 78 are so positioned as to project axially into the holes 55 in the disk 54 of the transmission plate 52. In the embodiment shown there are eight holes and eight pins.

Keyed to the bearing sleeve 76, is a pinion 80. The pinion 80 has, in this embodiment, eight teeth 81, of the character of teeth commonly found on pinions in hydraulic pumps of the internal gear type.

A ring gear 85 is mounted around the pinion 80, concentrically with the axis of rotation of the shafts 23 and 48 and therefore eccentrically with respect to the axis of rotation of the pinion 80. The ring gear 85 has radially inwardly extending teeth 89, of the type commonly found on ring gears in hydraulic pumps of the internal gear type. There is a different number of teeth 89 on the ring gear 85, than of teeth 81 on the pinion 80. In the present embodiment, there are nine teeth 89, and eight teeth 81.

The ring gear 85 has, around its periphery and axially centered thereon, an annular rib 88, which projects radially into a sliding engagement with the cylindrical inner surface of the body portion 44 of the housing 41. The rib 88 has a radial surface upon which the inner edge of the sliding sleeve 60 bears. On either side, axially of the rib 88, the outer surface of the ring gear 85 is coned in a direction divergently toward the rib, to provide an outer ring gear clutching face 87 and an inner ring gear clutching (braking) face 86.

On an inner radial face of the ring gear 85 is an annular groove, which receives the outer turn of a helically wound spring 90, the axially inner of which loosely embraces the bearing boss 26 and bears against thrust washers 91.

At the outermost end of the crank pin 70, a counter balance weight 95 is fixed to the shaft with an eccentric mass positioned opposite the offset crank pin 70 with respect to the shaft 23.

As can be seen particularly in FIGURE 2, the eccentricity of the crank pin 70 and the dimensions of the ring gear 85 and the pinion 80 are such as to insure that at every point in the travel of the pinion on the crank pin 70, one of the teeth 81 is fully enmeshed with teeth 89. while diametrically opposite, the teeth 81 and 89 are completely unmeshed. With this arrangement, in the embodiment shown, if the ring gear 85 is held against rotation, one revolution of the shaft 23, hence the crank pin 70, will cause the pinion 80 to move one-ninth of a revolution. In other words, in the illustrative embodiment shown, there is a nine to one reduction in the rotation of the pinion 80 with respect to the rotation of the shaft 23 and crank pin 70. On the other hand, if the ring gear 85 is free to rotate and can be connected to the ring gear 80, the two gears will rotate as one, at the speed of the shaft 23, because, under these circumstances, the pinion cannot rotate with respect to the ring gear 85. Such an arrangement is provided by the structures of this invention.

In operation, in the condition of the transmission illustrated in FIGURE 1, the push rod 61 is in its depressed (axially inward) position, forcing the sleeve 60, hence, because of the bearing of the sleeve 60 against the rib 88, forcing the ring gear 85 axially inwardly. This has moved the ring gear 85 out of engagement with the clutching surface 58 of the flange 56, and into a position at which the inner ring gear braking face 86 is in frictional engagement with the coned braking face 25 of the end shield wall 24, which is fixed against rotation. Accordingly, the ring gear 85 is held against rotation. Under these circumstances, rotation of the shaft 23, hence the crank pin 70, causes the pinion 80 to move eccentrically with respect to the ring gear, and to rotate, about the crank pin 70, at the rate of one-ninth of a revolution per revolution of the crank pin. The pinion 80, however, is keyed to the pin drive element 75, so as to move that element, including the pins 78, as it rotates.

The pins 78, in turn, orbit by the amount of the eccentricity of the crank pin 70, in the holes 55 in the transmission plate 52. As is illustrated particularly in FIGURE 3, at any moment, one of the pins 78 will be in direct and full driving position. Others will contribute a lesser component of thrust, while still others will contribute nothing to the driving at that moment. The engagement of the pins which are contributing a driving component against the margin defining the holes 55 in the plate 54 transmit the force, through the transmission plate to the shaft 48, hence to the sheave 50. This situation will obtain as long as the push rod 61 remains pushed firmly inwardly against the bias of the spring 90.

If, now, the push rod 61 is released, permitting the spring 90 to bias the ring gear 85 away from the face 25 and into engagement between the outer ring gear clutching face 87 and the flange surface 58, it will be seen that the ring gear is now connected through the transmission plate 52 and pins 78, to the pinion 80. In this arrangement, no

further relative movement between the pinion and the ring gear is permitted, and the two will turn as one, and at the same rate as the shaft 23, the torque from the shaft 23 and crank pin 70 being transmitted through the enmeshed teeth of the pinion and ring gear, which cannot change position relative to one another. In this condition of the transmission, the transmission is acting as a direct drive from the motor 2.

In the embodiments shown in FIGURES 4, 5 and 6, a single speed motor 202, with end shields 221 and 222, has a rotor shaft 223 which projects, through a bearing in the end shield 222, into the housing of a water pump 203, where it is keyed to an impeller. The housing of the water pump 203 is mounted on the end shield 222. A solenoid 232, mounted on the housing of the pump 203, controls a solenoid valve 233 in a drain line from a wash machine to the suction side of the pump 203.

In this embodiment, the end shield 221 has integral with it an annular end shield wall 224 extending axially outwardly from the end shield 221. The wall 224 is rabbeted at its axially and radially outer edge to receive an axially inner end of a transmission housing 241. The radially inner face of the wall 224 is cylindrical, and concentric with the axis of rotation of the shaft 223.

The housing 241 has a cylindrical body portion 244, a sleeve bearing-carrying nose 245, and a web section 246 connecting the body portion 244 and the radially smaller nose section 245. The nose section 245 supports a sleeve bearing 247, which, in this embodiment, has integral with it a radially extending flange 295, which has in its axially inner radial surface, an annular groove adapted to receive the axially outer turn of a helical spring 290.

A shaft 248, axially aligned with the axis of rotation of the shaft 223, is journalled for rotation in bearing 247, and projects beyond the bearing 247 at both ends. At its axially outer end, the shaft 248 has keyed to it a hub 249 of a sheave 250. The sheave 250 is bell shaped, with the pully belt-engaging portion of the sheave extending around the nose 245.

In this embodiment, the housing 241 has integral with it a fixed ring 242, projecting axially inwardly from the web 246, concentric with the axis of rotation of the shafts 223 and 248. The radially outer, axially inner corner of the ring 242 is chamfered to provide a housing ring brake face 258.

A transmission plate 252 is normally biased by the spring 290, the inner turn of which bears against the outer radial face of the transmission plate, away from the ring 242, as shown in FIGURE 4. The transmission plate 252 in this embodiment is dish shaped, with a central flat section 254, through which axial holes 255 extend, a rim section 256, and a radial lip 257.

The radially outer surface of the rim 256 is coned convergently axially inwardly to provide a transmission plate clutching face 286. The radially inner edge of the lip 257 is chamfered to form a clutching braking surface 287.

A control ring 260 is mounted slideably in the housing 241. The control ring 260 has a stepped end 263 which engages the axially inner edge of the lip 257 when the control ring 260 is moved axially outwardly. The control ring 260 has tabs 261 which project outside of the housing 241 through elongated slots 262, thus permitting the control ring 260 to be moved axially from outside the housing 241.

Axially inwardly of the transmisison plate 252, is an eccentric cup 270. The eccentric cup 270 is cylindriacl on its outside surface and, around its outer perimeter, is concentric with the axis of rotation of the shaft 223. The cup 270 has, at its axially outer radially inner edge, a chamfered section forming a coned surface 225 concentric with and complementary to the clutching surface 286 of the transmission plate. The radially inner surface of the cup 270 is also cylindrical, but is offset with respect to the outside surface of the cup and the axis of rotation of the shaft 223, making the wall of the cup relatively thin through one arc as compared with its thickness through the diametrically opposite arc, as shown in FIGURE 4. The cup 270 is mounted on a reduced, splined end 226 of the shaft 223.

The shaft 248 projects axially inwardly into brushing contact with the flat bottom surface of the cup 270. A pinion 280 is keyed to the end of the shaft 248, as shown in FIGURES 4 and 5. The pinion is identical to the pinion 80 of the embodiment shown in FIGURES 1–3.

A ring gear 285 is mounted for relative rotation in the cup 270, around the pinion 280. The ring 285 is circular, but, because of the eccentricity of the radially inner wall of the cup with respect to the axis of rotation of the shafts 223 and 248, the ring gear 285 is eccentrically mounted with respect to the pinion 280, just as the ring gear and pinion 85 and 80 respectively are mounted eccentrically with respect to one another in the embodiments shown in FIGURES 1–3. In the present embodiment, however, it is the ring gear which moves eccentrically, instead of the pinion, as will be explained hereinafter.

The ring gear 285 has integral with one radial surface, eight circumferentially spaced pins 278, which project axially within the compass of the holes 255 in the transmission plate 252.

In the operation of this embodiment of transmission, when the control ring 260 is in the position shown in FIGURE 4, the spring 290 has biased the transmission plate 252 axially inwardly to the place at which the clutching face 286 is in frictional engagement with the coned surface 225 of the cup 270. Under these conditions, the transmission plate 252 turns with the cup 270, the margins of the holes 255 engage some of the pins 278, the pins 278 drive the ring gear 285, hence the pinion 280 which is locked against relative movement with respect to the ring gear by the engagement of some if its teeth, and the pinion 280 in turn drives the shaft 248 to which it is keyed. This driving will be in one to one ratio with the rotation of the shaft 223.

When the tabs 261 are moved axially outwardly, by power means not here shown, the stepped end 263 of the control ring 260 engages the lip 257 of the transmission plate 252, moving the transmission plate 252 away from the cup 270 and into a position at which the braking surface 287 of the transmission plate frictional engages the housing ring brake face 258, which, as part of the housing ring is fixed against rotation. This, in turn, fixes the ring gear 285 against rotation (except for the limited amount of movement permitted by the holes 255) and the rotation of the cup 270 causes the ring gear 285 to undulate with respect to the pinion 280, moving the pinion 280 at the rate of one-eighth of a revolution per revolution of the shaft 223.

In this embodiment, as in all of the other embodiments, the single speed motor, rotating at constant speed, operates the pump at its designed optimum speed.

Referring now to FIGURES 7, 8 and 9 for still another embodiment of this invention, reference numeral 302 indicates a single speed motor, with end shields 321 and 322. A water pump 303, with a housing 331, a solenoid 332 and a valve 333, is mounted in the end shield 322. The pump 303 has an impeller which is keyed to an end of a rotor shaft 323 projecting through the end shield of the motor 302.

The end shield 321 has an axially outwardly directed annular wall 324, integral with it. The wall 324 has, around its axially and radially outer end, a rabbet, adapted to receive the axially inner end of a transmission housing 341. The transmission housing 341 has a cylindrical body part 344, a bearing supporting nose 345 extending axially of the body 344 and of smaller diameter than the body 344, and a web section 346, connecting the body 344 and the nose 345. The nose 345 has within it a bearing

sleeve 347, which, in this embodiment, has a flange 395 at its lower end, projecting radially from the axially inner end of the nose 345. A shaft 348 is journalled in the bearing 347. A hub 349 of a sheave 350 is keyed to the axially outer end of the shaft 348, and a transmission plate 352 is integral with or otherwise securely fixed to the other end of the shaft 348 axially inwardly from the bearing 347.

The transmisison plate 352 has axially extending holes 355 through it, and is provided at its axially inner, radially outer corner with a chamfer forming a clutching surface 358.

In this embodiment, the radially inner surface of the wall 324 is cylindrical and concentric with the axis of rotation of the rotor shaft 323 and the shaft 348 which is axially aligned with the shaft 323. A radially inwardly extending rib 398, with an axially outwardly divergently coned surface 325, is secured to the inner surface of the wall 324, at a distance from the bottom of a well 328 defined by the wall 324 and a bottom wall portion of the end shield 321 within the compass of the wall 324. An annular groove in the bottom wall extends around a bearing boss 326, and forms a spring receiving well 327 in the bottom wall.

A spring pressure transmitting plate 363 is mounted within the compass of the wall 324 around but spaced from the shaft 323, and axially outwardly from the boss 326 and inwardly of the rib 398. The spring plate 363 is stepped to form a spring plate clutching face 364 on the axially outer side of the plate 363 and a spring-positioning shoulder 365 on the axially inward side. A spring 390 is seated on thrust washers 391 at its axially inner end around the bearing boss 326 in the spring receiving well 327, and at its axially outer end, in the arris between the shoulder 365 and the central portion of the plate 363. The outer edge of a radial surface of the plate 363 engages an axially inner end of each of four control pins 360, integral at their other axial ends with a control ring 359. Tabs 361, projecting radially through slots 362 of the housing body 344, are also integral with the control ring 359. As can be seen from FIGURES 7 and 8, the tabs 361 extend outside the housing 341, so as to be accessible from outside the housing for moving the control ring 359. The pins 360 extend slideably through holes in the rib 398.

The axially outer end of the shaft 323, beyond the boss 326, is formed cylindrically but offset from the axis of rotation to define a crank pin 370, in substantially the same way in which the shaft 23 of the first embodiment is formed to provide the crank pin 70. The crank pin 370 is merely shorter axially than the crank pin 70 of the first embodiment.

Mounted for rotation on the crank pin 370, in this embodiment, is a pinion 380, identical with the pinions 80 and 280 except for being provided with axially extending pins 378 which project into the holes 355 of the transmission plate 352.

A ring gear 385 is mounted around the pinion 380, within the compass of the wall 324 radially inwardly of the pins 360. The ring gear 385 has an axially outwardly extending rim, with a bevelled radially inner surface to form a clutching face 387 complementary to the clutching face 358 of the transmission plate 352. At its axially inner radial side, the ring gear 385 is provided with a double chamfered annular boss, wedge shaped in cross section, which provides an outer brake face 386 and an inner clutching face 366.

In operation, if the transmission is in the position shown in FIGURE 7, the spring 390 has biased the spring plate 363 against the ring gear 385, pushing the ring gear 385 axially outwardly until the clutching face 387 of the ring gear engages the clutching face 358 of the transmission plate 352. In this condition, the ring gear, transmission plate and pinion 380 are all connected, through the pins 378. The shafts 323 and 348 will therefore turn at the same speed.

When the control ring 359 is moved axially inwardly by power means acting axially against the tabs 361 the pins 360 first move the spring plate 365 out of engagement with the clutching face 366 of the ring gear, and then, a shoulder 368 on the control ring 359 engages a radial surface of the ring gear 385 to move the ring gear first away from the transmission plate, to disengage the clutching faces 387 and 358, and then to a position at which the braking face 386 of the ring gear frictionally engages the coned surface 325 of the fixed rib 398. The ring gear 387 is now held against rotation, and the eccentric motion of the pinion 380 within the ring gear 385, in response to the rotation of the crank pin 370, causes the pinion to rotate one-ninth of a revolution per revolution of the shaft 323. This motion of the pinion 380 is transmitted to the transmission plate 352 by the action of the pins 378 as in the embodiment shown in FIGURES 1–3 and explained in connection with that embodiment.

Referring now to FIGURES 10, 11 and 12 for yet another embodiment of this invention, reference numeral 402 indicates a single speed motor with end shields 421 and 422, on the latter of which is mounted a water pump 403 with a casing 431 a solenoid 432 and a valve 433 in a drain line between a washing machine not here shown and a suction side of the pump 403. An impeller within the casing 431 is keyed to a rotor shaft 423.

At the other end of the motor 402 from the water pump 403 is a transmission 404.

The end shield 421 has integral with it an outwardly axially projecting annular wall 324. The wall 424 has radially outer and inner faces both of which are concentric with the axis of rotation of the rotor shaft 423. The wall 424 is rabbeted at its radially outer axially outer end, to receive the axially inner edge of a transmission housing 441.

The wall 424, a bottom wall 427, and a bearing boss 426 define a spring receiving well 428. Contiguous bottom wall 427, the radially inner surface of the wall 424 is coned divergently axially outwardly to form a conical braking surface 425. A guide rib 498 extends around the inner surface of the wall 424 above the coned surface 425. The guide ring 498 has axial passages through it, adapted to admit control pins 460. The control pins 460 are integral at their axially outer ends with a control ring 459, from which tabs 461 project radially through slots 462 in the housing 441.

The transmission housing 441 includes a body portion 444, within which the slots 462 are, a nose section 445, of smaller diameter than the body section 444, and within which is mounted a sleeve bearing 447, and a connecting web 446 extending between the body portion 444 and the nose section 445. The bearing sleeve 447 has a radially extending flange 495 integral with it and extending beyond the axially inner end of the nose section 445. A shaft 448 is journalled for rotation within the bearing 447. At its axially outer end, the shaft 448 has keyed to it a hub 449 of a sheave 450 of the same character of the sheaves 250 and 350 of the embodiments shown in FIGURES 4–9.

At its axially inner end, the shaft 448, in this embodiment, is integral with a ring gear 485. The ring gear 485 is concentric with the axis of rotation of the shaft 448 and of the rotor shaft 423, with which the shaft 448 is axially aligned. The radial outer surface of the ring gear 485 is cylindrical throughout its axial length. The ring gear 485 has on its axially inner radial surface an annular boss 488. The radially inner surface of the boss 488 is chamfered divergently axially inwardly, to form a clutching surface 487.

A transmission plate 452 is mounted within the compass of the wall 424 between the bottom wall 427 and the ring gear 485. The transmission plate 452 is inverted dish shaped, with a hole in a central web 454 to accommodate the shaft 423 around which it is spacedly mounted, holes 455 in the web 454, a side section 456 and a lip section 457. The axially outer surface of the side section 456

is coned convergently axially outwardly, complementarially to the clutching surface 487 of the ring gear, to provide a clutching surface 458. The radially outer edge of the lip 457 is chamfered to form a braking surface 486 complementary to the coned surface 425 of the wall 424. As in the embodiments shown in FIGURES 7–9, the shaft 423 is formed with a crank pin 470, cylindrical and axially parallel with but offset from the axis of rotation of the shaft 423. A pinion 480 is mounted for rotation on the crank pin 470, and is provided on its axially inner radial surface with integral drive pins 478. The drive pins 478 extend axially into the holes 455 in the transmission plate 452.

A spring 490 is mounted with its axially outer turn bearing against the transmission plate 452 at the arris between the center section 454 and the side 456, and with its axially inner turn embracing the boss 426 and resting against thrust washers 491.

In operation, in the condition of the transmission shown in FIGURE 10, the transmission plate 452 is biased by the spring 490 to a position in which the clutching surface 458 is in frictional engagement with the clutching surface 487 of the ring gear. In this condition, the ring gear is connected with the pinion 480, through the pins 478, and the ring gear is driven at the same rate as the pinion 480, which, by virtue of the fact that the pinion 480 cannot rotate with respect to the crank pin 470, is the same speed as the shaft 423.

When the tabs 461 are moved axially inwardly by power means, not here shown, the pins 460 bear on the axially outer radial surface of the lip 457, moving the transmission plate 452 out of engagement with the ring gear and into a position in which the braking face 486 of the transmission plate frictionally engages the coned surface 425 of the fixed wall 424. This engagement holds the transmission plate 452 from rotation, and causes the pinion 480 to undulate as the crank pin 470 rotates. The undulation of the pinion 480 causes the ring gear 485 to rotate at a rate of one-ninth of a revolution per revolution of the shaft 423.

The laundry equipment for which the power package of this invention is designed, is conventional, and has not been shown. It is to be understood that in the embodiments shown the belt-engaging part of the sheave drives a belt which in turn drives a sheave mounted on the clothes container (tub)-rotating shaft of the laundry equipment. This is merely illustrative. Any kind of conventional drive may be employed between the transmission shaft and the tub, including gears or even a direct drive from the transmission shaft.

The transmission system shown and described, including a transmission plate with holes of a size to accommodate the orbiting of drive pins, is the preferred type of transmission. It does require a known and fixed eccentricity and aligned shafts, but these conditions are easily met in the transmission of this invention. It produces a substantially continuous, smooth drive; it is simple and compact. It is apparent that the pins and holes may be reversed though space limitations make the illustrated arrangement the preferred one. However, other systems may be used. For example, referring to FIGURE 1, if the transmission plate 52 were omitted, and the shaft 48 moved axially outwardly away from the end of the crank pin 70 far enough to provide clearance, the pins 78 could be connected to one part of a scotch yoke or Oldham coupling, with the driven part of the yoke or coupling keyed to the shaft 48. A direct coupling means, for example, a plate similar to the plate 52 without the holes, could then be provided between the ring gear and the coupling, to join the ring gear and pinion in much the way the ring gear and pinion are joined in the embodiment shown in FIGURE 1, by complementary clutching surfaces on the ring gear and coupling. Other means, such as a plurality of universal joints, a Hotchkiss drive, radial or horizontal bellows, or a spoke drive can be used to convert the orbital motion of the eccentrically driven member into simple rotational movement. Such a motion converting coupling, together with means for braking the rotation of the one of the pinion and ring gear which does not orbit, and means for coupling the ring gear and pinion together, broadly, are required. As has been pointed out, however, the pin and transmission plate drive has a number of especial virtues not shared by the other types of motion-transforming devices. In all of the embodiments, to provide different ratios it is only necessary to substitute ring gears and pinions with different numbers of teeth.

Numerous other variations in the construction of the device of this invention, within the scope of the appended claims will occur to those skilled in the art in the light of the foregoing disclosure. It can be seen, for example, that the use of a two speed motor, while being of less utility as respects the water pump, provides a four speed transmission. Different housing arrangements, crank pin and shifting arrangements can be used. Intermediate gears in the nature of planetary gears can be employed, although such an arrangement is more complicated and space consuming. These are merely illustrative.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. A laundry equipment power package comprising a transmission having a shaft, and an electric motor connected to said transmission to drive said transmission shaft, said motor having a rotor shaft axially aligned with the transmission shaft, a crank pin integral with the rotor shaft and offset axially from the axis of rotation of said rotor shaft, a pinion revolvably mounted on said crank pin; drive pins connected to said pinion for movement therewith; a transmission plate having holes into which said pins project axially of said shafts, said holes being of a size to accommodate the eccentricity of the movement of the pins in response to the rotation of said crank pin; a ring gear mounted around the pinion eccentrically with respect to said pinion and concentrically with respect to the shafts, said ring gear being fixed to the transmission shaft and provided at an axially inner surface with a coned clutching face; the transmission plate being mounted for axial sliding with respect to the ring gear and pinion and provided with a clutching face complementary to the coned ring gear clutching face for selective engagement therewith, and with a chamfered braking face complementary to a braking surface on a fixed base member for selective engagement therewith, and means for moving the transmission plate axially between a position at which the transmission plate is disengaged from the ring gear and the chamfered braking face of the transmission plate engages the braking face of the base to hold the transmission plate against rotation, and a position at which the transmission plate is disengaged from the base and engaged, through their respective clutching faces, with the ring gear.

2. A laundry equipment power package comprising a transmission having a shaft, and an electric motor connected to said transmission to drive said shaft, said transmission comprising an internally toothed ring gear and an externally toothed pinion within said ring gear, said pinion and ring gear having different numbers of teeth and being of a size and eccentric with respect to one another in an amount sufficient to cause teeth of the pinion to enmesh with teeth of the ring gear at one arc and to be unmeshed at the diametrically opposite arc; means driven by said motor and rotatably connected to one of said ring gear and pinion for driving said one of the ring gear and pinion eccentrically with respect to the other and with respect to the transmission shaft; means for selectively braking the other of said pinion and ring gear whereby to cause said driven one of the ring gear and pinion to rotate with respect to the braked one at a rate proportionate to the numbers and differences in numbers of teeth of said pinion and ring gear; and motion-translating means operatively connecting the said driven one with the transmission shaft

for converting the eccentric motion of the driven one with respect to the transmission shaft to rotary motion of said shaft, said motion-translating means comprising a transmission plate concentric with the transmission shaft, and pins on one of said transmission plate and driven one of the pinion and ring gear, the other of said transmission plate and driven one having holes positioned to receive said pins and of a size with respect to said pins to accommodate the eccentricity of the driven one.

3. The improvement of claim 2 wherein the transmission plate is directly mounted on the transmission shaft.

4. The improvement of claim 2 wherein the transmission plate has the holes and the driven one the pins, and the transmission plate is directly mounted on the transmission shaft.

5. In a laundry machine having a revolving clothes-container adapted and required to be driven selectively at different speeds, the improvement comprising a transmission having a shaft adapted to drive said clothes-container, and an electric motor connected to said transmission to drive said transmission shaft, said motor having a rotor shaft axially aligned with the transmission shaft, a crank pin integral with the rotor shaft and offset axially from the axis of rotation of said rotor shaft, a pinion revolvably mounted on said crank pin; drive pins connected to said pinion for movement therewith; a transmission plate having holes into which said pins project axially of said shafts, said holes being of a size to accommodate the eccentricity of the movement of the pins in response to the rotation of said crank pins; a ring gear mounted around the pinion eccentrically with respect to said pinion and concentrically with respect to the shafts; means for selectively holding said ring gear against rotation; means for selectively releasing said ring gear for rotation and means, operative when the said ring gear is released from said holding means, for operatively connecting the ring gear and transmission plate, said ring gear and transmission connecting means serving to connect the rotor shaft, pinion, ring gear and transmission plate to said transmission shaft.

6. The improvement of claim 5 wherein the transmission plate is fixed to the transmission shaft, the ring gear is double coned on its radially outer surface to form oppositely directed axially outer clutching and axially inner braking surfaces, the transmission plate has a clutching surface complementary to the axially outer ring gear clutching surface, a fixed braking surface is provided complementary to the axially inner ring gear braking surface, and means are provided for selectively shifting the said ring gear axially from engagement with one of said clutching braking surfaces and disengagement with the other to disengagement with the said one and engagement with the said other.

7. The improvement of claim 5 wherein the transmission plate is fixed to the transmission shaft, the ring gear is provided with a clutching face at its axially outer side complementary to a clutching face on the transmission plate and adopted selectively to engage it, and the ring gear is provided on its axially inner radially outer side with a braking face complementary to and adapted selectively to engage a braking face of a ring secured to a fixed base, and means for shifting said ring gear axially between a position at which the clutching faces of the ring gear and transmission plate are engaged and the ring gear and base ring braking faces are disengaged and a position at which the clutching faces of the ring gear and transmission plate are disengaged and the ring gear and base ring braking faces are engaged.

8. The improvement of claim 5 wherein the motor is a single speed motor, the transmission is mounted on one end shield of the motor, and a water pump is mounted on the other end shield of the motor.

9. In a laundry machine having a revolving clothes container adapted and required to be driven selectively at different speeds, the improvement comprising a transmission having a shaft adapted to drive said clothes container and an electric motor connected to said transmission to drive said transmission shaft, said motor having a rotor shaft axially aligned with said transmission shaft; an axially outwardly open-mouthed cup mounted on said rotor shaft, said cup having a radially outer surface concentric with the axis of rotation of said shaft and a radially inner surface which is cylindrical but eccentric with the axis of rotation of the rotor shaft; a ring gear rotatably journalled in said cup, said ring gear having axially outwardly projecting drive pins; a pinion fixed to the transmission shaft, concentric therewith and positioned within the compass of the ring gear eccentrically therewith, said pinion having a different number of teeth from the ring gear and being of a size and eccentricity with respect thereto to cause their respective teeth to be meshed in one arc and to be unmeshed in the diametrically opposite arc; a transmission plate mounted concentrically around and in slidable relation to the transmission shaft, said transmission plate having axially directed holes in it into which the ring gear drive pins project, said drive pins and holes being of such a size as to accommodate the eccentricity of the cup, said transmission plate having a coned clutching surface on an axially inner side complementary to a concentric clutching surface on an axially outer, radially inner side of the cup, said transmission plate having, on an axially outer side, a coned braking surface; a ring fixed against rotation, positioned concentrically with the transmission plate and axially outwardly thereof and provided at its axially inner end with a braking surface complementary to the axially outer transmission plate braking surface, and means for shifting the transmission plate axially between a position at which the transmission plate is free of the fixed ring and the axially inner clutching surface of the transmission plate engages the clutching surface of the ring gear, and a position at which the transmission plate is free of the ring gear and the axially outer braking surface of the transmission plate engages the braking surface of the fixed ring.

References Cited

UNITED STATES PATENTS

894,473	12/1905	Symmonds	74—769
2,429,509	10/1947	Breckenridge	74—785 X
2,612,034	9/1952	Constantine	68—24 X
2,836,046	5/1958	Smith	74—785 X
2,842,002	7/1958	Stegman	68—24 X
2,953,934	9/1960	Sundt	74—804 X
3,160,032	12/1964	Black	74—804
3,165,943	1/1965	Sundt	74—804 X

DONLEY J. STOCKING, *Primary Examiner.*

DAVID J. WILLIAMOWSKY, *Examiner.*

J. R. BENEFIEL, *Assistant Examiner.*