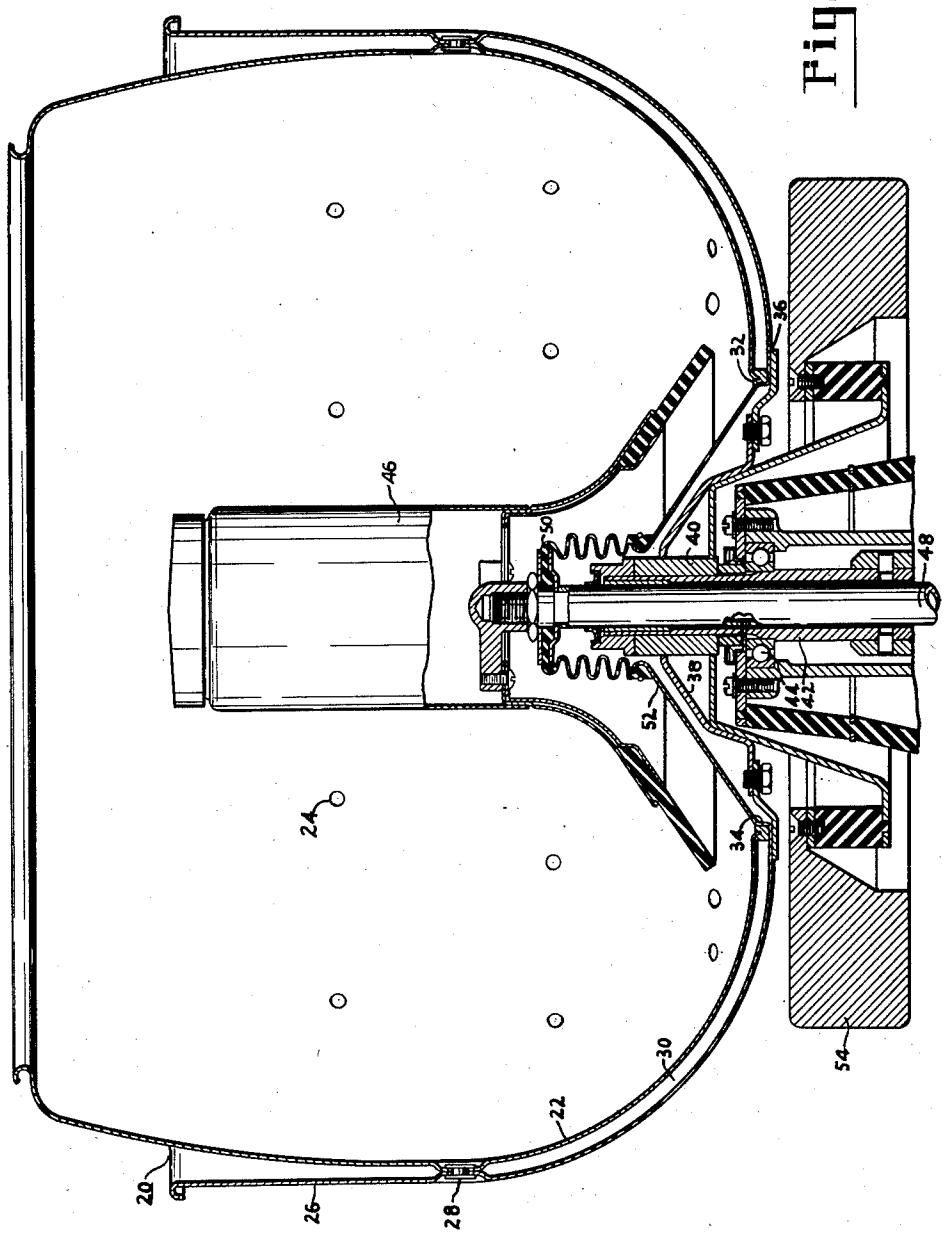
Sept. 18, 1945. D. K. FERRIS 2,384,903

DOMESTIC APPLIANCE

Filed Aug. 1, 1942 6 Sheets-Sheet 1

Fig. 1



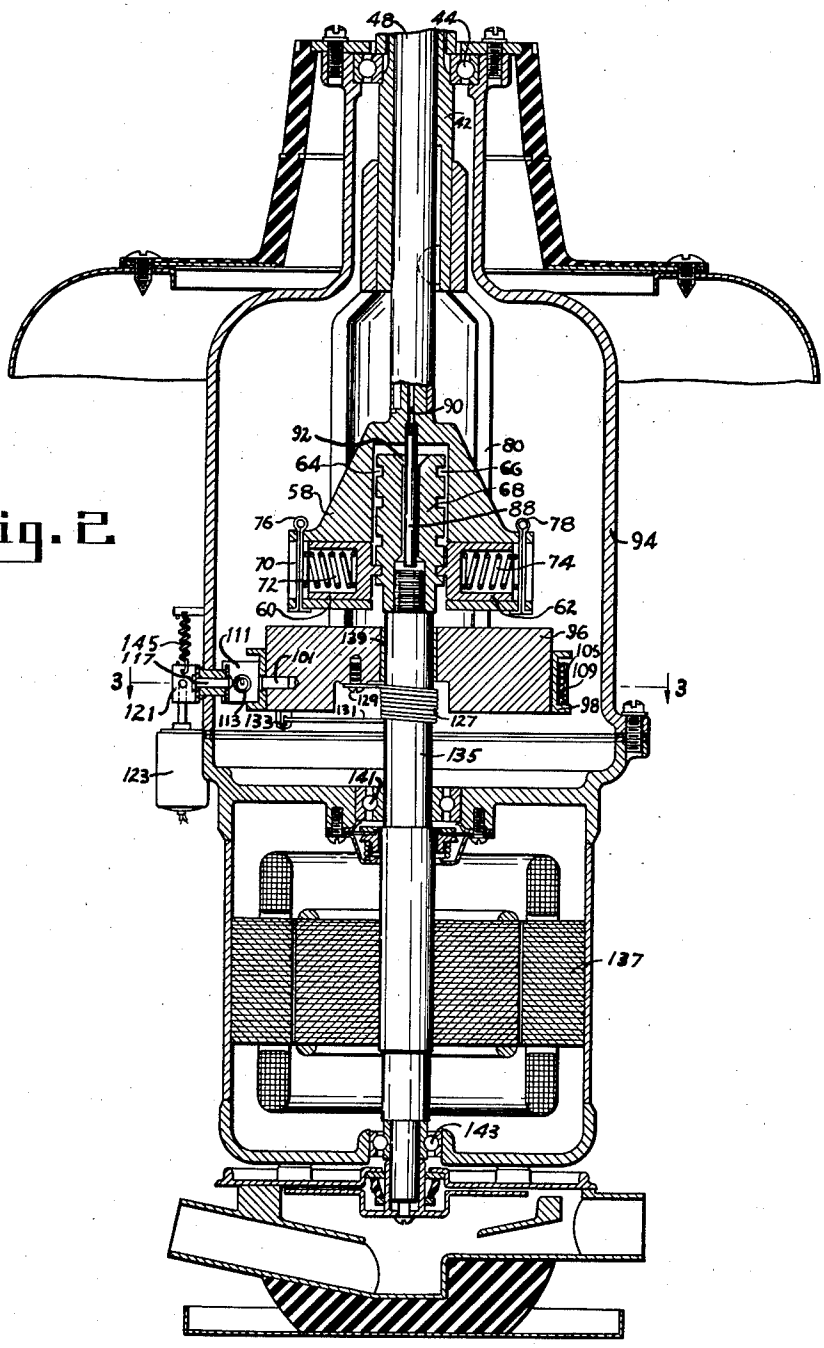
INVENTOR.
Donald K Ferris
BY Spencer Hardman and Fehr
attorneys

Sept. 18, 1945. D. K. FERRIS 2,384,903

DOMESTIC APPLIANCE

Filed Aug. 1, 1942 6 Sheets-Sheet 2

Fig. 2.



INVENTOR.

BY Donald K. Ferris

Spencer Hardman and Fehr
attorneys

Sept. 18, 1945. D. K. FERRIS 2,384,903

DOMESTIC APPLIANCE

Filed Aug. 1, 1942 6 Sheets-Sheet 3

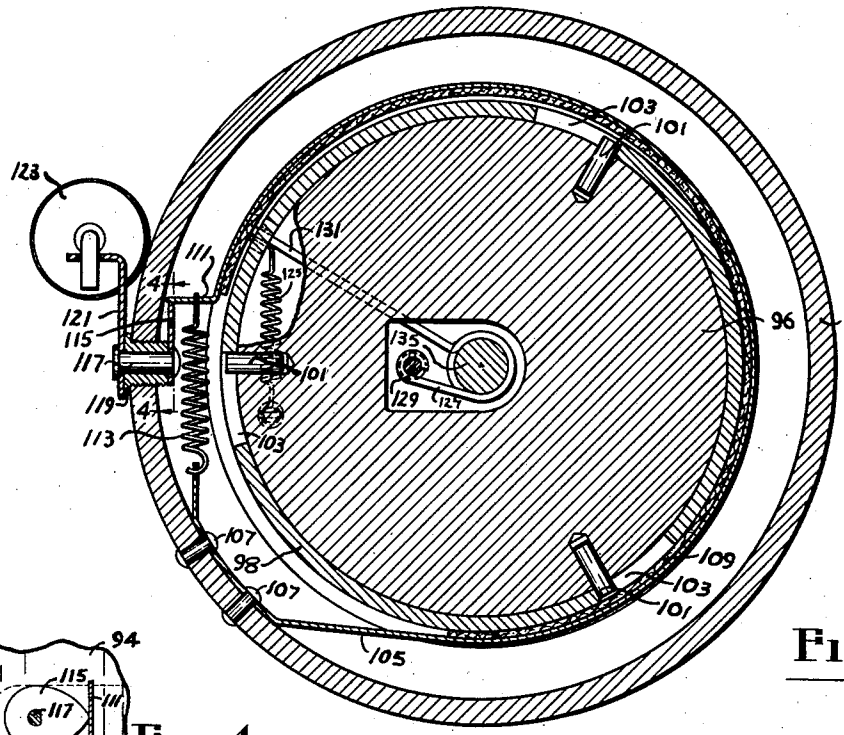


Fig. 3

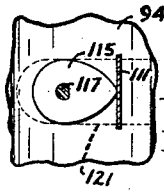


Fig. 4

Fig. 5

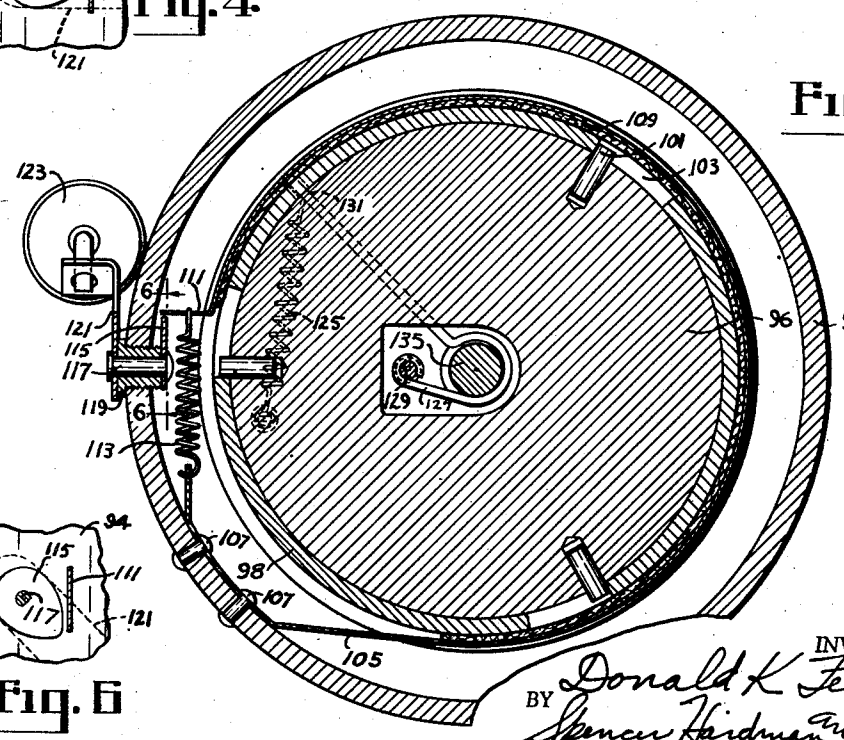


Fig. 6

INVENTOR.
BY Donald K. Ferris
Spencer Hardman and Fehr
attorneys

Sept. 18, 1945. D. K. FERRIS 2,384,903

DOMESTIC APPLIANCE

Filed Aug. 1, 1942 6 Sheets-Sheet 4

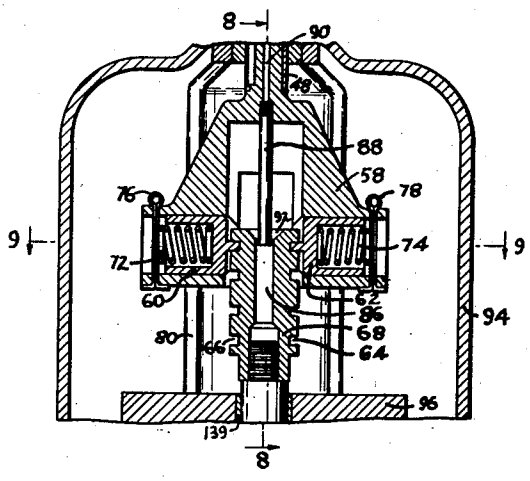


Fig. 7

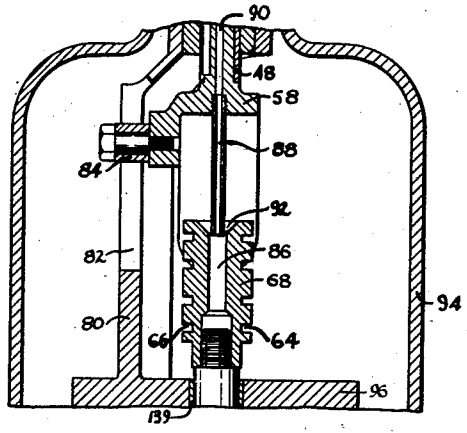


Fig. 8

Fig. 9

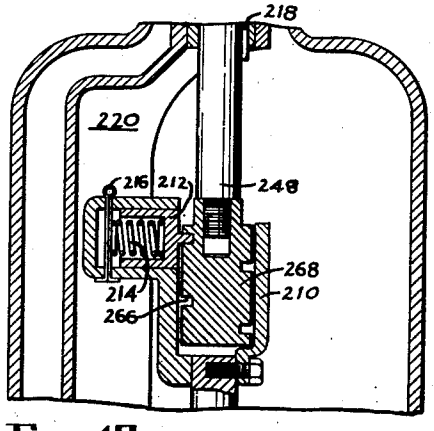
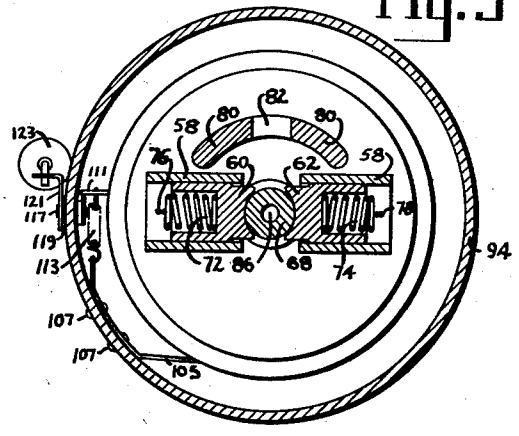


Fig. 10



INVENTOR.
Donald K. Ferris
BY Spencer Hardman and Fehr
attorneys

Sept. 18, 1945. D. K. FERRIS 2,384,903

DOMESTIC APPLIANCE

Filed Aug. 1, 1942 6 Sheets-Sheet 5

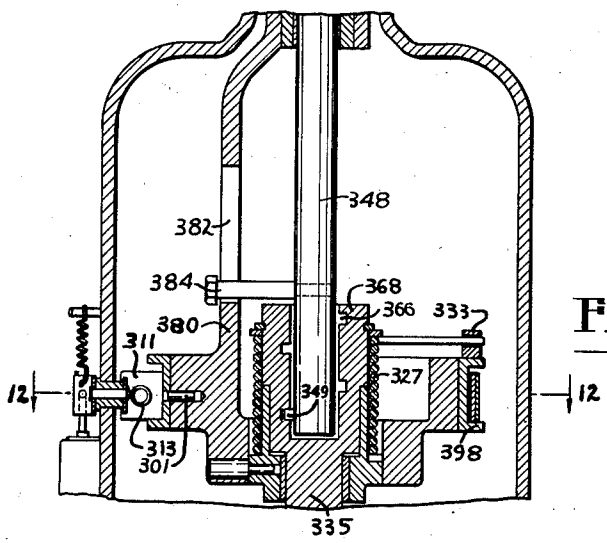


Fig. 11

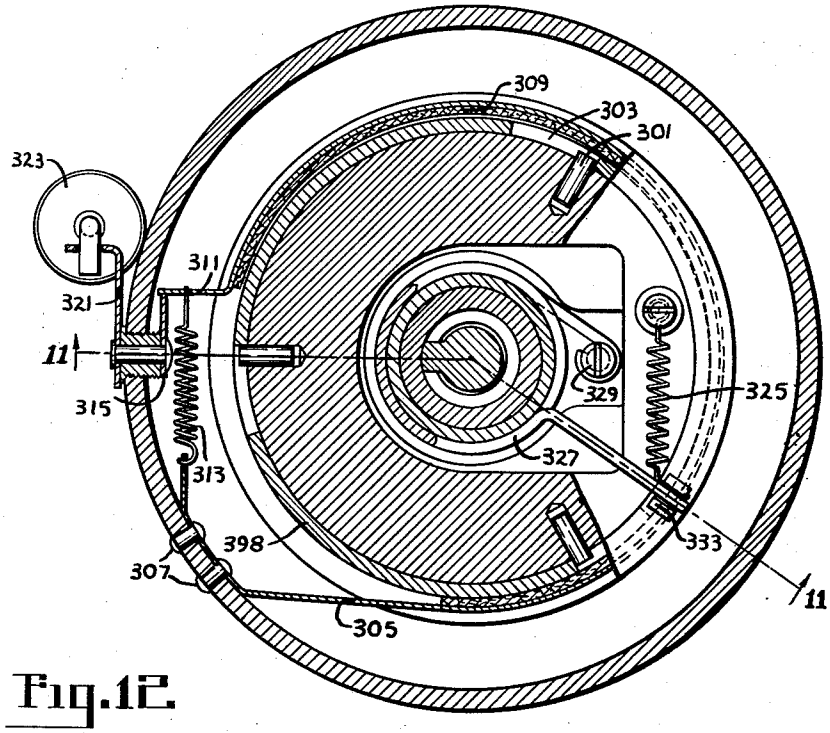


Fig. 12

INVENTOR.
Donald K Ferris
BY
Spencer Hardman and Fehr
attorneys

Sept. 18, 1945. D. K. FERRIS 2,384,903

DOMESTIC APPLIANCE

Filed Aug. 1, 1942 6 Sheets-Sheet 6

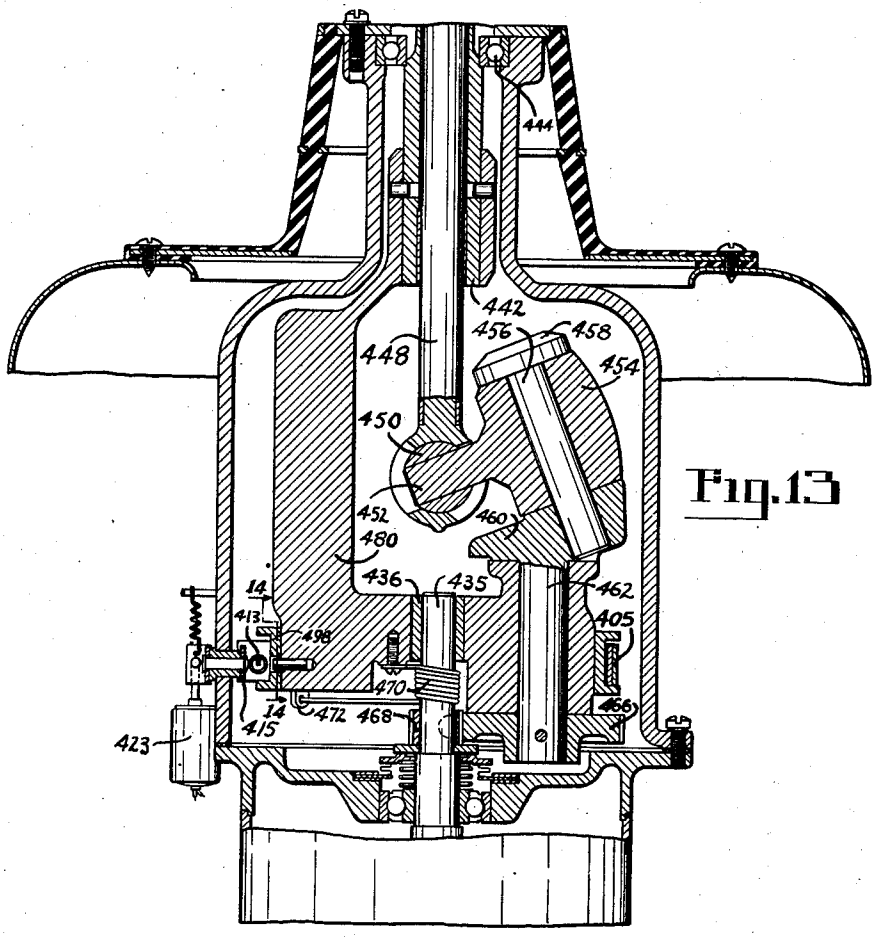


Fig. 13

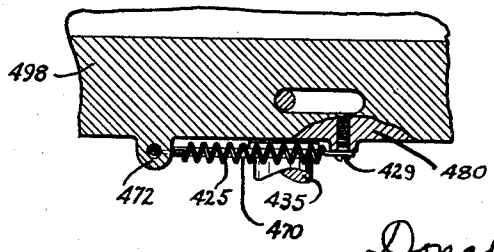


Fig. 14.

INVENTOR.
Donald K. Ferris
BY Spencer Hardman & Fehr
Attorneys

Patented Sept. 18, 1945 2,384,903

UNITED STATES PATENT OFFICE

2,384,903

DOMESTIC APPLIANCE

Donald K. Ferris, Dayton, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application August 1, 1942, Serial No. 453,223

5 Claims. (Cl. 192—12)

This invention relates to a domestic appliance and more particularly to washing machines.

It has long been recognized that it is highly desirable that in washing machines the washing and drying operations be accomplished successively in the same receptacle. By such an arrangement the manual effort required is greatly reduced, and this arrangement also makes automatic operation practical. The sale and use of such washing machines has been impeded by the rather complicated, unreliable and expensive mechanism used to provide agitation, drying and changing from agitation to drying in such a machine.

It is an object of my invention to provide a simple, reliable and inexpensive mechanism for agitating the contents of a washing machine.

It is another object of my invention to provide a simple, reliable and inexpensive means for connecting the tub to the driving means for spinning the tub to dry the clothes.

It is another object of my invention to provide an interlocking control between the connecting means and the means for stopping the tub upon completion of the spinning.

It is another object of my invention to provide a self-energizing braking means for stopping the tub and a simple means which requires comparatively little power for applying and releasing the braking means.

It is another object of my invention to provide a simple efficient lubricating means for washing machines.

These and other objects are attained by providing a washing machine with an agitating means connected through a simple cylindrical cam means to an electric motor for reciprocating the agitating means relative to the tub. The tub is connected by a wound spring clutch mechanism to the electric motor. The wound spring clutch mechanism is controlled by a self-energizing brake means which also stops the tub and which includes a movable brake drum having a limited amount of movement with respect to the tub for operating the wound spring clutch mechanism. The self-energizing brake means is in the form of a band brake which is applied through a spring and released by a cam operated by a solenoid.

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

In the drawings:

Fig. 1 is a top portion of a vertical sectional view through a washing machine mechanism including the tub and the agitating means;

Fig. 2 is the lower portion of the vertical sectional view of the washing machine mechanism;

Fig. 3 is a horizontal sectional view taken along the lines 3—3 of Fig. 2 showing the brake released and clutch engaged for spinning purposes;

Fig. 4 is a fragmentary view of the brake control cam holding the brake in released position;

Fig. 5 is a sectional view similar to Fig. 3 showing the brake applied to hold the tub stationary and to release the wound spring clutch for the agitating period;

Fig. 6 is a fragmentary view showing the brake operating cam in position for applying the brake;

Fig. 7 is a fragmentary vertical sectional view showing the cam with the dual cam follower in its upper position;

Fig. 8 is a fragmentary sectional view taken along the lines 8—8 of Fig. 7;

Fig. 9 is a sectional view taken along the lines 9—9 of Fig. 7;

Fig. 10 is a fragmentary vertical sectional view somewhat similar to Fig. 7 but showing a cylindrical cam attached to the agitator with a single cam follower connected to a driving motor;

Fig. 11 is a fragmentary sectional view taken on the line 11—11 of Fig. 12 showing an internal cylindrical cam connected to a driving motor; and a single cam follower connected to the agitator;

Fig. 12 is an enlarged sectional view taken along the line 12—12 of Fig. 11;

Fig. 13 is a fragmentary vertical sectional view of another form of washing machine mechanism employing the movable brake drum and wound spring type clutch mechanism; and

Fig. 14 is a sectional view taken along the line 14—14 of Fig. 13 through a portion of the brake drum adjacent its connection with the wound spring clutch mechanism.

Referring now to the drawings and more particularly Fig. 1, there is shown a washing machine tub generally designated by the reference character 20 and including an inner tub 22 provided with perforations 24 in its lower portion. Surrounding the inner tub 22 is an outer tub or flume member 26 which prevents the escape of water through the perforations in the inner tub 22 as long as the tub 20 is stationary. The inner and outer tubs 22 and 26 are provided with bosses fastened together by rivets 28 to form a flume 30 between the inner and outer tubs 22

and 26. The inner flange of the inner tub extends to a sealing ring 32 which is in sealing engagement with an annular shoulder 34 upon the bottom of the flume or outer tub member 26. This shoulder 34 is supported by a ring 36 which is fastened to a cup-shaped member 38 which in turn is fastened to a hub 40. This hub 40 is mounted upon the upper end of a rotatable sleeve 42 which is supported by a ball bearing 44.

The agitator 46 is threaded upon the upper end of a vertical rod or tube 48 which is slidable within the bearing sleeve 42. The agitator 46 is generally bell-shaped and contains the upper end of a flexible bellows 50 which has its lower edges sealed to the flange 52 of the flume or outer tub 26. Also connected to the hub 40 is a flywheel 54 for minimizing the vibration during the spinning of the tub.

Heretofore, mechanism of considerable complication has been used to reciprocate the agitator. According to my invention I provide a very simple means to accomplish this. The lower end of the agitator rod 48 is provided with a cam follower member 56 containing the cam follower thimbles 60 and 62 which at their inner end carry the cam follower projections extending into the opposite figure 8 shaped grooves 64 and 66 of the cylindrical cam 68. The cam follower thimbles 60 and 62 are cylindrical in shape and are movable within the cylindrical bore 70 which extends through the cam follower member 58. The cam follower thimbles 60 and 62 are yieldingly pressed inwardly so that their cam follower projections are at all times held within the grooves 64 and 66 of the cylindrical cam 68. This is done by the coil springs 72 and 74 which are held in place by the cotterpins 76 and 78.

In order to prevent the cam follower member 58 from rotating with the cam 68, when it is desired to reciprocate the agitator 46, the bearing sleeve 42 is provided with a yoke member 80 having a vertical slot 82 which receives the roller 84 extending from the rear of the cam follower member 58. To lubricate the bearing sleeve 42 and the ball bearing 44, the interior of the cylindrical cam 68 is drilled to provide a cylinder 86 of a lubricant pump which includes a hollow piston 88 threaded into the center of the cam follower 58 and connecting directly with the lubricant passage 90 leading to the bearing sleeve 42 and the ball bearing 44. The upper end of the cylindrical cam 68 is provided with a flared mouth 92 so that the oil which is splashed around within the frame 94 of the washing machine mechanism will fill the cylinder 86 within the cam 68 between each downward stroke of the cam follower 58 and the agitator shaft 48. On each downward stroke of the cam follower 58 and the hollow piston 88, oil will be forced from the bottom of the cylinder 86 up through the passage in the hollow piston and up through the lubricant passage 90 to the bearing sleeve 42 and the ball bearing 44.

The bottom of the yoke member 80 is provided with a disk 96. Supported upon this disk 96 is a flanged brake drum 98 which is held on the disk 96 by three pins 101. These pins are fixed to the disk 96 and extend into horizontal slots 103 in the brake drum so that, according to the length of these slots, the brake drum is allowed a limited amount of rotation upon the disk 96. The brake drum 98 cooperates with a self-energizing band brake member including a metal band 105 fastened by the rivets 107 to the housing or frame 94 provided upon its inner face with suitable brake lining 109. The other end of the band 105 is turned outwardly to provide a flange 111 to which is hooked one end of a tension coil spring 113 which has its other end anchored to the opposite end of the brake band 105. It will be understood that this brake is self-energizing when the disk 96 is rotating in the counterclockwise direction as viewed in Figs. 3 and 5. The spring 113 is used to apply the brake and apply the proper pulling force to the flange 111 to cause the brake band 105 to grip the brake drum 98.

In order to release the brake, a cam 115 is mounted upon the inner end of a rotatable shaft 117 which extends through a bushing 119 provided in the wall of the housing or frame member 94. The cam 115 is operated through a lever arm 121 by an electromagnet or solenoid 123. When the cam 115 is turned so that it does not engage the flange 111 the brake will be applied to the brake drum. When, however, the solenoid 123 is energized, the cam 115 will engage the flange 111 and lift the brake band 105 and its brake lining away from the brake drum 98 to release the disk 96 and the tub 20.

Through a novel interlocking arrangement the application and release of the brake is used to disconnect and connect the driving motor from and to the tub. This feature also cooperates perfectly with the cylindrical cam reciprocating mechanism for the reason that when the motor is connected to the tub for spinning purposes, the reciprocation of the agitator will be prevented, because it is necessary that there be relative rotation between the cylindrical cam 68 and the cam follower 58 to provide reciprocation of the agitator.

When the brake is applied to prevent rotation of the tub and the cam follower 58, reciprocation of the agitator will take place upon rotation of the driving means and the cylindrical cam 68. To accomplish this purpose, the brake drum 98 is urged in a counterclockwise direction by the tension coil spring 125. The spring 125 causes the brake drum 98 to be rotated relative to the disk 96 and the tub 20 until the pins 101 each engage one end of their respective slots 103.

Provided on the bottom of the disk 96 is a wound spring type clutch 127 having its one end fastened by a screw 129 to the disk 96 and its other end 131 extended through an aperture in an ear 133 extending downwardly from an edge of the brake drum 98. The wound spring clutch 127 extends in a counterclockwise direction around the drive shaft 135 of an electric driving motor 137. This drive shaft has a bearing 139 within the disk 96 and is threaded to the cylindrical cam 68 at its upper end. The drive shaft 135 is supported at its upper and lower ends by the ball bearings 141 and 143. The bearing 139 constitutes the lower bearing for the bearing sleeve 42 of which, of course, the upper bearing is the ball bearing 44. When the motor 137 and the solenoid 123 are energized, the brake band 105, the brake drum 98 and the wound spring clutch mechanism 127 will be in the position shown in Figs. 3 and 4.

Operation

To agitate the contents of the tub, the solenoid 123 as well as the electric motor 137 are energized. This will cause the brake release cam to turn in a clockwise direction as viewed in Fig. 6 to the position shown in Fig. 6, to release the brake band 105 and permit the spring 113 to apply the self-energizing band brake 105 to the brake drum 98,

as shown in Fig. 5. The application of the brake band 105 to the brake drum 98 will cause the brake drum 98 to be held, but the disk 96, the yoke member 80, the tub 20 and the cam follower 58 will continue to rotate through a limited angle relative to the brake drum 98 and the brake band 105 until the wound spring clutch 107 is unwound sufficiently to lose its grip upon the drive shaft 135 against its own spring tension and the tension of the spring 125 which will be stretched as shown in Fig. 5. The drive shaft 135 will then rotate freely while the cam follower member 58 will be prevented from rotating, but the follower 58 will reciprocate vertically between the positions shown in Figs. 1 and 2 and the positions shown in Figs. 7 and 8.

In order to terminate the agitating or washing period and to start drying the clothes the solenoid 123 is deenergized to cause its return spring 145 to turn the cam 115 in a counterclockwise direction to the position shown in Fig. 4 as viewed in Fig. 4, so that the flange 111 will be raised against the tension of the spring 113 to release the brake band 105 from the brake drum 98. The releasing of the brake drum 98 will allow the tension coil spring 125 to rotate the brake drum 98 relative to the disk 96 to cause the wound spring clutch 127 to grip the drive shaft 135 to cause the tub 20, the yoke member 80, the bellows follower 58, the disk 96 and the brake drum 98 to rotate with the cylindrical cam 68 and the electric motor 137, so that the washing fluid within the tub will be thrown over the rim of the flume or outer tub 26 and drawn from the inner tub 22 through the apertures 24 and the flume passage 30.

Second form

In Fig. 10 is shown a modification in which the agitator shaft 248 has connected to its lower end a cylindrical cam 268 provided with a single cam groove 266 in the form of a figure 8. This cylindrical cam 268 is rotatably mounted within a socket 210 forming part of the cam follower member which carries the single cam follower thimble 212 provided with a cam follower projection held in engagement with the cam groove 266 by the compression type coil spring 214 which is held by the cotterpin 216. A key 218 is provided for preventing relative rotation between the agitator shaft 248 and the yoke member 220 which connects to the tub. This figure illustrates that there are a number of different ways to use a cylindrical cam for operating the agitator.

Third form

In Figs. 11 and 12 is illustrated the use of the internal cylindrical cam. There is shown the agitator shaft 348 provided with a cam follower 349 extending into the cam groove 366 of the sin- internal cylindrical cam is connected at its lower end directly to the drive shaft 335 of the driving motor. The agitator shaft 348 is prevented from rotating relative to the yoke member 380 by the pin 384 provided with a roller extending into a vertical slot 382 in the yoke member 380. The outside of the internal cylindrical cam 366 is provided with a wound spring type of clutch 327 which has its lower end anchored to the screw 329 fixed to the lower end of the yoke member 380. The upper end of the wound spring clutch member is extended until it passes through an aperture in the ear 333 extending upwardly from the brake drum 398 which is rotatably mounted upon the lower end of the yoke member 380. The brake drum member 398 is supported by three pins 301 which extend into three longitudinal slots 303 in the brake drum.

Extending around the brake drum 398 is a self-energizing band brake 305 which is anchored to the housing by the rivets 307 at one end and provided with a flange 311 at the opposite end to which is connected the tension coil spring 313. The band brake is faced with brake lining 309 and it grips the brake drum in a self-energizing manner when the tension spring 313 is allowed to exert its force upon the flange at the loose end of the band brake. The brake is released by a cam 315 operated by the solenoid 323 through the arm 321 and the shaft 317 for lifting the flanged end 311 of the band brake against the tension of the spring 313 to release the brake.

Operation of third form

This modification operates in substantially the same manner as the first modification. When the solenoid 323 and the driving motor are energized, the cam 315 will move away from the flange 311 to cause the spring 313 to apply the self-energizing brake 305 to the brake drum 398. This application will cause the brake drum 398 to be held stationary by the brake band 305 and the yoke member 380 will then rotate with respect to the brake drum 398 until the pins 301 reach the opposite ends of the slot 303 from the position they are shown in Fig. 12. This action will cause the wound spring 327 and its anchoring screw 329 to turn in a counterclockwise direction relative to the ear 333 which holds the other end of the wound spring clutch member so that the wound spring clutch member will be unwound to release its grip from the outside of the cylindrical cam 368. This release will allow the main driving shaft to turn relative to the yoke member 380 to cause the cam follower member 349 to traverse the cam groove 366 to reciprocate the agitator shaft 348.

When it is desired to terminate the agitating period, the solenoid 323 is deenergized to cause the came 315 to engage the flange 311 at the end of the band brake 305 to release the brake 305. Upon the release of the brake 305, the tension spring 325 will turn the brake drum 398 in a counterclockwise direction relative to the yoke 380 until the pins 301 reach the end of the slot 303, as shown in Fig. 12. At the same time the ear 333 will move the extended end of the wound spring clutch member 327 in a counterclockwise direction to cause it to wrap tightly and grip the outside of the cylindrical cam 368. It should be noted that the wound spring type clutch member is self-energizing in the direction of rotation of the driving motor and in the same direction as the band brake 305. Thus, in this arrangement which is used in all the forms illustrated, the driving energy of the motor is used to tighten the wound spring clutch member 327. This engagement causes the brake drum, the yoke 380, the wound spring clutch member, the tub and the agitator and agitator shaft 348 to turn by reason of the direct driving connection with the motor drive shaft 335. When the clothes have been spun sufficiently dry, the solenoid 323 may be energized to remove the cam 315 from contact with the flange 311 of the brake band 305 to allow the spring 313 to pull the band brake 305 into engagement with the brake drum 398. Because of its self-energizing relationship, the band brake 305 will wrap itself tightly upon the brake drum un-

der the force provided by the rotational inertia of the spinning tub.

Fourth form

In Figs. 13 and 14 I have shown how my wound spring clutch and movable brake drum type of control can be applied to a washing machine using another form of agitator operation. In this form, the agitator shaft 448 reciprocates within a bearing sleeve 442 supported at its upper end by the ball bearings 444. The lower end of the agitator shaft 448 holds a wrist pin 450 which receives in sliding engagement a pin 452 extending from the hub 454 which is rotatably mounted upon the inclined pin 456 and is tightly held between the head 458 of the pin 456, and a rotatable member 460. The rotatable member 460 is provided with a shaft 462 which is rotatably mounted in a yoke member 480 fastened to the bottom of the bearing sleeve 442, and is rotatably mounted with respect to the upper end of the drive shaft 435 of the electric driving motor. A plain bearing 436 is provided in the yoke member 480 for receiving the upper end of the drive shaft 435. The shaft 462 at its lower end is provided with a spur gear 466 which meshes with a spur pinion 468 keyed to the drive shaft 435. A wound spring type clutch member 470 surrounds the drive shaft 435 and has one end anchored by a screw to the yoke 480 while the other end is provided with a projection which extends through the ear 472 projecting downwardly from the brake drum 498 which is rotatably mounted upon the yoke 480 and supported by three pins projecting from the yoke into circumferential slots provided in the brake drum 498. A self-energizing band brake 405 extends around the brake drum and is pulled into engagement with the brake drum by the tension coil spring 413 and released by a cam 415 under the control of the solenoid 423. A tension coil spring 425 extends between the ear 472 and an anchoring screw 429 to rotate the drum 498 relatively to the yoke 480 in such a direction to wind the wound spring clutch member 470 upon the drive shaft 435 when the band brake 405 is released.

Operation of fourth form

When the band brake 405 is applied to the brake drum 498 the yoke member 364 will turn relative to the brake drum 498 until the pins extending from the yoke member into the slots in the brake drum 498 reach the end of the slots. This will cause the unwinding and release of the wound spring clutch member from the drive shaft 435 and will also prevent the further rotation of the yoke member 480 and the further rotation of the washing machine tub which is connected to the upper end of the bearing sleeve 442. The rotation of the drive shaft 435 will cause the pinion 468 to rotate the gear 466 and to revolve the pin 456. The angularity of the pin 456 with respect to the shaft 462, upon whose axis the member 460 rotates, will cause the pin 452 to move up and down thereby reciprocating the agitator shaft 448.

When the agitation is completed, the band brake 405 will be released to allow the tension coil spring 425 to rotate the brake drum 405 relative to the yoke member 480 in order to wind the wound spring clutch member 470 to cause it to grip the drive shaft 435 and rotate the yoke member 480 as well as the washing machine tub, the agitator, the agitator shaft 448 as well as the remainder of the members which did provide the reciprocation of the agitator shaft 435. When it is desired to terminate the spinning operation band brake 405 is applied by the spring 413 thereby assuring the smooth swift stop to the rotation of the tub. This also causes the release of the yoke 480 from the drive shaft 435 by the wound spring clutch member 470.

The self-energizing character of the brake makes it possible to operate the brake with a small amount of power. The application of the brake by means of a spring provides smoothness and uniformity in stopping the tub. The use of the operation of the brake to control the operation of the self-energizing wound spring clutch provides an interlocking arrangement which insures the release of the clutch upon application of the brake and the release of the brake prior to engagement of the clutch.

While the form of the embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, a rotatable driving means, a rotatable driven means provided with a movable braking member provided with a braking surface, a reciprocable driven means rotatable coincidentally with said rotatable driven means, an anchored braking means for engaging said braking surface, a reciprocating mechanism connecting said rotatable driving means and said reciprocable driven means, a clutch means for connecting said driving means and said rotatable driven means, means responsive to the relative movement between the braking member and the rotatable driven means for controlling the clutch means, and means for controlling the operation of said braking means.

2. In combination, a driving means, a driven means, means providing for relative movement of the driving means with respect to the driven means, a brake means having one element provided with a stationary anchorage and a cooperating element connected to the driven means, means providing a limited amount of movement between the cooperating element and the driven means, a wound spring clutch means wound into coaxial contact relationship with a portion of the driving means and having one end of the spring connected to said driven means and the other end connected to said cooperating element for clutching together and unclutching the driving and driven means by the relative movement between said cooperating element and the driven means.

3. In combination, a driving means, a driven means, means providing for relative movement of the driving means with respect to the driven means, a brake means having one element provided with a stationary anchorage and a cooperating element connected to the driven means, means providing a limited amount of movement between the cooperating element and the driven means, a wound spring clutch means wound into coaxial contact relationship with a portion of the driving means and having one end of the spring connected to said driven means and the other end connected to said cooperating element for clutching together and unclutching the driving and driven means by the relative movement between said cooperating element and the driven means, and a second spring means connecting said cooperating element and said driven means and having a greater spring force with respect to the cooperating element and the driven means for overcoming spring reaction of the wound spring clutch

means to cause the clutch means to engage the driving means.

4. In combination, a rotatable driving means, a rotatable driven means, a reciprocable driven means, means for causing said reciprocable driven means to rotate coincidentally with said rotatable driven means, means operated by the relative rotation of said driving and rotatable driven means for reciprocating said reciprocable means, a movable brake means for preventing rotation of said rotatable driven means and causing the driving means to reciprocate the reciprocable means, a clutch means movable into engagement with a portion of said driving means and having one portion connected to said rotatable driven means and the other portion connected to and operated by said brake means for causing the driving means to rotate both driven means, said rotatable driven means being provided with bearings, a lubricant reservoir for lubricating said clutch means, a plunger type lubricant pump including piston and cylinder members located in said reservoir, means for transmitting lubricant from said pump to said bearings, and means operated by the reciprocation of said reciprocable means for moving said piston member relative to said cylinder member to pump lubricant.

5. In combination, a rotatable driving means, a rotatable driven means, a reciprocable driven means, means for causing said reciprocable driven means to rotate coincidentally with said rotatable driven means, means operated by the relative rotation of said driving and said rotatable driven means for reciprocating said reciprocable means, a movable brake means for preventing rotation of said rotatable driven means and causing the driving means to reciprocate the reciprocable means, and a wound spring type clutch means movable into wrapping engagement with a portion of said driving means and having one end connected to said rotatable driven means and the other end connected to and operated by said brake means for causing the driving means to rotate both driven means.

DONALD K. FERRIS.