

July 26, 1960

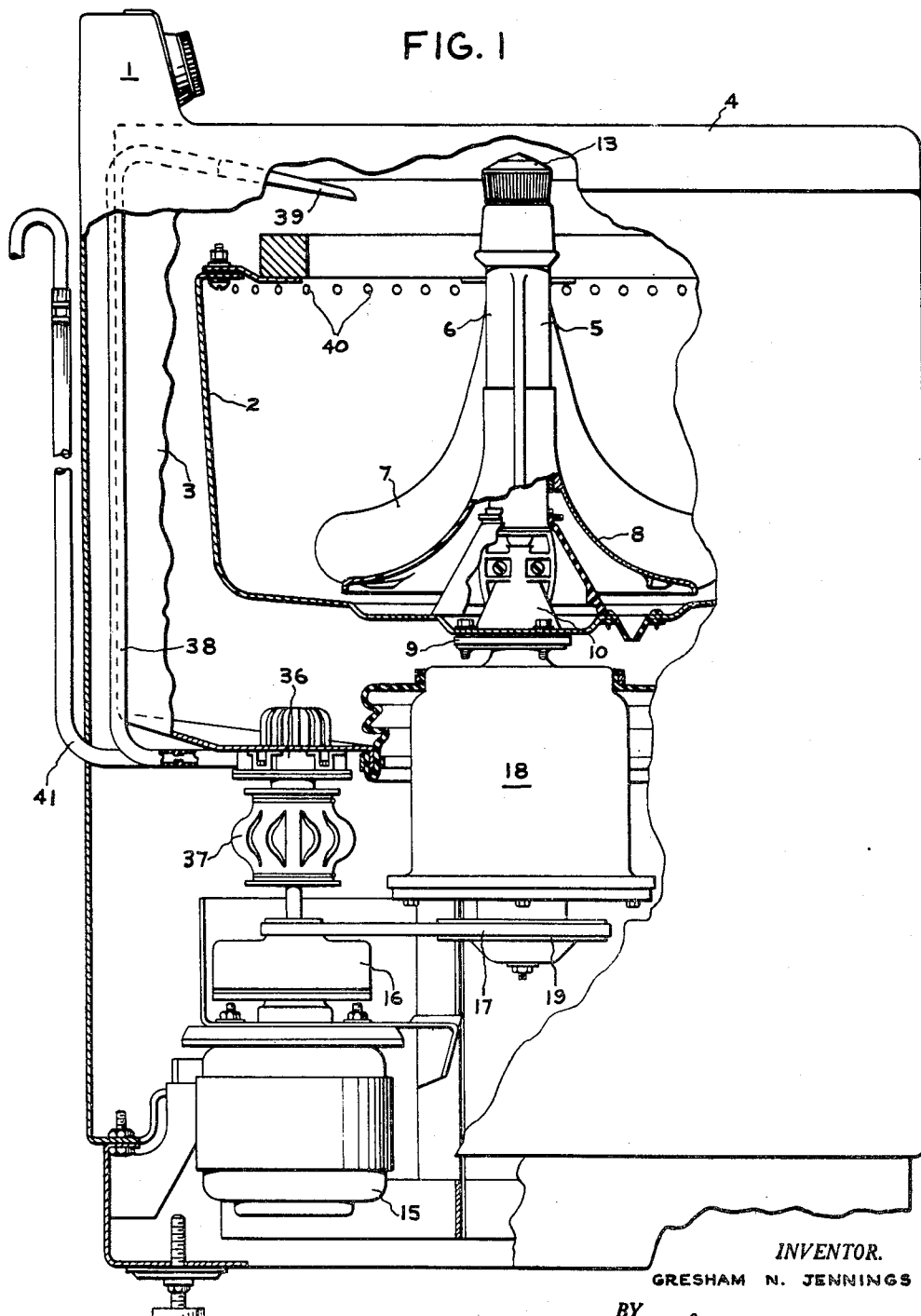
G. N. JENNINGS

2,946,409

BRAKE MECHANISM FOR CLOTHES WASHING MACHINES

Filed Feb. 7, 1958

3 Sheets-Sheet 1



INVENTOR.
GRESHAM N. JENNINGS
BY *G. P. Lawrence*
HIS ATTORNEY

July 26, 1960

G. N. JENNINGS

2,946,409

BRAKE MECHANISM FOR CLOTHES WASHING MACHINES

Filed Feb. 7, 1958

3 Sheets-Sheet 2

FIG. 2

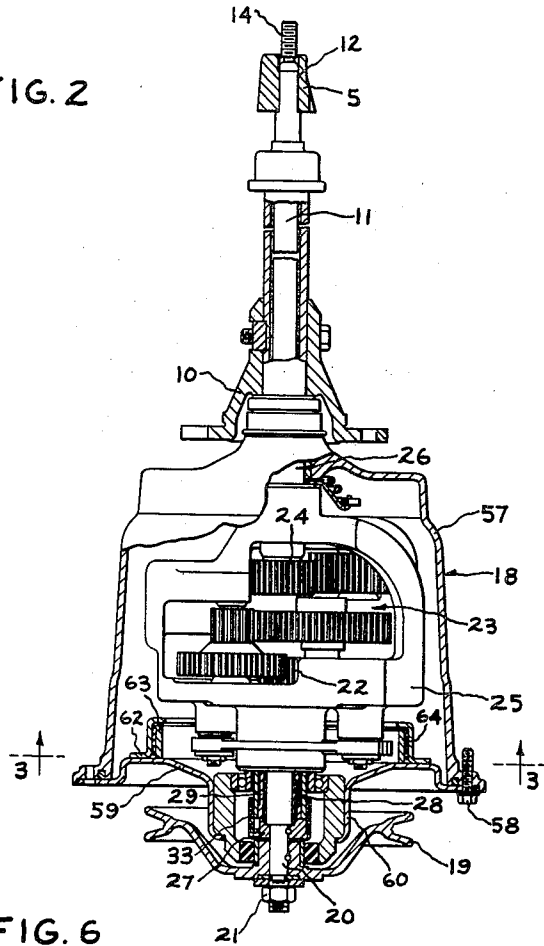
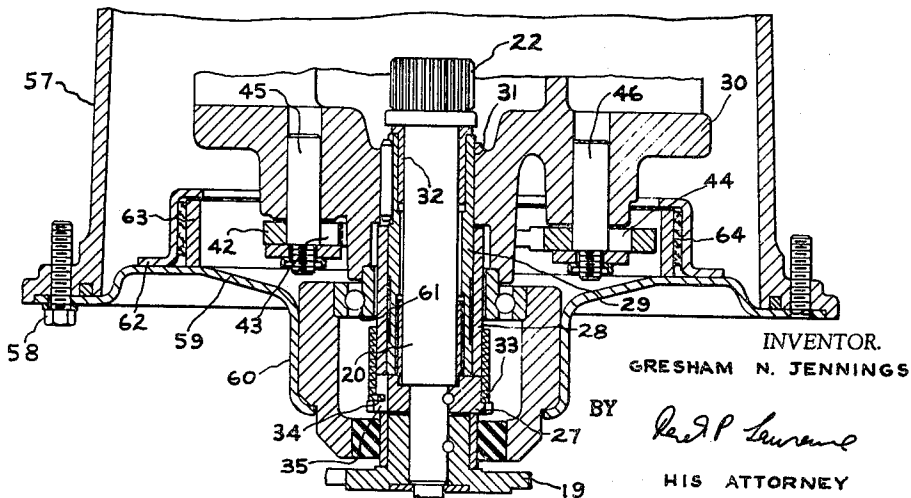


FIG. 6



July 26, 1960

G. N. JENNINGS

2,946,409

BRAKE MECHANISM FOR CLOTHES WASHING MACHINES

Filed Feb. 7, 1958

3 Sheets-Sheet 3

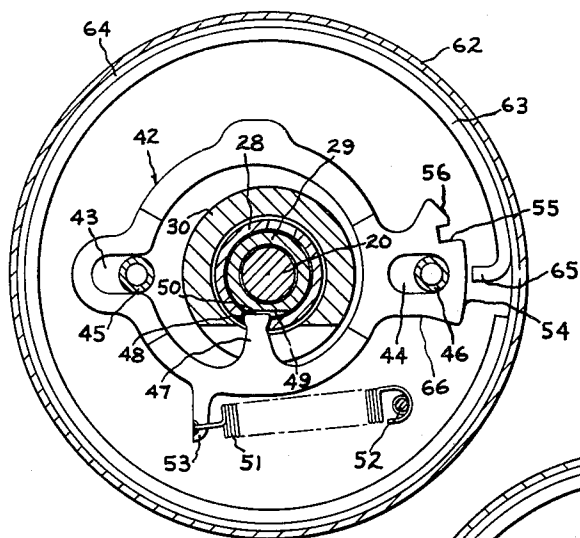


FIG. 3

FIG. 4

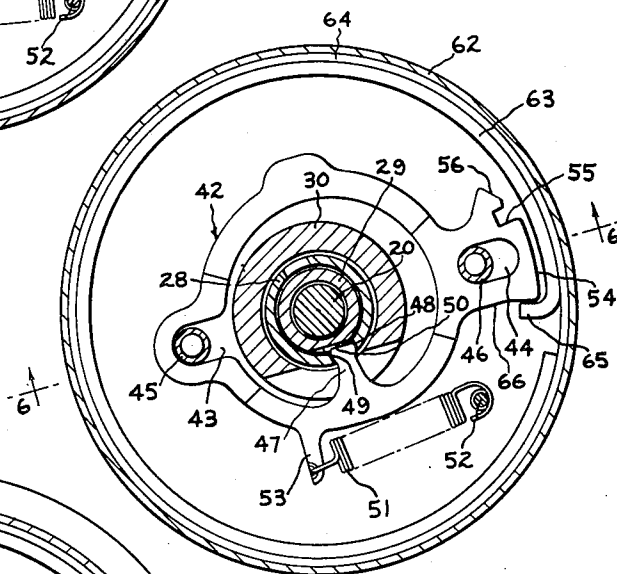
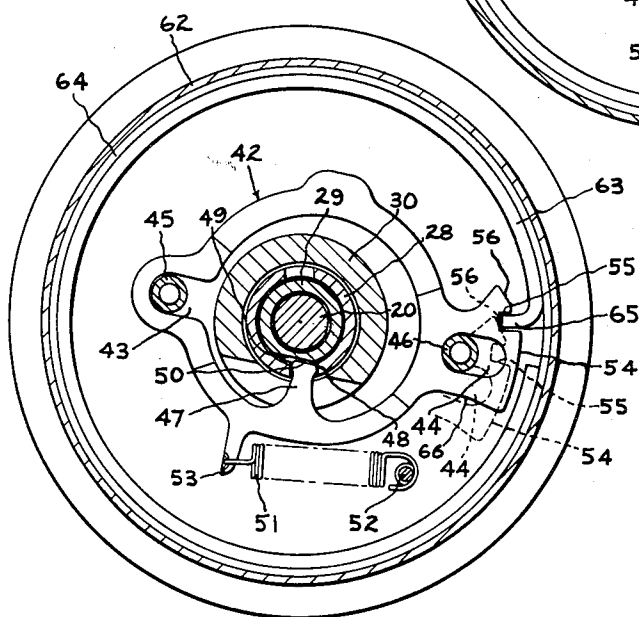


FIG. 5



INVENTOR.
GRESHAM N. JENNINGS

BY *Robert P. Lawrence*

HIS ATTORNEY

1

2,946,409

BRAKE MECHANISM FOR CLOTHES WASHING MACHINES

Gresham N. Jennings, Louisville, Ky., assignor to General Electric Company, a corporation of New York

Filed Feb. 7, 1958, Ser. No. 713,876

1 Claim. (Cl. 188—134)

This invention relates to brake mechanisms, and more particularly to such mechanisms for use in automatic clothes washing machines to prevent undesired rotation of parts which are rotatable at other times in the washing machine cycle.

Automatic clothes washing machines customarily proceed through a sequence of operations in order to wash, rinse and dry the clothes. The sequence ordinarily includes a washing operation, a first centrifugal extraction operation in which the wash water is removed from the clothes, a rinsing operation in which the clothes are rinsed in clean water, and a final centrifugal extraction operation in which the rinse water is removed from the clothes. Depending upon the type of machine, the action within any given operation may be slightly different, as for example, some machines having a basket in which the clothes are washed include a two stage initial extraction operation in order to avoid suds locking of the basket, and other machines include a spray rinse during the rinsing operation in addition to the customary submersion rinse. But the general sequence of washing, extracting, rinsing and then extracting again is used in almost all automatic washing machines.

During the extracting operations, the basket container for the clothes is rotated at high speed so as to effect extraction of the liquid from the clothes by centrifugal action. Because of the high speed reached by the basket, or clothes container, there is a very substantial amount of momentum in the basket at the end of the spin operation, and if the basket is allowed merely to coast to a stop it may take as long as 100 seconds. This is undesirable, both because it tends to lengthen the washing cycle, and because, where a safety switch is used to shut off the power when the lid is lifted during spin, continued high speed rotation would partly undo the usefulness of the safety switch. It is therefore desirable that suitable braking means be provided so that the basket will be rapidly stopped at the end of the spin operation. More particularly, it is desirable to make such a device which operates instantaneously and automatically as soon as the spin sequence is finished, that is, as soon as the driving force to the basket has ceased to be applied.

A second undesirable type of basket rotation has been found to occur as a result of various actions and reactions during the washing and rinsing portion of the cycle. The usual approach is to oscillate an agitator device within the basket while keeping the basket stationary. It has, however, been found that sometimes the basket will tend to creep around. This is particularly true where the agitator action is effected through a gear sequence which depends for its oscillating action on the basket and its transmission providing a stationary base for the gears. In such a case, the reactions to the oscillating action of the agitator are transmitted back through the gears to the basket and its transmission, causing a tendency of the basket to step, or creep, in a circle.

2

It is desirable to improve the operation of the washing machine by maintaining the basket stationary during washing and rinsing operations so as to eliminate the creeping thereof. This, again, is a braking type action in that it is desired to prevent rotation of the basket.

It is, therefore, an object of the invention to provide a braking mechanism for particular use in automatic washing machines which will stop the basket from spinning as soon as the power applied to make it spin has ceased to be applied.

It is a further object of the invention to provide suitable apparatus for braking or preventing the creeping effect of the basket during the washing and rinsing cycles.

Yet a further object of the invention is to provide a unitary arrangement which will effect both the braking after spin and the braking during washing and rinsing.

Yet another object of the invention is to effect these results automatically as a result of lack of torque from the driving means to the basket.

In one aspect of the invention I provide, in a washing machine, suitable braking apparatus which includes a rotatable brake member arranged to be connected both to a driving member and to a driven member, such as a clothes basket, so as to rotate with them. The brake member connects the two so that torque to and from the driven member must necessarily pass through the brake member. This is effected by connecting the brake member to the driving and driven member so that it has freedom for limited sliding motion relative thereto in a direction generally perpendicular to the axis of rotation. When torque is transmitted from the driving member to the driven member the brake member slides in a first direction to a first pre-determined position and then rotates in that position; when the torque is transmitted to the brake member in the opposite direction, from the driven member, as a result of the momentum of the driven member after application of power to the driving member is stopped for instance, the brake member slides in the opposite direction to a second predetermined position. Substantially stationary braking means are provided, and when the rotatable brake member is in its second position it engages the stationary braking means so as to stop rotation of all the aforementioned rotatable members.

This construction provides for a rapid stopping of rotatable parts when power is not being applied, as at the end of a spin or extraction sequence. In addition, since the torque also comes from the driven member to the brake member during creeping of the basket, this too moves the rotatable brake member to a position where it engages the stationary braking means.

The features of the invention which are believed to be novel are set forth with particularity in the appended claim. The invention itself however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following details and description taken in conjunction with the accompanying drawings.

In the drawings, Fig. 1 is a side elevational view of a clothes washing machine which includes the new and improved braking arrangement, the view being partially broken away and partially in section in order to show details;

Fig. 2 is an enlarged view of the transmission apparatus of the machine in Fig. 1, partly broken away and partly in section to show details;

Fig. 3 is a view along line 3—3 in Fig. 2 illustrating the parts of the braking system in the positions they assume during the extraction sequence;

Fig. 4 is a view along the same line as Fig. 3, with the

3

parts in the position they assume at the end of a spin sequence in order to effect braking;

Fig. 5 is a view along the same line as Figs. 3 and 4, with the parts in the position they assume during washing and rinsing operations in order to prevent creep of the clothes basket; and

Fig. 6 is an enlarged fragmentary sectional view along line 6-6 in Fig. 4.

Referring now to Fig. 1, I have shown therein an agitator type clothes washing machine 1 having a clothes basket 2 in turn disposed within an outer imperforate tub or casing 3 mounted within an appearance cabinet 4. At the center of basket 2 there is positioned a vertical axis agitator 5 which includes a center post 6 and a plurality of radially extending vanes 7. The agitator is further provided with an outwardly and downwardly flared skirt 8 to which vanes 7 are joined at their lower ends.

Both the clothes basket 2 and the agitator 5 are rotatably mounted. The basket is mounted on a flange 9 of a rotatable hub 10, and the agitator 5 is mounted on a shaft 11 (Fig. 2) which extends upwardly through hub 10. Agitator 5 is secured at the top of shaft 11 by mating engagement with flat portions 12 formed on the shaft, and is held in position by a suitable member 13 (Fig. 1) which is internally threaded so as to screw on to threaded portion 14 at the end of shaft 11.

During the cycle of operation of the machine 1 the agitator is first oscillated back and forth within the basket 2 to wash the clothes therein. Then, after a predetermined period of this washing action, the basket 2 is rotated at high speed to extract centrifugally the washing liquid and discharge it into the outer tub 3. Following this extraction operation a supply of clean liquid is introduced into the wash basket for rinsing the clothes and the agitator is again oscillated. Finally, the basket is once more rotated at high speed to extract the rinse water and discharge it into the outer tub.

The basket 2 and agitator 5 are powered through a reversible motor 15. Motor 15 drives the basket and the agitator through a drive which includes a clutch 16 which is mounted on the motor shaft. The clutch allows the motor to start without load and then picks up the load as it comes up to speed. A suitable belt 17 transmits power to transmission assembly 18 through pulley 19. Thus, depending upon the direction of motor rotation, pulley 19 of transmission 18 is driven in opposite directions.

The details of transmission 18 are shown more clearly in Fig. 2 to which reference is now made. As previously described, the pulley 19 is driven from the reversible driving motor 15 by means such as belt 17. Pulley 19 is keyed so as to be rigidly secured to a driving input shaft 20, the pulley being secured on the shaft by any suitable means such as a nut 21 threaded onto the end of the shaft. The shaft 20 extends upwardly, terminating at its upper end in a driving pinion 22 (see also Fig. 3) which drives an agitator gear train indicated generally by the numeral 23 so as to provide an oscillary drive to an output agitator pinion 24, keyed or otherwise rigidly secured to the lower end of agitator shaft 11.

The entire gear train 23 is carried by a casing 25 which is secured to a spin tube 26 in turn rigidly fastened to hub 10, flange 9, and basket 2. Casing 25 forms a stationary base for the gears to effect the oscillatory drive of the agitator. A driving hub 27 is keyed to input driving shaft 20 above pulley 19 and has the same outside diameter as a tube member 28. Tube 28 is in turn mounted about a concentric tube 29 which is rotatable relative to shaft 20, and which is rigidly secured to plate 30, as by being pressed into the opening 31 of the plate. Plate 30 forms the base of the casing 25 so that the tube 29 is effectively rigidly secured to the casing and is rotatably mounted on shaft 20 by means of bearing 32.

4

Encircling both hub 27 and the lower portion of tube 28 is a spring clutch 33 having one end 34 secured in a slot 35 provided in hub 27. It can be seen that spring 33 is therefore always rotated with pulley 19 and shaft 20. The spring is coiled in the form of a helix so that rotation in one direction will cause the spring to tend to unwind, expanding it slightly in diameter and causing it to ride loosely on the outer surface of tube 28. Under these circumstances no torque is transmitted to tube 28 and plate 30, and the casing 25 therefore remains substantially stationary to provide the oscillating movement of agitator 5. However, if the direction of rotation of shaft 20 is reversed as a result of the reversal of direction of rotation of motor 15, spring clutch 33 will tend to wind up tightly and thus grip the exterior surface of tube 28 so as to rotate the tube, plate 30 and casing 25 together with gear train 23. The rotation of the casing 25 at the same speed as the input gear 22 precludes the oscillating motion of the agitator and instead drives the agitator and basket together so that they rotate at centrifugal extraction speed.

To summarize the operation, as thus far described, rotation of shaft 20 in one direction causes a loosening of spring clutch 33 and consequently no torque is transmitted to tube 28 and plate 30, the torque being transmitted only through gear 22 and gear train 23 to gear 24 and agitator shaft 11 to effect oscillating movement of the agitator 5. For the other direction of rotation, the spring clutch 33 is tightened to transmit torque to tube 28 and case 25 so that the case rotates at the same speed as gear 22, thus causing the agitator 5 and basket 3 to be rotated together at the same speed.

Referring again to Fig. 1 to complete the general description of washing machine 1, motor 15 also drives a pump 36 through a flexible coupling 37 which connects the motor shaft and the pump shaft. During washing and rinsing operations, pump 36 discharges into a conduit 38 which leads to a nozzle 39 so that the liquid is recirculated constantly from the tub into the basket and then through overflow openings 40 back into the tub. At the end of the washing and rinsing portions of the cycle, and in response to a reverse direction of rotation of motor 15 to effect extraction as described, pump 36 discharges into a conduit 41 which is adapted for discharge to a stationary tub or drain so that the pump is effective to drain tub 3. While any suitable pump may be used for this purpose, the one just described is representative, and is described in detail and claimed in a co-pending application Serial No. 468,460, now Patent No. 2,883,843, filed November 12, 1954, by John Bochan and owned by the General Electric Company, the assignee of this application.

In order to provide rapid stopping of basket 2, at the end of the spin extraction, when the motor 15 ceases to supply torque to basket 2 through shaft 20, the construction illustrated in Figs. 2, 3, 4, 5, and 6 is provided. Referring particularly to Fig. 3 in conjunction with Fig. 6, there is provided an annular brake member 42 which has a pair of slots 43 and 44 formed therein. Brake member 42 is positioned substantially concentric with tube 28 adjacent an end of plate 30 so that pins 45 and 46, which are secured to plate 30 extend into the slots 43 and 44 respectively. Slots 43 and 44 are generally parallel to each other so that, while the engagement of the pins within the slots secures brake member 42 to rotate with plate 30, the brake member is also slidable in a direction generally perpendicular to its axis of rotation to the extent permitted by the pins and the slots.

Brake member 42 also includes an inwardly extending portion 47 which is secured within an opening 48 provided in tube 28. Portion 47 fits in opening 48 so that rotation of member 42 necessarily causes rotation of tube 28.

However, the fit is a relative loose one, permitting limited pivoting of portion 47 in opening 48; it will thus

be seen that the particular arrangement causes the limited sliding movement of member 42 to be effected as a result of the initial rotation of tube 28. The pivoting nature of portion 47, causes it to actually extend inwardly beyond tube 28 at times; to accommodate portion 47, tube 29 has a cutaway portion 49 so that the end 50 of portion 47 does not contact tube 29.

In the preferred embodiment, as illustrated, plate 42 is preferably biased to the position shown in Figs. 4 and 5 relative to the other rotatable parts 20, 28, 29 and 30. This may be effected, as shown, by a spring member 51 secured at one end to a pin 52 projecting from plate 30 and at its other end to an extension 53 on member 42; the spring tends to pull the member 42 around in a counterclockwise direction to the position in which it appears in Figs. 4 and 5.

At one end, preferably substantially in line with the direction of movement provided by the slots 43 and 44 and pins 45 and 46, member 42 is provided with a projecting section 54. Projecting section 54 is preferably provided at one end with a notch 55 and a cam surface 56 slanting radially outward from the edge of the section to the notch.

As shown in Figs. 2 and 6, the stationary outer casing 57 of transmission assembly 18 is secured by bolts 58 to a bottom plate 59. Plate 59 has an inner annular flange 60 formed therein to provide a housing for a bearing 61 which mounts the movable parts of the transmission for rotation within casing 57. Rigidly secured to casing 57 is an annular flange member 62, and a brake band 63 is provided therein, bearing against a liner 64 fastened to the flange 62. The brake band is formed of a material having a relatively high co-efficient of friction, and is shaped so that it is biased to form a circle substantially larger than that permitted when it is secured within flange 62. In this manner, band 63 expands against liner 64 which also has a high-friction surface. Brake band 63 is provided with a radially inwardly extending end 65.

Referring now to all the figures, the operation of the improved braking device of my invention will be described. It will be recalled that the machine 1 proceeds through an ordinary sequence of first washing, then extracting, then rinsing, and then extracting again. The various functions of the improved apparatus of the invention can be most clearly explained if the sequence is taken up at the beginning of the first extraction at the end of the washing sequence. At this point, motor 15 has just started to operate in a direction which is reverse to that which was provided for washing and which causes spring clutch 33 to wind itself tightly about tube 28 thus causing it to rotate with shaft 20. Thus, torque is transmitted from motor 15 to shaft 20, hub 27, spring clutch 33 and tube 28. Referring to Fig. 3, it can be seen that rotation of tube 28 which is in a clockwise direction tends to carry with it portion 47 of brake member 42. However, initially, portion 47 pivots in opening 48 and the brake member slides to the left, that is, to the position shown in that figure. This results from the inertia of basket 2, case 25, and plate 30, tending to preclude their rotation until other movable parts with less inertia have moved to the full extent possible in the direction dictated by the direction of the torque applied. When pins 45 and 46 stop further sliding, the brake member 42 will then rotate with tube 28, carrying with it plate 30. As a result, the entire case 25 rotates at the same speed as train 23 therewith, and both agitator 5 and basket 2 are rotated together at high speed, by shaft 11 and hub 10 respectively to provide a centrifugal extraction.

This action proceeds for a predetermined period after which motor 15 is de-energized so that it no longer transmits torque through shaft 20. Instead it is the rotating basket which is transmitting torque, as a result of its momentum, through pins 45 and 46 to the brake member 42. This reversal of the direction of torque

transmission causes member 42 to slide to the right as viewed in Fig. 4. This sliding of brake member 42 to the right in response to the reversal of torque transmission is enhanced by the provision of spring 51 since the spring also tends to pull the brake member 42 to the right. The amount of displacement permitted by the slots and pins causes leading edge 66 of section 54 to come into contact with end 65 of brake band 63 after less than one revolution regardless of its rotational position with respect to the stationary parts 62, 63 and 64. When the brake member engages band 63, as shown in Fig. 4, it tends to force the brake band to rotate relative to the lining 64 on flange 62. However, the high co-efficient of friction of the engaging surfaces of band 63 on lining 64 causes a rapid stopping of the rotating member 42 and band 63 to be effected. Thus, the desired result is automatically provided in response to the cessation of torque transmission from shaft 20.

The next sequence in the cycle calls for a rinsing action wherein the basket 2 stays stationary and the agitator 5 is oscillated. As stated above, the basket tends to creep around as a reaction to the forces created by the oscillating agitator. This creeping movement is in the counterclockwise direction as viewed in Figs. 3, 4 and 5 and is transmitted through hub 10, casing 25, plate 30 and pins 45 and 46 to the brake member 42 thereby also causing it to creep. The fact that motor 15 is rotating in the reverse direction to that provided during spin has caused spring clutch 33 to turn loosely on tube 28 so that the tube no longer tends to rotate the brake member 42 in the clockwise direction. For this reason, the torque resulting from the creeping action of basket 2, assisted by spring 51, causes the brake member 42 to remain in the position where the pins 45 and 46 are at the left ends of slots 43 and 44 as shown in Figs. 4 and 5. Therefore, after less than one revolution of creep, the brake member 42 will have come back around so that cam surface 56 of section 54 engages end 65 of brake band 63, as shown in broken outline in Fig. 5. The creeping force is strong enough to cause the brake member to force itself around until end 65 of brake strip 63 is beyond cam surface 56 and drops into notch 55 so as to preclude any further creeping motion.

The operation of the invention thus causes brake member 42 to assume the position shown in Fig. 3 to release the brake and permit extraction to take place whenever the basket is caused to spin as a result of torque transmitted from motor 15. However, the instant that no more torque is transmitted from the motor, brake member 42 will move to the right as shown in Fig. 4 to stop the spinning action in a very brief period of time. Whenever the machine proceeds into either the wash or rinse agitation, a very small amount of creep is permitted until the brake member 42 assumes the position shown in Fig. 5 at which point further creeping is precluded.

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

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

Braking apparatus combining rotatable driving and driven members, a rotatable annular brake member positioned substantially concentrically with said driving member and having a pair of parallel slots formed therein, a pair of pins secured to said driven member extending substantially parallel to the axis of rotation of said driven member into said slots whereby said brake member is secured to said driven member to rotate therewith and for limited sliding motion in a direction substantially perpendicular to its axis of rotation, said brake member

having an inwardly extending portion secured to said driving member in limited pivotable relation therewith, said brake member initially sliding in a first direction to a first position determined by said slots and said pins in response to one direction of rotation of said driving member transmitted to said inwardly extending portion and thereafter rotating with said driven and driving members to transmit torque from said driving member to said driven member, said brake member sliding in the opposite direction to a second predetermined position determined by said slots and said pins in response to a predetermined torque transmitted from said driven member to said brake member as a result of the momentum of said driven member after application of power to said driving member is stopped, and annular substantially stationary braking means positioned about said brake member and having an inwardly extending por-

tion, said brake member having an outwardly projecting portion engageable by said brake member in its second position whereby engagement of said braking means inwardly extending portion and said brake member outwardly projecting portion cause rapid stopping of all rotatable members when said brake member is in its second predetermined position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,610,498	Geldhof et al. -----	Sept. 16, 1952
2,844,225	Hubbard et al. -----	July 22, 1958
2,845,156	Dayton -----	July 29, 1958

FOREIGN PATENTS

204,257	Australia -----	Nov. 15, 1956
922,922	Germany -----	Jan. 27, 1955