July 29, 1952 J. G. DE REMER 2,604,771

LAUNDRY MACHINE

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Fig. 2

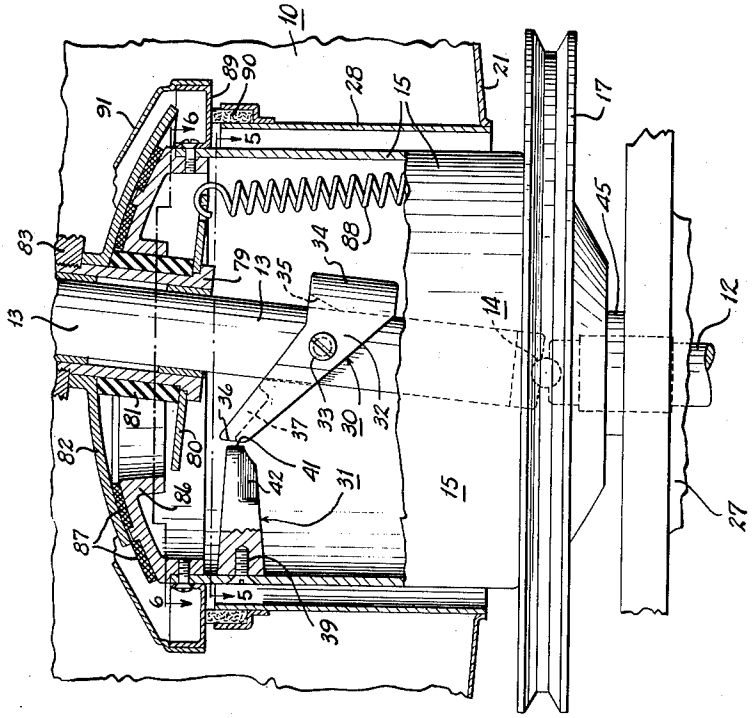
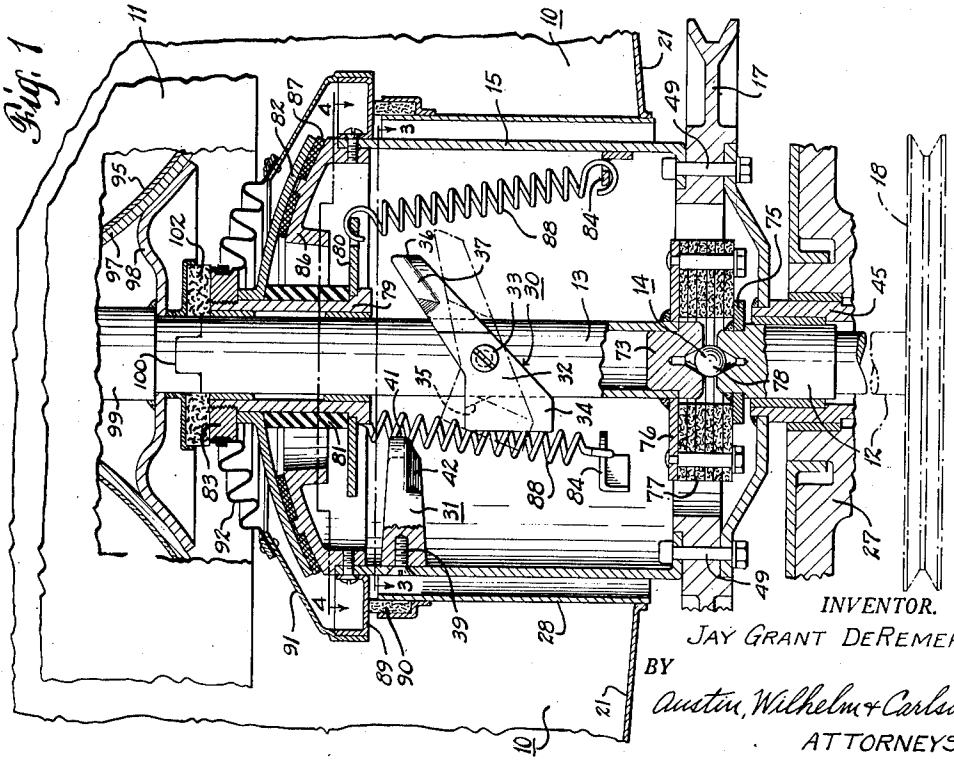


Fig. 1



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Fig. 3

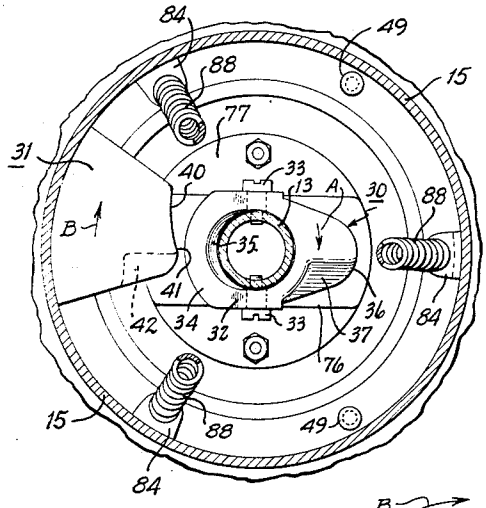
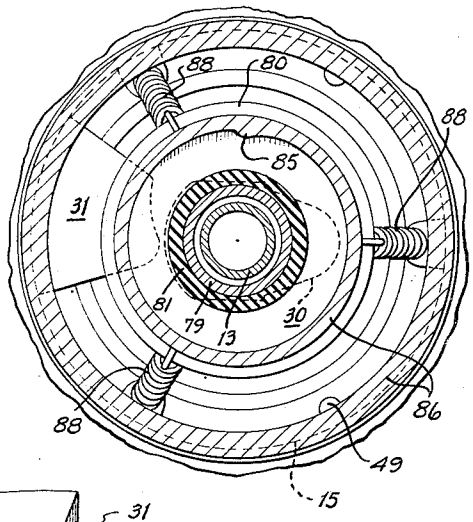


Fig. 4



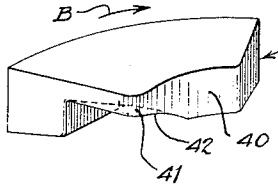
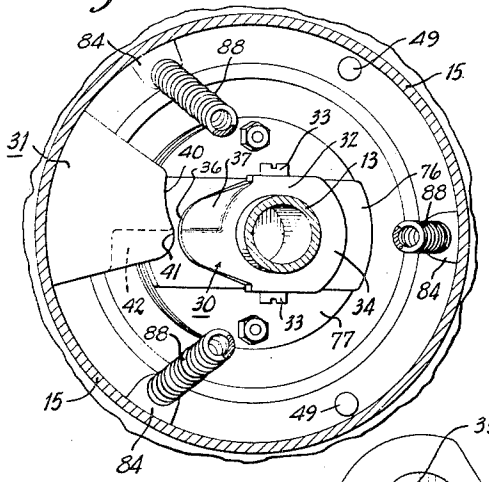


Fig. 7

Fig. 5



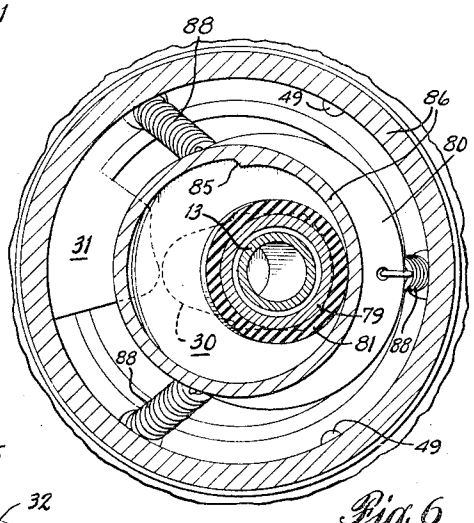


Fig. 6

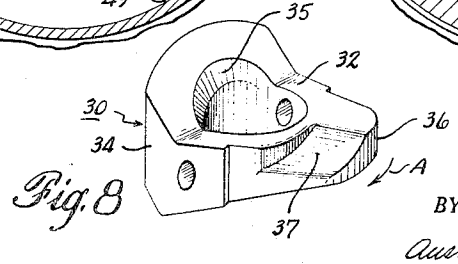


Fig. 8

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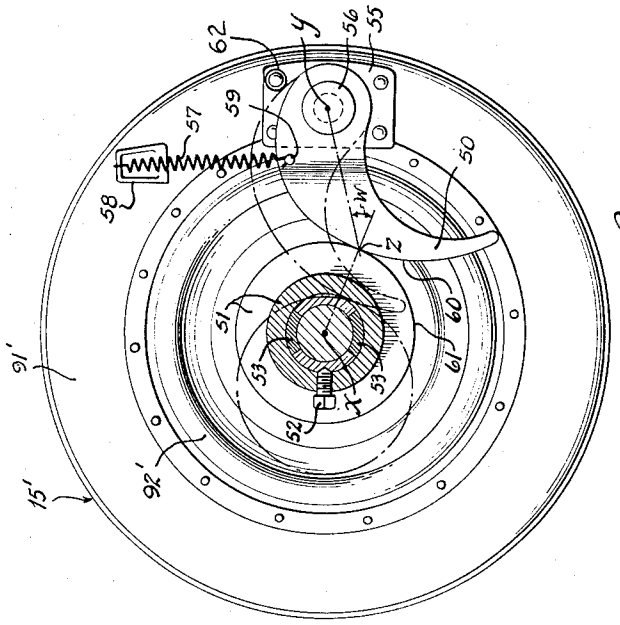


Fig. 10

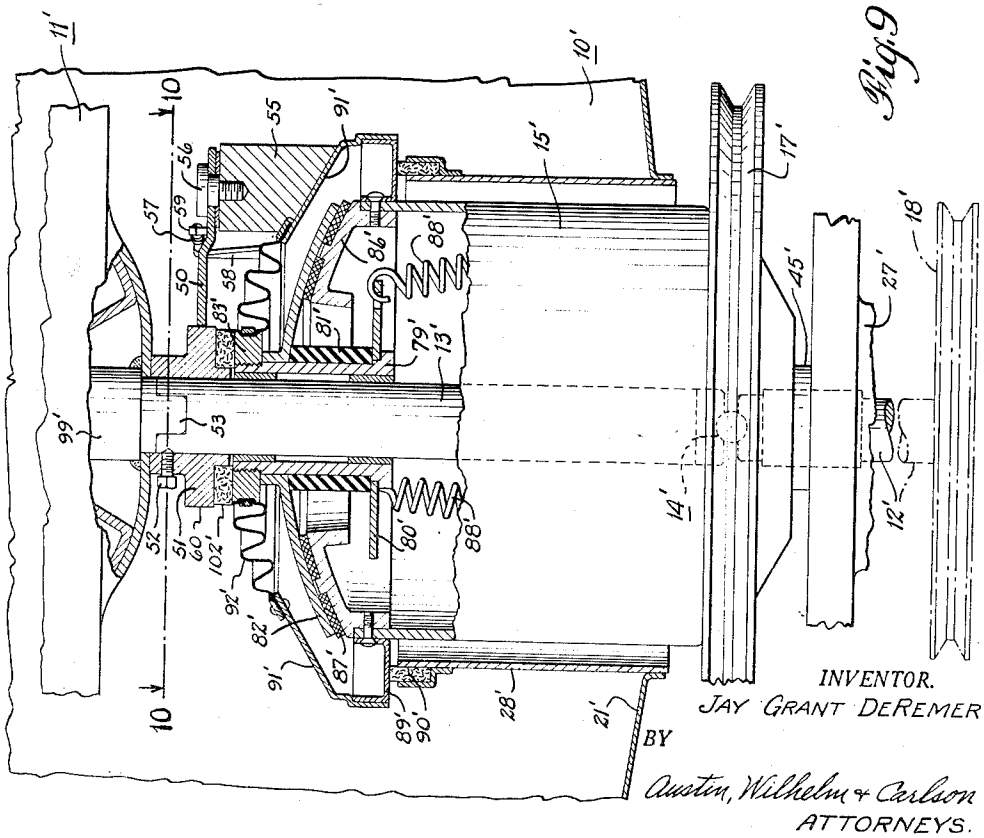


Fig. 9

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UNITED STATES PATENT OFFICE

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LAUNDRY MACHINE

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Application May 28, 1949, Serial No. 96,018

3 Claims. (Cl. 68—25)

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The invention relates to combined washing and centrifugal drying machines and, more particularly, to such machines in which the laundry is washed and centrifugally dried in a single basket.

The invention includes improvements over the laundry machine disclosed in my copending application, Serial No. 12,718, filed March 3, 1948, although not necessarily limited to the specific structure shown in that application.

According to the prior application, an imperforate, open top basket is mounted upon a spin shaft comprising an upper section and a lower section connected by a universal joint. A gyrator shaft surrounds the spin shaft and supports a friction head at its upper end. A spherical friction plate is journaled on the upper spin shaft section. A series of helical tension springs operate between the friction plate and the gyrator shaft to exert pressure between the friction head and plate and to apply a centering action to the upper spin shaft section. For the centrifugal drying operation, the spin shaft is spun at centrifugal drying speed and the gyrator shaft is rotated at a slower speed to impart an accelerating force to the upper spin shaft section as it tends to precess; this accelerates precession and thus stabilizes the basket. For washing, the basket is tipped to inclined position; the spin shaft is held stationary and the gyrator shaft continues rotation to move the basket axis in a conical path, with the universal joint at the apex of the cone. This agitates the clothes. In order to facilitate tipping over of the basket to inclined position from the central drying position to the "agitate" position, the spring arrangement in the prior application was deliberately made unsymmetrical.

Exhaustive tests have proven the unsymmetrical spring arrangement to be satisfactory to facilitate tipping over of the basket from central drying position to inclined washing position. However, if the springs should be too strong, the friction stabilizing surfaces may be forced together with such pressure as to prevent the unsymmetrical spring arrangement from initiating the tip-over action.

One of the objects of the present invention is to apply a positive tip-over force to the basket axis at the end of a spinning operation so that the basket is in proper position for the gyratory washing motion.

According to a preferred form of the present invention, a centrifugally-operated cam member is pivotally mounted upon the upper spin shaft section about a horizontal pivot; and a track

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member is rigidly secured to the inside of the gyrator shaft. When the spin shaft is rotated above a certain predetermined speed, centrifugal force moves the cam member out of the path of the track member. When the spin shaft decelerates to the predetermined speed, the cam member moves to a position in the path of the track member and the two members engage, generating a positive thrust against the basket axis to tip over the basket.

According to an alternative form of the present invention, the upper spin shaft section carries a collar and the gyrator shaft carries a cam member pivoted thereto about a vertical axis. The cam member has a spiral surface engageable with the collar. The angle of engagement of the cam surface with the collar is such that, when the spin shaft slows down to a speed slower than the gyrator shaft, the cam exerts a positive thrust on the upper spin shaft section to tip over the basket.

The invention also consists in certain new and original features and combinations hereinafter set forth and claimed.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part hereof, in which:

Fig. 1 is a vertical section through the central part of a laundry machine, illustrating the preferred form of tip-over device utilizing the centrifugally-operated cam member pivoted to the upper spin shaft section, sometimes called the basket shaft. This figure illustrates the position of the parts at the end of a centrifugal drying operation, when the spin shaft speed has decelerated to a point where the cam member, as shown in full lines, is in position to engage the track member;

Fig. 2 is a section similar to Fig. 1, showing the position of the basket shaft after engagement of the cam and track has tipped the basket shaft over to the position shown;

Fig. 3 is a plan section taken on the line 3—3 of Fig. 1;

Fig. 4 is a plan section taken on the line 4—4 of Fig. 1; this figure illustrates the relationship of the bump on the gyrator shaft and the track member;

Fig. 5 is a plan section on the line 5—5 of Fig. 2;

Fig. 6 is a plan section on the line 6—6 of Fig. 2;

Fig. 7 is a perspective of the track member;

Fig. 8 is a perspective of the cam member;

Fig. 9 is a central vertical section through a laundry machine, illustrating a modified form of tip-over device; and

Fig. 10 is a plan section taken on the line 10—10 of Fig. 9.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

The present invention is illustrated as applied to a machine closely following the detail of the machine shown in the prior application. Only so much of the prior machine, as is necessary to explain the present invention, is described herein.

Referring now to the drawings, and more particularly to Figs. 1 to 8, the laundry machine comprises, in general, a tank 10 containing an imperforate type clothes basket 11. The basket is driven for centrifugal extraction by a spin shaft made up of a lower section 12 and an upper section 13 connected by a universal joint 14. The basket is gyrated by a gyrator shaft comprising a lower section 45 and an upper section 15 rigidly connected by a series of bolts 49 which also connect gyrator pulley 17. An electric motor (not shown) drives the gyrator shaft through pulley 17 and the spin shaft through spin pulley 18.

It will be understood that during a washing operation the spin shaft 12, 13 is held stationary, while the gyrator shaft 15, 45 rotates, causing the basket axis to describe the surface of a cone about the vertical axis of the machine, without rotation about its own axis; that is to say, a gyratory motion is imparted to the basket. For centrifugal extraction, the spin shaft is driven, along with the gyrator shaft, causing liquid to be expelled from the clothes in the basket. At the same time, the gyrator shaft, acting through the gyrostabilizing devices, accelerates precession of the spinning basket thereby reducing precession amplitude.

Referring now to the preferred form of tip-over device shown in Figs. 1 to 8, this device comprises, generally, a cam member 30 pivoted to the upper section 13 of the spin shaft and a track member 31 rigidly secured to the upper section 15 of the gyrator shaft. In general, when the spin shaft is rotating at sufficiently high speed, the cam member 30 takes the position shown in the dot-dash lines in Fig. 1 and is below the level of the track member 31. When the spin shaft drops below a predetermined speed, the cam member takes the position shown in full lines in Fig. 1 where it can engage the track member 31; this engagement generates a thrust on the spin shaft pushing it over to one side. The exact operation and inter-acting of these parts is explained more in detail below.

The invention will now be described more in detail.

The tank 10, which may be of metal or other sheet material, has a sloping bottom 21. Connected at the center of the bottom 21 is a vertical circular cylindrical well 28. Bottom 21 is suitably supported by the frame of the machine. The concentric shaft assembly of the inner spin shaft section 13 and the outer gyrator shaft 15 pass through the well 28.

The concentric shaft assembly of inner spin shaft 12, 13 and outer gyrator shaft 15, 45 is journaled in hub 27 supported by the frame of the machine; hub 27 directly journals the lower gyrator shaft section 45; shaft 45 in turn journals the lower spin shaft section 12. The weight of the basket 11 and laundry is transmitted through the spin shaft 12, 13 through a suitable axial thrust bearing (not shown). The several radial bearings between the concentric shafts and the axial thrust bearing may be of any desired type. Oilless bearings have proved satisfactory under test.

The universal joint 14 connects the upper and lower spin shaft sections. The lower spin shaft section 12 carries a cross piece 75 which may be suitably welded thereto. The upper tubular section 13 carries a cross piece 76 which may be suitably welded thereto. These cross pieces are disposed at right angles in plan. A thick neoprene rubber disc 77 is bolted to the cross pieces by bolts as indicated. The disc 77 may be of one homogeneous piece or it may be laminated.

To fix the point of flexure between the upper and lower sections of the spin shaft, a ball 78 is provided. This ball is seated in conical recesses, one in solid shaft 12 and the other in an insert plug 73 in tubular shaft 13. Thus the universal joint permits free angular movement of the axis of the upper section 13 with respect to the axis of the lower section 12, while transmitting torque. The ball 78 seating in the above-mentioned conical recesses fixes the point of intersection of the axes of the two shaft sections, regardless of any lateral flexibility of discs 77 which would otherwise permit the above-mentioned point of intersection to shift under the forces developed during centrifugal drying.

The friction plates and associate construction of the gyrostabilizer will now be described. A sleeve 79 is journaled on the upper end of upper spin shaft 13. Sleeve 79 carries an anchor plate 80; it also carries a bumper roll 81 which may be of rubber or some other material softer than metal. The sleeve 79 also carries the relatively flat spherical friction plate 82. A nut 83 screwed on sleeve 79 holds all of these parts together.

The upper end of the gyrator shaft section 15 has bolted thereto a ring or friction head 86. Ring 86 has riveted thereto a flat ring 87 which may be of suitable brake lining friction material. The upper surface of friction ring 87 is spherical to cooperate with the spherical lower surface of friction plate 82; the center of the sphere is the center of universal joint ball 78. Upper friction plate 82 preferably is slightly loose on sleeve 79, to take care of any slight inaccuracy in manufacture, which might otherwise prevent the center of its lower spherical surface from coinciding with the center of universal joint ball 78.

Friction head 86 has a conical inner surface conforming to the generally cylindrical surface on bumper roll 81 when these parts are engaged. Friction head 86 has an abutment 85 (Fig. 4) engageable against the bumper roll 81 to assist

in driving the basket to impart gyrating movement to the basket during washing, as explained hereinafter.

The spherical friction stabilizing surfaces are urged together by a series of helical tension springs 38. These springs act between anchor ring 80 and lugs 84, secured to the upper gyrator section 15. These springs, when the spin shaft section 13 is vertical or approximately vertical, act both axially and radially of the spin shaft section 13. They pull the friction surfaces of spherical members 82, 87 together thus making the friction acting between these members independent of the weight of the basket and its contents. They also apply a force tending to center the upper section of the spin shaft with respect to the gyrator shaft.

It will be noted, particularly from Fig. 4, that three equally spaced springs are provided. This provides a symmetrical centering action in contrast to the unsymmetrical centering action caused by deliberately omitting one of the six springs in the prior application. However, if desired, the unsymmetrical spring arrangement of the prior application may be used with the present invention to aid and assist the positive kick-over action of the cam 30 and track 31.

Provision is made to prevent water and froth due to saponification of the soap from getting onto the friction surfaces and down into the driving mechanism. To this end a sealing ring 89 is connected to the friction head 86. This ring has a plane lower surface which bears against a felt ring 90 suitably secured to the stationary well 28. Sealing ring 89 carries a canopy 91 which is connected to a flexible bellows-like boot 92 which is clamped to nut 83 by a suitable band. A felt washer 102 secured to the basket 11 also helps seal the central pedestal assembly as discussed below.

The basket 11 has a cone-like hub 95. The hub is strengthened by reinforcing plates 97 and 98 connected to nipple 99. These reinforcing plates may be suitably welded to the nipple. They may be connected to the basket hub in any suitable way.

The nipple 99 carries a pair of notches 100 in its edge and also carries an internal tube (not shown). This tube and the notches 100 cooperate with the upper spin shaft section 13 which snugly receives the tube and has lugs entering the recesses 100 (Fig. 1). This is for the purpose of making the basket easily detachable from the gyrostabilizer assembly merely by lifting out of the machine. This construction follows the prior application to which reference is made for a more complete disclosure.

Nipple 99 carries a holder for felt washer 102 which seals the joint formed by the interfitting lugs and recesses 100 and thus prevents liquid from getting down inside of the tubular gyrator shaft section 13 or down in between sleeve 79 and shaft section 13.

Lower spin shaft section 12 and gyrator shaft pulley 17 are driven by the driving mechanism, transfer clutch and servomotor disclosed in the prior application. For washing, the spin shaft is held stationary by a suitable brake (not shown) and the gyrator shaft continues to rotate. For centrifugal drying, the brake on the spin shaft is released and a clutch (not shown) connects spin pulley 18 to lower spin shaft section 12 to spin the basket. The torque necessary to accelerate the basket is supplied through a special slip clutch (not shown) between the main drive motor and the common drive for both spin pulley 18 and gyrator pulley 17; this has the effect of maintaining a constant ratio between gyrator shaft and spin shaft speeds during acceleration to full spin speed. This constant ratio provision has certain advantages in stabilizing the basket as explained in the prior application.

The tip-over device shown in Figures 1 to 8 will now be described.

The cam member 30 (see also Fig. 8) comprises a collar portion 32 somewhat loosely fitting upper spin shaft section 13 so as to permit the pivoting action above described. Bolts 33 pass through holes in the collar 32 and are threaded into spin shaft section 13, as illustrated particularly in Fig. 3. The cam member 30 also comprises a "weight" 34 having a beveled stop surface 35 which engages the spin shaft section when the weight 34 flies out to the dot-dash position shown in Fig. 1. The cam member 30 also comprises a projecting nose 36 having a bevel 37 on its leading edge; the cam member 30 spins with the spin shaft in the direction of arrow A.

It will be understood that centrifugal force acting on nose 36 aids centrifugal force acting on weight 34 to bring the cam 30 below the level of track member 31; and that the gravity restoring force on weight 34 is opposed by the force of gravity acting on nose 36. For simplicity, the operation of the cam member will be described as if the weight 34 exerted the sole controlling effect with respect to gravity and centrifugal force.

The track member 31 (see also Fig. 7) comprises a segment body bolted to the gyrator shaft 15 by bolts 39. Track member 31 has a bevel 40 at its leading edge terminating in a nose 41, see particularly Figs. 3 and 5; it also has a trailing bevel surface 42 on its under side. Track member 31 rotates with the gyrator shaft in the direction of arrow B.

The operation of the machine with respect to the action of the tip-over device will now be described. Assume that the machine is performing its centrifugal drying function. The spin shaft will be rotating at full speed of, say, 720 R. P. M. and the gyrator shaft will be rotating at its full gyrostabilizing speed of, say, 120 R. P. M. Both these shafts rotate clockwise in plan, in the directions of arrows A and B.

As the end of the centrifugal drying period approaches, the machine shifts to remove driving torque from the spin shaft and to apply braking effort to the spin shaft; the gyrator shaft continues to rotate at substantially full speed.

While the spin shaft is rotating at centrifugal drying speed, the cam fly weight 34 holds the cam out of the path of the track 31 so that the track and cam cannot engage even though the basket axis precesses. This is the dot-dash position of the cam in Fig. 1.

As the spin shaft decelerates, at some speed, say 90 R. P. M., which may be below the gyrator shaft speed, the cam weight 34 falls, causing the cam nose 36 to rise to the level of the track 31. This is the full-line position of the cam in Fig. 1. The track 31 is now rotating faster than the cam; the track engages the cam in such direction as to exert a thrust on it, pushing the upper section of the spin shaft, radially with respect to the axis of the gyrator shaft, to the position shown in Fig. 2.

The brake causes the spin shaft to decelerate rapidly at the rate of, say, 100 revolutions per minute per second. Fig. 2 thus shows the parts

one-half second later than Fig. 1. The gyrator shaft and track 31 have made one revolution (120 R. P. M) and caught up with the spin shaft cam 30 which only rotated about one-half revolution in one-half second. The track therefore struck the cam, the nose 36 of the cam riding up bevel thrust surface 40 of the track; this action tipped spin shaft to the position shown in Fig. 2.

Since the spin shaft by this time has slowed down considerably, the gyroscopic action is very much reduced. As soon as the upper spin shaft section is tipped over a small angle, the gyrator shaft through the friction members exerts a centrifugal action on the basket, its contents and the upper spin shaft section, helping to throw it outwardly until the rubber roll 81 engages the friction head 86.

This position of the track member 31 should be in proper relation to drive lug 85 which engages the bumper roll 81 to gyrate the basket for washing. As indicated particularly in Figs. 4 and 7, the drive lug 85 is immediately behind the position directly opposite the track member 31, so that if the roll 81 rides up on lug 85 and slips off, the cam 30 will immediately put it back again. At the same time the track member 31 should not be at such a great angle behind the lug 85 that it will permit the system to wedge in between the lug and the track.

Thus the basket is effectively tipped, regardless of any excessive friction acting between the friction gyrostabilizing surfaces, which might otherwise prevent the basket from tipping over for the gyratory washing action.

The basket is then gyrated with the spin shaft stationary. The basket axis is driven to describe a conical path, about the gyrator shaft axis as the axis of gyration, and the center of the universal joint as the apex of the cone. This is the "agitate" position of the basket such as used for washing the clothes.

At the end of the gyratory agitating period, the machine again shifts to remove the brake from the spin shaft and apply spinning torque thereto; the gyrator shaft continues to rotate. However, due to slipping of the motor constant-torque, slip clutch above mentioned, and the fact that the gyrator shaft and spin shafts are geared together at this time, the speed of both of these shafts may be temporarily reduced during acceleration of the basket. Thus the spin shaft will be rotating at a higher speed than the gyrator shaft during this period.

As the spin shaft accelerates from zero, it usually reaches the assumed critical speed of 90 R. P. M. (when the cam weight 34 flies out) before the basket straightens up; thus the cam is taken out of the level of the track before the track and cam could engage due to the basket straightening up.

Regardless of theoretical conditions under which the cam and track members may or may not engage, if they do engage when the spin shaft is spinning more slowly than the gyrator shaft, a tip-over thrust will be generated; if they engage when the spin shaft is spinning faster than the gyrator shaft, the leading bevel surface 37 on the cam member will simply ride under the trailing bevel surface 42 on the track member without generating any tip-over thrust. This condition should seldom, if ever, occur but the over-riding relationship is provided as an additional safety factor.

Referring now to the modification shown in Figs. 9 and 10, the modified tip-over device is applied to a machine of substantially the same construction as that illustrated in Figs. 1 to 8. In Figs. 9 and 10 similar parts are identified by the same reference characters as similar parts in Figs. 1 to 8, but with primes added; thus, it will not be necessary to describe these parts again.

The tip-over device comprises essentially a cam member 50 pivoted to a part rotatable with gyrator shaft 15' and a collar 51 rigidly secured to spin shaft section 13'. A spring 57 normally holds cam member 50 in engagement with collar 51. With ordinary centrifugal spinning operation, the spin shaft is rotating faster than the gyrator shaft and the collar 51 simply overrides or slips over the cam 50. But when the spin shaft slows down to a speed less than that of the gyrator shaft, the angle of the cam is such as to exert a thrust on the spin shaft, tipping over the basket in a manner described below more in detail.

The collar 51 is rigidly secured to upper spin shaft section 13' by bolt 52. Collar 51 carries the felt washer 102' and prevents suds from getting down in between the spin shaft section 13' and the sleeve 79'.

In this form the basket 11' is secured to the spin shaft section 13' in a manner slightly different from corresponding parts in Figs. 1 to 8. Here the basket carries lugs 53 which fit notches on the upper spin shaft section 13'. Basket 11' carries a sleeve (not shown) similar to that of Figs. 1 to 8 which telescopes down inside of the upper spin shaft section 13' for the purpose of removably mounting the basket in the manner described above.

The cam member 50 is pivoted to base 55 by a pivot 56. Base 55 is secured to canopy 91' which in turn is secured to upper gyrator shaft section 15'. A spring 57 acts between bracket 58 also secured to canopy 91' and a pin 59 secured to cam 50. Spring 57 continuously urges the cam surface 60 on cam 50 against the circular surface 61 on collar 51. Stop 62 secured to base 55 limits the movement of cam 50 towards collar 51.

The operation of the machine with respect to the action of the tip-over device, illustrated in Figs. 9 and 10, will now be described. Assume that the machine is performing its centrifugal drying function with the spin shaft 13' rotating at the assumed speed of 720 R. P. M. and the gyrator shaft 15' rotating at the assumed full gyrostabilizing speed of 120 R. P. M. Both shafts rotate clockwise in plan. During the centrifugal drying period, the cam surface 60 bears against circular surface 61; but since the spin shaft is rotating faster than the gyrator shaft, the circular surface 61 simply overrides the cam surface 60 and no thrust is generated between these surfaces.

As the end of the centrifugal drying approaches, the machine shifts to remove driving torque from the spin shaft 13' and to apply braking effort to the spin shaft while the gyrator shaft 15' continues to rotate at substantially full speed.

As the spin shaft decelerates, it finally drops below the gyrator shaft speed. The gyrator shaft then rotates at a higher speed than the spin shaft. The cam surface 60 then exerts a pushing action on the cylindrical surface 61, generating a thrust which pushes the upper spin shaft section over until the bumper roll 81' engages the friction head 86'. The spin shaft continues to decelerate and when spin rotation ceases, the

machine is in gyratory agitate position wherein the basket axis is driven to describe a conical path, about the gyrator shaft axis as a center, and the center of the universal joint as the apex of the cone in a manner described above.

The stop **62** prevents cam **50** from following collar **51** all the way over as it tips. Thus the two surfaces, **60** and **61**, are kept out of contact during the gyratory washing action. However, the cam follows the collar far enough to insure positive tip-over.

At the end of the gyratory agitate period, the machine again shifts to remove the brake from the spin shaft and applies spinning torque thereto.

To obtain the tip-over thrust, it will be understood that the curvature of cam surface **60** at the point of tangency *z* must be proper with respect to the center *x* of collar **51** and the center *y* of cam pivot **56**. The tangent of the angle *w* formed by lines *xz* and *yz* must be less than the coefficient of friction between the contacting surfaces. To make this condition hold true throughout the entire extent of contact of the cam surface **60**, this surface should have the shape of the spiral of Archimedes. It will be understood that suitable friction materials may be used for the contacting surfaces, and the surfaces may be suitably roughened, to provide the desired friction.

Thus two forms of tip-over device are provided which exert a thrusting force on the upper spin shaft section at the end of a centrifugal drying period to positively place the basket in gyratory agitate position. In both forms, the controlling factor in exerting the thrust is the slowing down of the spin shaft to a speed approximating the gyrator shaft speed; in both forms provision is made for the engaging members to overrun when engaging with spin speed exceeding gyrator speed.

While certain novel features of the invention have been disclosed herein, and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In a combined washing and centrifugal drying machine, a rotatable basket having a central spinning position and an off-center agitating position, a stationary support under the basket, a spin shaft connected to said basket and rotatably mounted on said support, means mounting said spin shaft to permit it to precess, a hollow gyrator shaft surrounding said spin shaft and spaced therefrom to permit said spin shaft to precess, means to spin said basket in substantially central position, means to drive said gyrator shaft to gyrate the basket in off-center agitating position, friction means operating between said shafts to stabilize the basket during the central spinning operation, said friction means acting to resist movement of said basket from central spinning position to off-center agitating position, tip-over devices comprising tip-over parts carried respectively by said spin shaft and by said gyrator shaft, one of said parts comprising a tip-over member and means pivoting it to its supporting shaft, said pivoted tip-over member being engageable with the other said part to exert, at times, a thrust on the basket to push it from central position to off-center position, both said shafts rotating in the same direction for the spinning operation with the spin shaft rotating faster than the gyrator shaft, the operation of said tip-over devices being such that said pivoted tip-over member is in inoperative condition with respect to said other tip-over part during the spinning operation and said pivoted tip-over member has operative engagement with said other tip-over part to push said basket to off-center position when said spin shaft decelerates to a predetermined speed.

2. A machine according to claim 1 in which the pivoted member comprises a cam pivoted to the spin shaft and the other tip-over part comprises a track member secured to the gyrator shaft, said pivoted member also comprising a fly weight holding said cam out of the path of said track member during the central spinning operation and letting said cam move into the path of said track member when said spin shaft decelerates to said predetermined speed.

3. The machine according to claim 1 in which the tip-over part carried by the spin shaft comprises a circular portion and the pivoted member comprises a cam pivoted to the gyrator shaft, said cam having a cam surface bearing against said circular portion, the angle of said cam surface and the coefficient of friction being such that said cam exerts no thrust on said circular portion while said spin shaft travels faster than said gyrator shaft and does exert a thrust on said circular portion when said spin shaft decelerates to a speed less than that of said gyrator shaft.

JAY GRANT DE REMER.

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