May 27, 1941. A. L. KIMBALL ET AL 2,243,565

WASHING MACHINE

Filed April 3, 1936 2 Sheets-Sheet 1

Fig. 1.

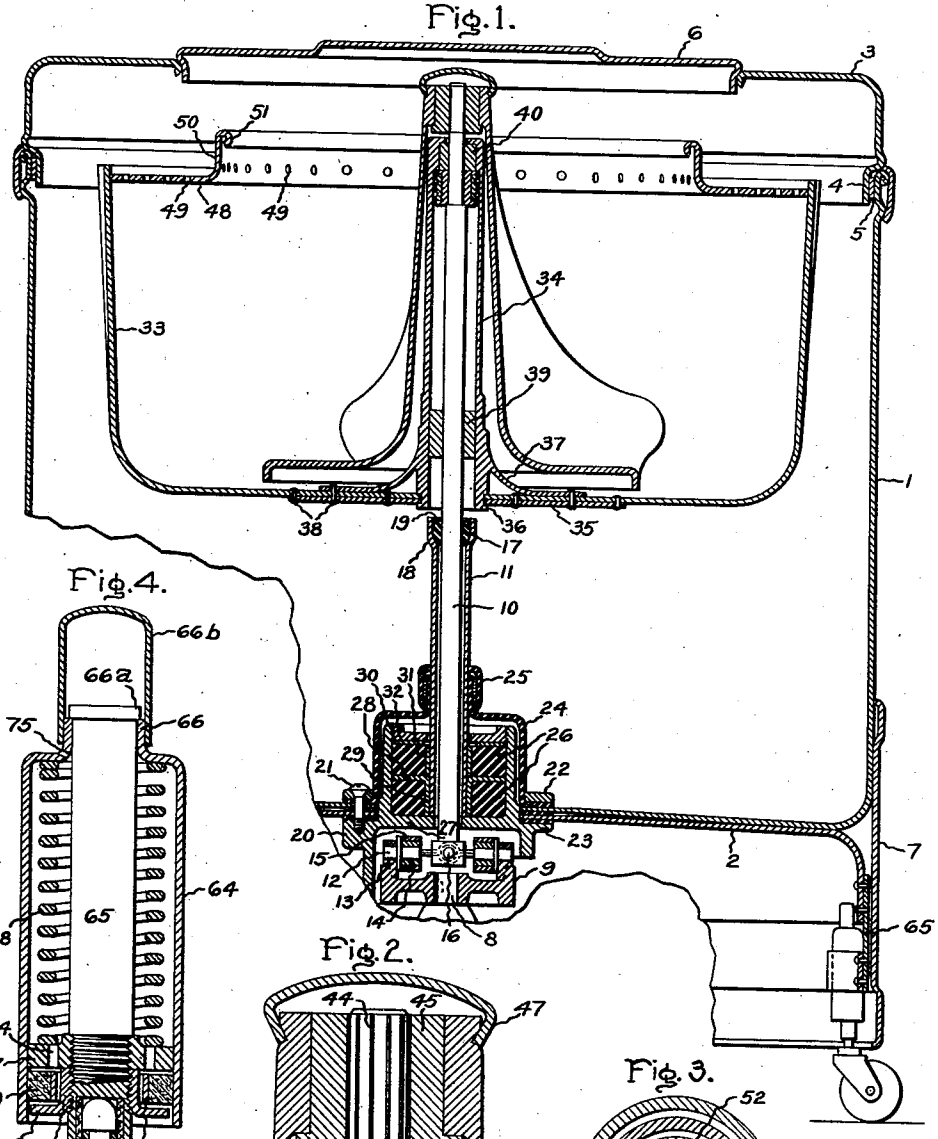


Fig. 4.

Fig. 2.

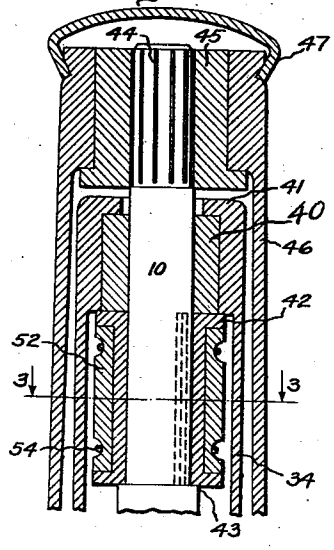
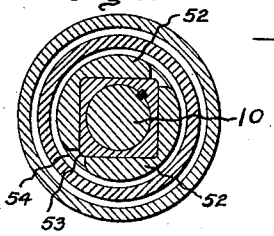


Fig. 3.



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Fig.5.

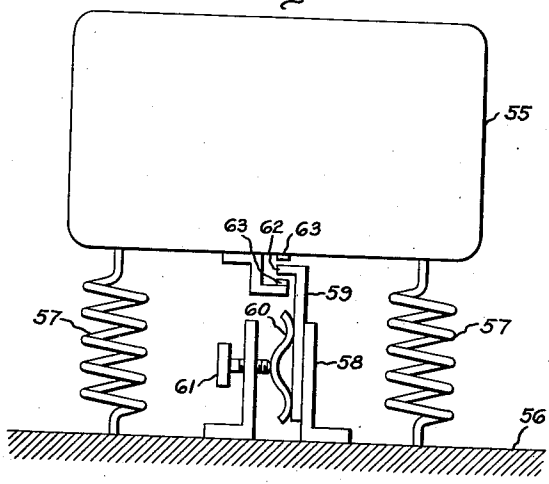


Fig.7.

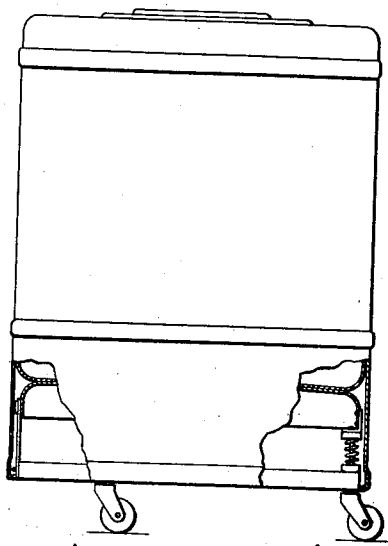


Fig.10.

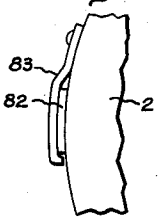
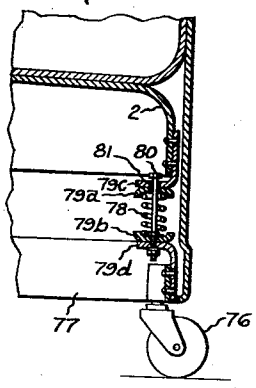


Fig.8.



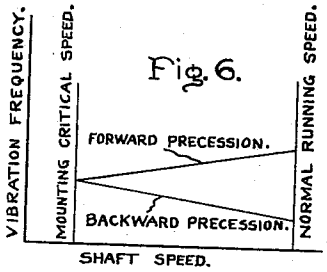
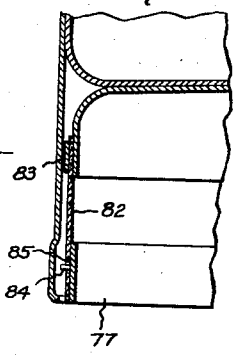


Fig.6.

Fig.9.



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UNITED STATES PATENT OFFICE

2,243,565

WASHING MACHINE

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Application April 3, 1936, Serial No. 72,584

10 Claims. (Cl. 210—71)

The present invention relates to washing machines of the type having a centrifugal extractor for drying the clothes.

In washing machines of this type there may be considerable vibration of the extractor due to unbalanced distribution of the clothes and to gyroscopic action. The vibration due to unbalance may be particularly great when the extractor is being brought up to its normal operating speed. If the machine is rigidly supported on the floor these vibrations will be transmitted to the floor and thereby cause undesirable vibration of the floor.

The object of our invention is to provide an improved construction and arrangement in machines of this type which will decrease the transmission of vibration from the machine to the floor and for a consideration of what we believe to be novel and our invention attention is directed to the accompanying description and the claims appended thereto.

In the accompanying drawings Fig. 1 is a fragmentary sectional elevation of a washing machine embodying our invention; Fig. 2 is an enlarged view of the arrangement for driving the agitator and the rotatable receptacle; Fig. 3 is a sectional view taken on line 3—3 of Fig. 2; Fig. 4 is a sectional elevation of one of the supports for decreasing the transmission of vibration from the machine to the floor; Fig. 5 is a diagrammatic view illustrating the construction and operation of the support shown in Fig. 4; Fig. 6 is a plot showing the frequencies of precession of the receptacle; Fig. 7 is a fragmentary elevation of a machine having a modified form of support for decreasing the transmission of vibration to the floor; Fig. 8 is an enlarged view of the spring support; Fig. 9 is an enlarged view of the arrangement for damping the vibrations; and Fig. 10 is an enlarged plan view of the arrangement for damping the vibration.

We have shown our invention applied to the washing machine shown in application Serial No. 61,635, filed January 31, 1936. The washing machine comprises a stationary tub 1 which is supported on a base 2. The upper end of the tub is partially closed by an annular cover 3 having a flange 4 which fits within the upper edge of the tub. Between the flange 4 and the tub is a suitable gasket 5. A cover 6 rests on the inner edge of the annular cover 3 and completes the closing of the top of the stationary tub. When clothes are to be inserted or removed from the washing machine only the cover 6 need be removed. The cover 3 is removed when the inside of the stationary tub is cleaned. The abutting edges of the tub 1 and the base 2 are covered by skirt 7 carried by the tub.

Within the base 2 is supported a driving mechanism for the washing machine which is adapted to effect selective oscillation or rotation of a vertical shaft 8. Any suitable driving mechanism may be used, for example the driving mechanism shown in application Serial No. 14,255, filed April 2, 1935. Keyed to the shaft 8 is a brake drum 9 which is connected by means of a suitable universal joint to the lower end of a vertical shaft 10 which extends through a sleeve 11. The universal joint comprises diametrically opposed pins 12 which are fixed in ears 13 on the upper side of the brake drum. The inner ends of the pins 12 are journalled in bearings 14 clamped between plates 15 which form the intermediate member of the universal joint. The lower end of the shaft 10 is provided with diametrically opposed pins 16 which are spaced between the pins 12 and are likewise journalled in bearings carried between the plates 15 of the universal joint. With this construction the vertical shaft 10 may have a gyratory movement with respect to the driving shaft 8. The sleeve 11 extends above the normal water level in the stationary tub. The upper end of the sleeve is provided with a spherical seat for a self-lubricating bearing 17 which guides the shaft 10. This spherical seat comprises a flared portion 18 of the sleeve and a collar 19 which is secured in the upper end of the sleeve. The spherical seat permits alignment of the bearing 17 with the shaft 10 so that the bearing pressure is uniform regardless of the inclination of the shaft.

The housing for the driving mechanism which is supported within the base 2 has a hollow post 20 which extends through central openings in the top wall of the base and the bottom wall of the stationary tub. The post 20 is secured to the bottom wall of the tub and to the base by means of screws 21 which are threaded through a clamping ring 22 into a flange 23 which is integral with the post 20. Suitable gaskets are arranged between the flange 23 and the base and between the base and the bottom wall of the tub. Leakage from the bottom of the tub is prevented by means of a rubber sleeve 24 which has its lower edge clamped between the ring 22 and the bottom of the tub and which has its upper edge clamped to the sleeve 11 above the post 20 by means of a clamp 25. Within the post 20 is a resilient mounting for the lower end of the sleeve 11 which comprises two annuluses 26 of rubber

or other resilient material. The lower annulus is arranged between an inwardly extending flange 27 at the lower end of the post and a flange 28 projecting from a sleeve 29 secured to the sleeve 11. The upper annulus is arranged between the upper side of the flange 28 and a washer 30. The inner edge of the upper annulus 26 rests against a sleeve 31 which is fixed to the sleeve 11. The sleeve 31 is of the same dimensions as the sleeve 29 and is used so that the annuluses 26 may be of the same size. The resilience of the mounting is adjusted by means of a nut 32 which is threaded into the upper end of the post 20. This nut varies the compression of the rubber and thereby varies the stiffness of the mounting. With this mounting, the sleeve 11 is resiliently held in a central position and is free to tilt in all directions in order that the shaft 10 which is guided in the sleeve may have a gyratory movement.

In the upper part of the stationary tub is a rotatable tub or receptacle 33 for receiving liquid and material to be washed. The space between the bottom of the receptacle 33 and the bottom of the stationary tub 1 is sufficient to provide a storage space for all the liquid which can be placed in the receptacle. At the center of the receptacle is a vertical sleeve 34 which serves as the hub for the receptacle. The upper end of the sleeve 34 projects above the water level in the receptacle. The lower end of the sleeve 34 fits into an opening in the bottom wall of the receptacle and an opening in a stiffening disk 35, both of which are held in position between a shoulder and a spun-over portion, as shown at 36. The lower end of the sleeve 34 is provided with a circular flange 37 which extends over the upper side of the bottom wall of the receptacle. The flange 37 and the stiffening disk 35 are secured to the bottom wall of the receptacle by means of rivets 38. The lower end of the sleeve 34 is guided by a self-lubricating bearing 39 which is fixed to the vertical shaft 10. The upper end of the sleeve 34 is guided on the shaft 10 by a self-lubricating sleeve bearing 40 which is pressed within the upper end of the sleeve against an inwardly extending flange 41 (see Fig. 2) formed thereon. The lower end of the sleeve bearing 40 bears on a hardened steel thrust collar 42 which is keyed to the shaft 10. The thrust collar is supported on the shaft by means of a shoulder 43 on the shaft. The weight of the receptacle and the material contained therein is transmitted to the thrust collar 42 by the bearing 40 and through the shoulder 43 to the shaft 10. From the shaft 10 the weight is transmitted through the universal joint and the shaft 8 to a suitable thrust bearing in the driving mechanism which is contained within the base 2.

The shaft 10 projects above the sleeve 34 and the projecting end is provided with splines 44 which fit between complementary splines formed in a bushing 43 which is fixed in the upper end of the hub of an agitator 46. Leakage of water through the upper end of the agitator as the water is splashed about is prevented by a cup 47 which is snapped in place over the upper end of the agitator. The splines 44 provide a rigid driving connection for the agitator and at the same time permit the agitator to be easily lifted from the end of the shaft.

During washing, the shaft 10 is oscillated through the driving shaft 8 and thereby causes oscillation of the agitator 46 in the receptacle 33. During this oscillation of the agitator the receptacle remains substantially stationary due to inertia. The clothes are prevented from falling over the upper edge of the receptacle by means of an annular guard ring 48 which is located slightly below the upper edge of the receptacle. During washing, water may be continuously discharged into the top of the receptacle. The excess water will flow through openings 49 in the guard ring over the upper edge of the receptacle, carrying with it the scum which floats on top of the water. The inner edge of the guard ring 48 is provided with a vertical flange 50 having a rounded upper edge 51 which serves as a handle by means of which the receptacle may be lifted from the shaft 10.

During extracting, the driving connection between the shaft 10 and the receptacle 33 is effected by means of a centrifugal clutch which is carried on the thrust collar 42. This clutch comprises two shoes 52 which are held against a squared cam surface 53 of the thrust collar by means of two split rings 54. During washing the agitator 46 is oscillated and the oscillation of the shaft 10 is at a relatively slow speed of the order of magnitude of 60 oscillations per minute, and the split rings 54 are strong enough to hold the shoes 52 against the squared portion 53. For wringing, the shafts 8 and 10 are rotated and as soon as the speed of rotation exceeds a few hundred R. P. M. the clutch shoes 52 move outwardly under the action of centrifugal force and touch the inner surface of the sleeve 34 which forms the hub of the receptacle 33. As soon as the shoes 52 contact the inner surface of the sleeve 34, their rotation is retarded and the squared surface 53 of the collar 42 cooperates with the inner surface of the shoes 52 and wedges the shoes tightly against the inner surface of the sleeve 34. The pressure between the shoes and the sleeve is proportional to the torque exerted by the shaft 10. This effects a positive driving connection between the shaft 10 and the receptacle which causes the receptacle to be rotated. Similarly, when the speed of the shaft is retarded by the brake, in stopping, the shoes release and immediately wedge in the opposite direction.

In the use of the machine, the receptacle 33 is loaded with clothes and filled with a suitable washing solution. The driving mechanism is then adjusted so that the shaft 10 is oscillated. During this oscillating movement, the receptacle 33 remains substantially stationary due to inertia and the oscillation of the agitator relative to the receptacle causes the clothes to be washed. During the washing operation, the receptacle 33 may be tilted to one side due to the fact that the clothes are not uniformly distributed in the receptacle. This inclination is permitted by the resilient support for the lower end of the sleeve 11 and by the universal joint arranged between the driving shaft 8 and the lower end of the shaft 10. Water is preferably continuously discharged into the top of the receptacle 33 and allowed to flow continuously over the upper edge of the receptacle, thereby floating off the scum which collects on the top of the water. During the washing operation the bearing loss in the bearings 39 and 40 is negligible due to the low speed of oscillation of the shaft 10.

At the conclusion of the washing operation, the driving mechanism is adjusted so that the shaft 8 is rotated continuously in one direction. As soon as the speed of rotation of the shaft

8 exceeds a few hundred R. P. M. the clutch shoes 52 move outwardly under the action of centrifugal force and touch the inner surface of the sleeve 34 which forms the hub of the receptacle 33. As soon as the shoes 52 contact the inner surface of the sleeve 34, their rotation is retarded and the squared surface 53 of the collar 42 cooperates with the inner surface of the shoes 52 and wedges the shoes tightly against the inner surface of the sleeve 34. This effects a positive driving connection between the shaft 10 and the receptacle which causes the receptacle to be rotated.

Since the clothes may be nonuniformly distributed in the receptacle, the receptacle may be unbalanced. This unbalance will usually consist partially of a static unbalance which is equivalent to a single weight displaced from the axis of rotation of the receptacle and partially of dynamic unbalance which is equivalent to the couple produced by vertically spaced weights of equal size located on opposite sides of and equidistant from the axis of rotation of the receptacle. The static unbalance will tend to cause gyration of the receptacle about its axis so that the receptacle rotates about its center of mass. The dynamic unbalance will tend to cause tilting of the receptacle so as to bring the receptacle into a position in which there is no unbalanced couple. The resilient mounting provided for the lower end of the sleeve 10 permits gyration of the receptacle about its axis so that the receptacle rotates about its center of mass, neutralizing the effect of static unbalance. Since the resilient mounting has some stiffness, the gyration of the receptacle about its axis is not sufficient to permit the receptacle to rotate about its center of mass, but the resilient mounting does permit sufficient gyration of the receptacle so that the vibration due to static unbalance is considerably decreased. Since the sleeve bearings 39 and 40 prevent tilting of the receptacle with respect to the shaft 10, the receptacle will cause vibration due to the dynamic unbalance. This tendency of the receptacle to tilt causes heavy bearing pressure on the bearings 39 and 40, but since there is no relative rotation between the bearing surfaces of these bearings, this pressure causes no bearing loss. Most of the force due to the dynamic unbalance of the receptacle will be transmitted through the universal joint at the lower end of the shaft 10 to the shaft 8. This force is taken by the bearings in which the shaft 8 rotates. Since the bearings for the shaft 8 are a considerable distance from the receptacle 33, the force on the bearings due to the unbalanced couple is less than it would be at a point nearer the receptacle. This means that the bearing loss due to the unbalanced couple is decreased. Also, these bearings are located below the stationary tub 1 and are therefore not subjected to the humid atmosphere within the tub and are more easily lubricated. Some of the force due to the dynamic unbalance or unbalanced couple is transmitted to the sleeve 11. However, since this sleeve is resiliently supported, these vibrations are cushioned. The cushioning action decreases the bearing pressure on the bearing 17 and thereby decreases the bearing loss.

During the rotation of the receptacle vibrations are transmitted from the receptacle through the universal joint and the sleeve 11 to the base 2. Some of the vibrations are shaft frequency vibrations due to unbalance. These vibrations are particularly great when the speed of the shaft is such that the vibrations are resonant with the natural frequency of the mounting provided by the rubber rings 26. This vibration may be termed the critical vibration of the machine due to this mounting and the speed at which this vibration occurs may be called the mounting critical speed. It is desirable that the speed at which this vibration takes place be substantially below the normal operating speed, for example one fifteenth of normal speed, so that the centrifugal forces due to unbalance which are proportional to the square of the speed will be relatively small and the reaction on the bearings will not produce so much friction that the receptacle cannot be driven through the critical speed. In addition to these vibrations there may be gyroscopic vibrations which result in precession of the receptacle. Precession is a rotation of the axis of rotation of the receptacle and may be forward or backward with respect to the direction of the shaft rotation. The frequency of precession is of the same order as the mounting critical frequency due to the mounting provided by the rubber rings 26. As the shaft speed increases above this critical speed the frequency of the forward precession increases slightly and the frequency of the backward precession decreases slightly, both changes being substantially in proportion to the change in speed. Fig. 6 is a plot showing the precession frequencies. The gyroscopic vibrations may be of large amplitude. The gyroscopic vibrations occur at shaft speeds above the mounting critical speed. Due to the time required for the gyroscopic vibrations to build up, the gyroscopic vibrations are usually important only near the normal running speed.

At normal running speed, the transmission to the floor of vibrations due to unbalance may be decreased by means of a resilient support between the floor and the machine. However, a resilient support which will decrease the transmission to the floor of the vibrations due to unbalance at normal running speed is relatively ineffective to decrease the amplitude of the larger amplitude vibrations due to the mounting critical speed or to gyroscopic vibrations. These large amplitude vibrations may be of such magnitude as to cause the receptacle to strike against the tub and damage the machine. The reaction produced on the bearings by the critical vibrations due to the mounting may be sufficiently large to prevent bringing the receptacle up to its normal operating speed. It is therefore desirable that some means be provided for damping these large amplitude vibrations. This damping should be relatively ineffective for vibration of small amplitudes so that it will not increase the transmission of these vibrations.

A supporting arrangement which will decrease the transmission of the vibrations due to unbalance at normal running speed and which will damp the larger amplitude vibrations is shown diagrammatically in Fig. 5. In this figure the machine is shown diagrammatically at 55, and the floor or other supporting surface is shown at 56. Between the floor and the machine are arranged supporting springs 57 which are of the proper stiffness to decrease the transmission to the floor of vibrations due to unbalance at normal running speed. These springs are chosen so that the natural frequency of the machine on the springs does not correspond with any frequency of precession. It is generally preferable to have this natural frequency above the pre-

cession frequencies. These springs are arranged at the outer edge of the machine and are resilient in all directions so that the horizontal and vertical components of vibration are cushioned. In parallel with the springs **57** at the center of the machine is arranged a friction damping means comprising relatively slidable plates **58** and **59** which are pressed together by a spring **60**. The tension of the spring **60** is varied by means of a screw **61**. The friction plate **59** is provided with a tongue **62** which extends between spaced abutments **63** carried by the machine. The spacing of the abutments **63** is greater than the thickness of the tongue **62**. Due to this lost motion connection, the damping means is effective only for vibrations of large amplitude. During the operation of the machine, the machine has a rocking vibration on the spring **57** which comprises horizontal and vertical components. Since the damping means is arranged at the center of the machine, it is affected by only the vertical component of vibration which is the principal component of vibration transmitted to the floor. It is important that the damping means be unaffected by the horizontal component of vibration since any resistance offered to horizontal vibration will produce a reaction which will increase the transmission of the vertical vibration. It is also important that the damping means be substantially unaffected by small amplitude vertical vibrations. Another characteristic of this damping arrangement is that it is not affected by the weight of the machine since the tongue **62** assumes a position which corresponds to the deflection of the springs **57** under the weight of the machine.

Fig. 4 shows a construction utilizing the principles of the construction shown in Fig. 5. In this construction the support for the machine is contained within a plurality of sleeves **64** which are clamped at spaced points to a ring **65** depending from the base **2**. Within each sleeve **64** is a spindle **65** which is slidable in a flange **66** at the upper end of the sleeve. Between the upper end of the sleeve and a collar **67** threaded on the spindle is arranged a coil spring **68** which provides the resilient support for the machine. A flange **66***a* on the upper end of the spindle holds the spring **68** under initial compression. The upper end of the flange **66** is closed by a dust cover **66***b*. In the lower end of the spindle is carried the stem **69** of a suitable caster. With this arrangement the washing machine is resiliently supported by the spring **68**. The arrangement for damping the vibrations of the machine comprises a ring **70** of friction material which has a tight fit within the sleeve **64**. The vibrations are transmitted to the ring **70** through the collar **67** and through a flange **71** on sleeve **72** which is threaded on the spindle. The flange **71** and the collar **67** are spaced apart a distance greater than the thickness of the ring **70** so that the damping action of the ring is effective only for vibrations of large amplitude. The ring **70** is free to assume a position dependent upon the deflection of the spring **68** under the weight of the washing machine. The inner edge of the ring **70** is reenforced by a metal sleeve **73**. This sleeve is spaced from the sleeve **72** and provides a space for the flow of air through vents **74** in the collar **67** and a vent **75** in the upper end of the sleeve **64**. These vents prevent interference with the action of the support by the compression of air within the sleeve **64**.

This construction has the disadvantage that the horizontal components of the vibrations tend to product pressures between the spindle **65** and the sleeve **66** and between the collar **67** and the sleeve **64**. These pressures tend to increase the transmission of vibration from the machine to the floor.

This objection is overcome by the arrangement shown in Figs. 7 to 10 inclusive. In this arrangement the casters **76** are carried on a supporting ring **77**. The weight of the machine is resiliently supported by a plurality of springs **78** which are arranged between spring seats **79**^{a} and **79**^{b} respectively carried by brackets **79**^{c} and **79**^{d} on the base **2** and the ring **77**. The springs are short enough so that they provide a stable support for the machine without requiring guides for preventing tipping of the machine. The springs **78** are held in the spring seats when the weight of the machine is not supported on the springs by bolts **80** extending through the springs. Suitable clearance holes **81** are provided in parts **79**^{a} and **79**^{c} which permit movement of the base of the machine with respect to the caster supporting ring **77**. This means that the horizontal components of vibrations are cushioned by the springs **78**. The arrangement for damping the large amplitude vibrations comprises a plurality of vertical links **82** of friction material arranged between the base **2** and the caster supporting ring **77**. As shown in Fig. 9, a strip spring **83** holds the link **82** against the base **2** and provides the damping friction. The lower end of the link **82** is connected to the ring **77** by a pin **84** which extends through an elongated slot **85** in the link. This arrangement provides a lost motion connection which prevents movement of the link **82** with respect to the base **2** by vibrations of small amplitude. The pin and slot connection also makes the damping action of the links **82** substantially independent of the horizontal components of vibration.

What we claim as new and desire to secure by Letters Patent in the United States is:

1. In combination, a frame, an extractor rotatably carried in the frame, means for resiliently supporting the frame on a base, friction damping means for resisting vibration of the frame relative to the base, said damping means having relatively moving parts and a lost motion connection between the parts, and means for connecting the friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

2. In combination, a frame, an extractor rotatably mounted in the frame, means for resiliently supporting the extractor on the frame for gyratory movement relative thereto whereby the extractor may rotate about its center of mass, said supporting means being of such stiffness that the critical speed of the extractor is substantially below its normal running speed, means for resiliently supporting the frame on a base, said supporting means being of such stiffness that the natural frequency of vibration of the frame thereon is outside the frequencies of precession of the extractor, friction damping means for resisting vibration of the frame on the base, said damping means having relatively movable parts and a lost motion connection between the parts, and means for connecting the friction damping means to said frame and said base whereby relative movement of said parts is

effected by vibration of the frame relative to the base.

3. In combination, a frame, an extractor rotatably carried in the frame, said extractor being subject to large amplitude vibrations such as the vibrations at the critical speed and gyroscopic vibrations and being subject to relatively small amplitude vibrations such as the vibrations at the normal running speed due to load unbalance, means for resiliently supporting the frame on a base, friction damping means of the type responsive to said large amplitude vibrations as distinguished from said small amplitude vibrations for resisting vibration of the frame relative to the base, said damping means having relatively moving parts, and means connecting said friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

4. In combination, a frame, an extractor rotatably carried in the frame, means for resiliently supporting the frame on a base, said supporting means being of such stiffness that the critical vibration occurs substantially below the normal running speed of the extractor, friction damping means for resisting vibration of the frame relative to the base, said damping means having relatively moving parts and a lost motion connection between the parts, and means for connecting the friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

5. In a combined clothes washing and drying machine, of the type having a rotatable receptacle in which the clothes are washed and centrifugally dried, a frame, a rotatable receptacle carried by the frame for receiving clothes, means for rotating the receptacle to centrifugally extract liquid from the material contained therein, means for resiliently supporting the frame on a base, friction damping means for resisting vibration of the frame relative to the base, said damping means having relatively moving parts and a lost motion connection between the parts, and means for connecting the friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

6. In a combined clothes washing and drying machine, of the type having a rotatable receptacle in which the clothes are washed and centrifugally dried, a frame, a rotatable receptacle carried by the frame for receiving clothes, means for rotating the receptacle to centrifugally extract liquid from the material contained therein, means for resiliently supporting the receptacle on the frame for gyratory movement relative thereto whereby the receptacle may rotate about its center of mass, said supporting means being of such stiffness that the critical speed of the receptacle is substantially below its normal running speed, means for resiliently supporting the frame on a base, said supporting means being of such stiffness that the natural frequency of vibration of the frame thereon is outside the frequencies of precession of the receptacle, friction damping means for resisting vibration of the frame on the base, said damping means having relatively movable parts and a lost motion connection between the parts, and means for connecting the friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

7. In a combined clothes washing and drying machine, of the type having a rotatable receptacle in which the clothes are washed and centrifugally dried, a frame, a rotatable receptacle carried by the frame for receiving clothes, means for rotating the receptacle to centrifugally extract liquid from the material contained therein, said receptacle being subject to large amplitude vibrations such as the vibrations at the critical speed and gyroscopic vibrations and being subject to relatively small amplitude vibrations such as the vibrations at the normal running speed due to load unbalance, means for resiliently supporting the frame on a base, friction damping means of the type responsive to said large amplitude vibrations as distinguished from said small amplitude vibrations for resisting vibration of the frame relative to the base, said damping means having relatively moving parts, and means connecting said friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

8. In a combined clothes washing and drying machine, of the type having a rotatable receptacle in which the clothes are washed and centrifugally dried, a frame, a rotatable receptacle carried by the frame for receiving clothes, means for rotating the receptacle to centrifugally extract liquid from the material contained therein, means for resiliently supporting the frame on a base, said supporting means being of such stiffness that the critical vibration occurs substantially below the normal running speed of the receptacle, friction damping means for resisting vibration of the frame relative to the base, said damping means having relatively moving parts and a lost motion connection between the parts, and means for connecting the friction damping means to said frame and said base whereby relative movement of said parts is effected by vibration of the frame relative to the base.

9. In combination with a centrifugal extractor, a support therefor comprising relatively movable parts having resilient means arranged therebetween, one of said parts being a sleeve and the other of said parts being a spindle slidable in said sleeve, a washer frictionally engaging one of said parts and movable to a position corresponding to the deflection of the resilient means, and a lost motion connection between said washer and the other of said parts for transmitting the vibration of the centrifugal extractor to said washer.

10. In combination with a centrifugal extractor, a support therefor comprising relatively movable parts having resilient means arranged therebetween, one of said parts being a sleeve and the other of said parts being a spindle slidable in said sleeve, a washer frictionally engaging one of said parts, and members carried by one of said parts and spaced apart a distance greater than the thickness of said washer for transmitting vibration from said centrifugal extractor to said washer.

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