

June 20, 1950

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AUTOMATICALLY CONTROLLABLE BRAKE MEANS FOR
SPIN-DRYER TYPE WASHING MACHINES

2,512,263

Filed Sept. 14, 1948

2 Sheets-Sheet 1

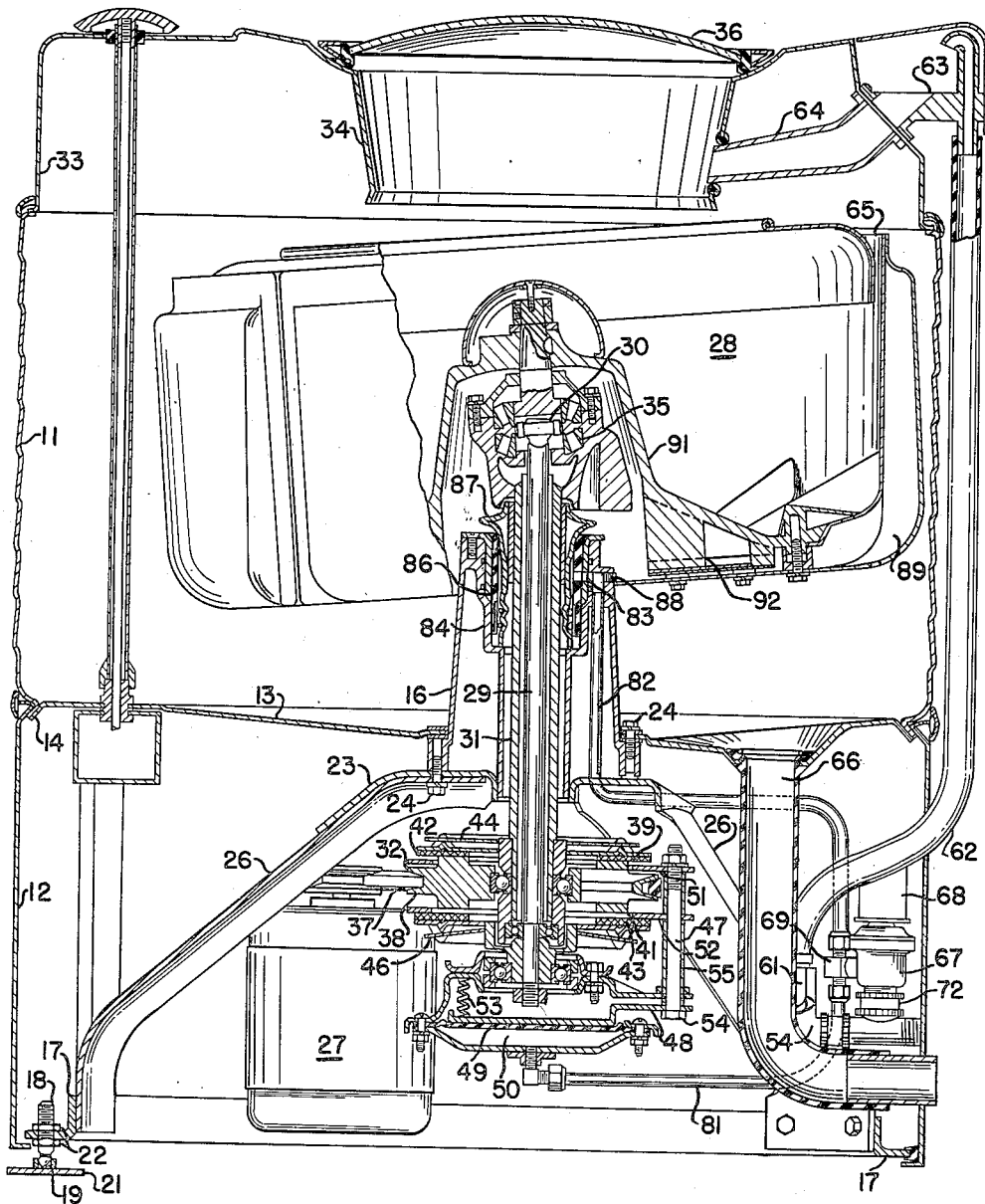


Fig. 1

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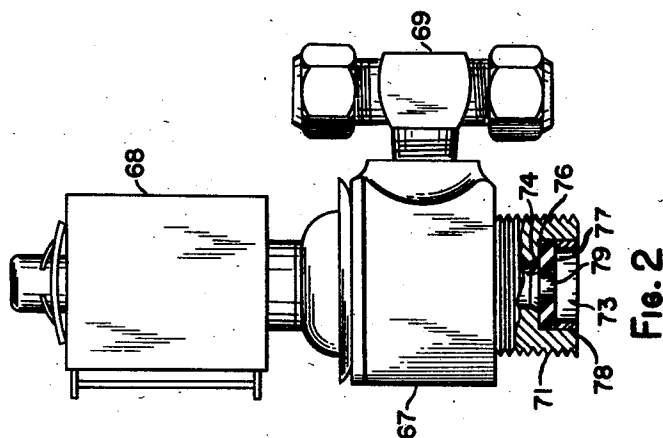


Fig. 2

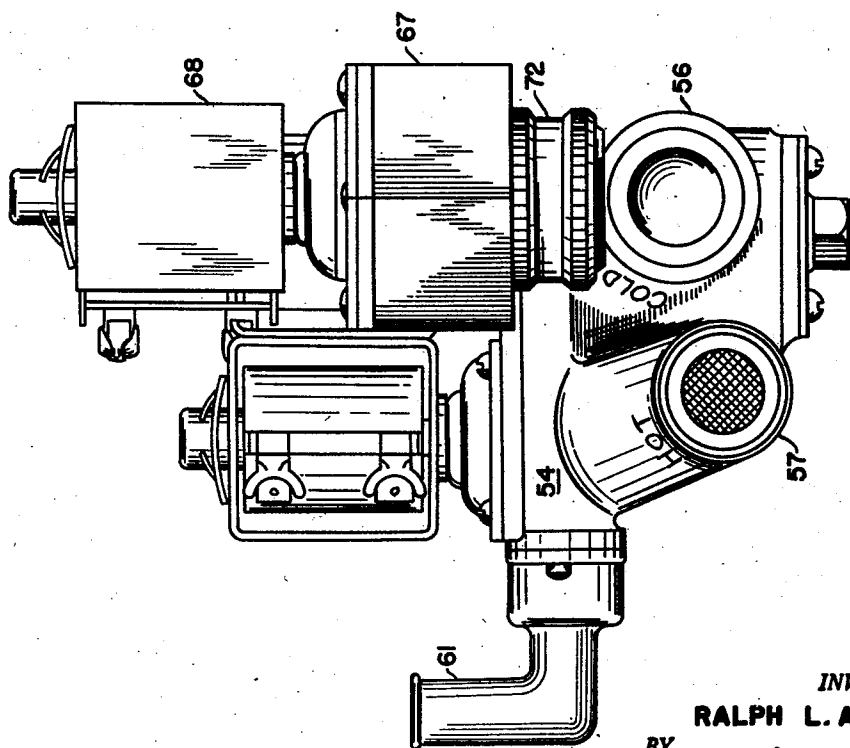


Fig. 3

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2,512,263

AUTOMATICALLY CONTROLLABLE BRAKE
MEANS FOR SPIN-DRIER TYPE WASH-
ING MACHINESRalph L. Archbold, Euclid, Ohio, assignor to The
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Application September 14, 1948, Serial No. 49,198

7 Claims. (Cl. 188—110)

1

This invention relates to washing machines of the spin-drier type having hydraulically operable brake means associated with the drive mechanism for the machine, and more particularly to means adapted during spinning of the container to automatically apply the brake means when vibration exceeds a predetermined value or line pressure drops to a predetermined value.

It is well known that in washing machines of the spin-drier type out-of-balance loads occur during spinning of the clothes container, due to unequal load distribution of the clothes around the container, which results in highly undesirable vibrations of the machine, particularly in washing machines of this type which are not bolted or otherwise fixed to the supporting surface. Various means have previously been proposed to compensate for out-of-balance loads during spinning of the clothes container, but the out-of-balance, in some instances, may exceed the capacity of the compensating means resulting in excessive vibration of the machine creating a tendency for the machine to "walk" and if the excessive vibration is not quickly checked damage may result. In the event no compensating means are provided, excessive vibration will occur with a smaller out-of-balance load. The present invention is adapted to automatically cause retardation of the rotational speed of the container in spin-drier type washing machines having hydraulically operable brake means when vibration exceeds a predetermined value whether or not compensating means for out-of-balance loads are employed.

According to the invention, a washing machine of the type having a brake operable in a given direction by hydraulic pressure and against spring pressure has a valve associated with the fluid supply line for the brake, which is adapted to open when vibration exceeds a given value and reduce the fluid pressure sufficiently to allow spring pressure to apply the brake thereby retarding spinning of the container until the vibration is reduced to a safe point.

It is a primary object of the invention to provide means in a spin-drier type washing machine for automatically retarding spinning of the clothes container when vibration exceeds a predetermined value.

Another object of the invention is to provide means in a spin-drier type washing machine for automatically limiting vibration during spinning of the clothes container due to out-of-balance loads therein.

Another object of the invention is to provide means in a spin-drier type washing machine hav-

2

ing compensating means for out-of-balance loads, dependent upon city line or the like water pressure, to retard spinning of the container when the line pressure drops to a predetermined value.

Other objects of the invention and the invention itself will become increasingly apparent from a consideration of the following description and drawings wherein:

Figure 1 is a vertical sectional view of a washing machine embodying the invention;

Figure 2 is an enlarged side elevational view, partially in section, of a solenoid operated valve and flow control device which I may employ; and

Figure 3 is a front elevational view of hot and cold water control valves for the washing machine, including a solenoid operated valve controlling the flow of water to a balancing means and brake means.

For convenience, the invention is illustrated as applied to a spin-drier type washing machine generally similar to a machine of the type more fully described in a co-pending application of Gerald I. Cockerill and Ralph L. Archbold, Serial No. 704,482, filed October 19, 1946, wherein balancing means dependent upon water supplied from a city line or the like are employed, but the invention is not limited to a washing machine employing balancing means.

Referring now to the drawings and particularly to Fig. 1, I have indicated at 11 the tub of a washing machine, the tub walls being downwardly extended as indicated at 12 to house the drive mechanism. The tub is provided with a base 13 having a peripheral flange 14 by which it is secured to the tub walls. The tub base is formed with a central opening for a pedestal 16.

The entire machine is supported from a generally rectangular frame 17 of L section, somewhat rounded at the corners. Tapped holes at the corners of the horizontal flange of the frame received studs 18 whose rounded heads are received in sockets 19 formed on plates 21 to form feet for the machine which may be adjusted by rotation of studs 18 to conform to irregularities of the supporting surface. Jam nuts 22 lock the feet in adjusted position. Plates 21 are preferably bonded to the supporting surface.

Pedestal 16 is secured to a top plate or spider 23 by bolts 24, the plate 23 being welded to preferably four legs 26. Lower portion of legs 26 are preferably welded to the corners of frame 17. An electric motor 27 is supported by brackets (not shown) connected to legs 26.

The clothes are washed and partially dried in a container generally indicated at 28 supported

by concentric shafts extending through the pedestal 16 to a clutch and brake assembly generally indicated at 32. Shaft 29 is connected to container 28 through universal joint 30 and shaft 31 through a double tapered roller bearing 35. By rotation of one or the other of these concentric shafts, while holding the other shaft, the container 28 is giving a wobbling motion to effect washing of the clothes or is rotated about its axis for extracting liquid from the clothes.

The tub 11 is preferably rectangular in cross section with rounded corners. The upper end of the tub 11 is fitted to a top 33 formed with a central portion 34 of inverted frusto-conical form to provide an opening through which clothes may be placed into and removed from the container 28. Cover 36 is hinged to top 33 to close said opening during operation of the machine.

Motor 27 drives a conventional V belt 37 or any conventional driving means to rotate a pulley 38. I may have a speed reduction in the V belt drive for approximately three to one when using a standard 1,750 R. P. M. motor, in which case the pulley 38 will turn about 600 R. P. M. which is below the critical speed of the container. Pulley 38 is formed to provide a flat face 39 at its top surface and a flat face 41 at its bottom surface. These surfaces are located so as to become drivingly engaged with two friction clutch plates 42 and 43. The clutch plates have suitable brake material on the contact faces and are spring-loaded by means of star shaped flat springs 44 and 46 so as to be constantly urged towards the pulley faces 39 and 41. Clutch plate 42 is keyed or otherwise suitably secured to the outer hollow shaft 31 and clutch plate 43 is similarly secured to the inner solid shaft 29.

The clutch friction surfaces are brought into and out of operating engagement with pulley 38 by means of actuating rods 47, preferably three, which are connected through lever arms 48 to a disc secured to a diaphragm 49. Rods 47 support two flat brake rings 51 and 52 mounted to be movable therewith. Opposing upward movement of diaphragm 49 and resultantly rods 47 are preferably three compression springs 53. Diaphragm 49 forms the top movable wall of a chamber 50.

During the washing cycle, the brake and clutch parts are in position illustrated in Fig. 1 wherein the diaphragm 49 and arms 48 are forced downwardly by the springs 53. Arms 48 are securely attached to actuating rods 47 through rod heads 54 so that any downward movement of arms 48 is transmitted to rods 47. A spacing sleeve 55 extends between lower brake ring 52 and arms 48 and spacing sleeves are also provided between the brake rings whereby upward movement of arms 48 and rods 47 will be transmitted to the brake rings. Spacing sleeves 55 slidably project through openings formed in arms extending from the housing for the lower bearing which is fixedly supported by a cross brace (not shown). Since brake rings 51 and 52 are movable with rods 47, downward movement of the rods will move top brake ring 51 from operating engagement with clutch plate 42 and place lower brake ring 52 in engagement with clutch plate 43. Thus, with the parts in the position illustrated in Fig. 1, the inner shaft 29 is braked against rotation by the engagement of brake ring 52 with clutch plate 43. This allows clutch spring 44 to force the upper clutch plate 42 into operating engagement with upper face 39 of pulley 38 thereby permitting the pulley to drive

the hollow or wash shaft 31. Since the container is held against rotation by inner shaft 29, including universal joint 30, and the inclined bearing is rotated with shaft 31, a wobbling action or what might be termed a rotatably progressing reciprocating motion is imparted to container 28 to effect washing of the clothes in a manner more fully described in the aforesaid copending application Serial No. 704,482.

During the spinning cycle, diaphragm 49 is moved in an upward direction by the hereinafter described hydraulic means, thus forcing arms 48 upwardly against the force of springs 53. This action raises brake rings 51 and 52 so that brake ring 51 comes into contact with clutch plate 42 and lifts it from driven engagement with pulley 38 and at the same time allows clutch spring 46 to force lower clutch plate 43 into operating engagement with lower face 41 of pulley 38. This permits pulley 38 to drive the inner or spin shaft 29 and holds the outer shaft 31 against rotation. The container is thus rotated at high speed to extract liquid from the clothes.

A conventional mixing valve 54 is provided with a cold water inlet 56 and a hot water inlet 57. A thermostat or thermostats within the mixing valve controls the temperature of water delivered therefrom and the water is delivered at intervals during operation of the machine preferably through solenoid actuated valve means, the solenoid circuits being controlled by a conventional electric timer (not shown). Water is delivered from the mixing valve through an L-shaped coupling 61 which connects with a hose 62. The top end of the hose delivers the water to a vacuum breaker arrangement indicated at 63 and thence through a short conduit 64 to the top of container 28. I preferably insert a flow regulating device in coupling 61 to deliver water at a substantially constant rate, despite variations in water pressure. However, the manner of delivering water to the container for washing and rinsing constitutes no essential part of the present invention.

During the extraction or spinning cycles, the wash or rinse water is centrifugally expelled from the container 28 through an annular opening 65 and is drained from tub 11 through an open drain 66.

The valve means for delivering water to chamber 50 and a balancing and bleed valve to be hereinafter described will now be explained. For convenience, the aforesaid valve, chamber 50 and the means for delivering water to the valve and chamber will be referred to as a hydraulic system of the machine as distinguished from the water delivery system hereinbefore described. A valve 67 is periodically actuated by a solenoid 68 under control of the electric timer whereby the valve will remain open for predetermined intervals during operation of the machine and deliver cold water to a T coupling 69. For convenience, the valve is mounted above the mixing valve and makes connection with the cold water supply line leading to the cold water inlet of the mixing valve. Valve 67 has a threaded extension 71 which through a coupling 72 is sealingly connected to the cold water supply line. Extension 71 is formed with a cylindrical bore 73 extending to a reduced frusto-conical bore forming an inclined annular shoulder 74 which connects with a reduced diameter passage 76. A flow regulating washer 77, formed of rubber or the like flexible material, is seated against the shoulder formed intermediate bores 73 and 74 and is maintained

5

thereagainst by press fitting a sleeve 78 within the bore. Washer 77 is provided with a relatively small central orifice 79 whereby during liquid flow pressure differential will be created between the upstream and downstream side of the orifice in a well known manner. Washer 77 has sufficient inherent stiffness so that it will not be deformed or bent in the direction of liquid flow at pressures thereon below a predetermined value, such as 15 p. s. i. At pressures above said value the radially inner portion of the washer will be bent or deformed in the direction of flow causing the orifice to assume a frusto-conical shape and reduce the cross-sectional area of the orifice at the upstream face of the washer 77. Thus, with an increase in line pressure, the orifice will be reduced and the flow will be maintained substantially constant, despite variations in line pressure. Of course, when the radially inner portion of the washer abuts inclined shoulder 74, no further reduction in orifice size will occur, but the stiffness of the washer and the inclination of shoulder 74 are so controlled that reduction in orifice size will not cease until the highest line pressures normally encountered are attained. In the case of exceptionally high line pressures, it may be desirable to employ a pressure reducing valve. Thus, during periods when valve 67 is open, there will be a substantially constant rate of flow through T coupling 69.

One arm of coupling 69 is connected by a conduit 81 to diaphragm chamber 50 and the other arm is connected by a conduit 82 which extends upwardly within pedestal 16 to a port 83. Port 83 extends through a generally cup shaped housing 84 and a rubber sleeve 86 which is bonded or otherwise suitably secured to housing 84. Sleeve 86 forms one part of a valve which, in the present instance, is referred to as a bleed valve; the other part of the valve comprises a metal sleeve element 87 welded to the upper portion of outer shaft 31, element 87 being radially inwardly dished at the zone of port 83 to form an annular passage between sleeve 86 and sleeve 87 communicating at all times with port 83. The upper portion of rubber sleeve 86 makes a continuous seal with sleeve 87 when shafts 29 and 31 are not subject to any unbalanced force or pull. However, from a practical viewpoint, when the container is spinning, even without a clothes load, a slight unbalance occurs breaking the seal at the side opposite the zone of unbalance so that a slight liquid flow occurs.

The manner in which the hydraulic system automatically limits vibration will now be explained. As previously pointed out, washer 77 is adapted to supply liquid at a substantially constant rate to T coupling 69 and resultantly to the conduits 81 and 82. In practical effect, conduits 81 and 82 can be considered a single conduit adapted to have liquid supplied at a substantially constant rate with a closed diaphragm chamber at one end of the conduit and a bleed valve at the other end of the conduit. Since housing 84 for rubber sleeve 86 is fixed, any vibration of the container will pull coaxial shafts 29 and 31 eccentrically of housing 84 and will leave a segment shaped opening between rubber sleeve 86 and metal sleeve 87 at a zone opposite the unbalance causing the vibration. Also, the extent or area of this opening will be dependent upon the amplitude of vibration so that the greater the vibration the greater the discharge or bleeding of liquid. Since conduits 81 and 82 are connected through T coupling 69 and the rate of liquid flow

6

to these conduits is substantially constant, the pressure in diaphragm chamber 50 will drop as the bleed valve opening increases. The extent of bleed valve opening can be so correlated to the force of springs 53 that when the radial extent of the opening reaches a point where it is considered undesirable or unsafe to permit further vibration the springs 53 will overcome the pressure in chamber 50 and cause the brake to be applied to spin shaft 29. This will retard the rotational speed of the container and resultantly the amplitude of vibration of the container, thereby decreasing the bleed valve opening and increase the pressure in chamber 50. Thus, an intermittent retarding or snubbing action of the container spin speed will occur until the spin cycle is completed. The net result is that in the absence of an operator who might manually stop the machine and readjust the clothes in the container for better balance, vibration will be automatically limited to a safe point, and this is particularly desirable in automatically controlled washing machines. Of course, the amount of liquid extracted from the clothes under these conditions will be less than if the container had continued to rotate at its maximum speed, but damage to the machine will be avoided.

In the event that the line pressure does not vary substantially, a fixed orifice could be employed or a rigid washer substituted for flexible washer 77. A relatively small bleed hole (not shown) is provided at a point where liquid from chamber 50 may drain into tub 11 and the bleed hole may be provided in a threaded plug 88 disposed at the top portion of pedestal 16. This bleed hole will permit liquid to be forced from chamber 50 under the influence of springs 53 when valve 67 is closed by the timer and it is desired to apply the brake to shaft 29 and drive shaft 31 for the washing operation. Inasmuch as liquid is continuously bleeding from this hole while valve 67 is open, a relatively small hole is desirable for economy of water.

The parts so far described relate to a washing machine wherein no compensating means for out-of-balance loads in the container are provided, but the invention is also adaptable to a washing machine having compensating means and particularly to a washing machine having compensating means of the type to be now described. Container 28 has a plurality of individual pockets 89 mounted on the external surface of the container side wall. The container has a central portion 91 of inverted cup form and passages 92 extend outwardly from portion 91 to the pockets 89 and when an opening is formed between valve sleeves 86 and 87, due to an unbalanced load in the container during spinning, liquid will be delivered to the bottom zone of portion 91 at a zone opposite the zone of unbalance. This liquid will be transmitted by centrifugal force through one or more passages 92 to one or more pockets 89 communicating with said passages and water will continue to be supplied until sleeves 86 and 87 again make peripheral sealing contact. This will occur when the amount of water in a pocket or pockets compensates for the out-of-balance load and vibration caused by the out-of-balance load substantially ceases. In the event that the out-of-balance load is greater than the compensating capacity of the pockets, vibration will continue and liquid will continue to bleed through the opening formed between valve sleeves 86 and 87. As previously explained, this bleeding will reduce pressure in diaphragm 50

resulting in retardation of the rotational speed of the container. In other words, in a washing machine having compensating means of the type just described, the valve comprising the sleeves 86 and 87 acts both as a control means for the flow of water to the balancing pockets and as a bleed valve limiting vibration.

I have found that if the line pressure drops below a predetermined value, the balancing pockets will demand water at a faster rate than can be supplied, which, if continued, would result in excessive vibration of the container. If flow regulating washer 77 is made sufficiently stiff so that orifice 79 will not be reduced in cross-sectional area below said predetermined low line pressure, then the flow to the bleed valve will be reduced causing a reduction of fluid pressure in chamber 80 and snubbing the container during spinning as previously explained. This, in effect, prolongs the accelerating period of the container when being brought up to spin speed to either permit a sufficient amount of water to be supplied to the pockets 89 to compensate for out-of-balance or prevents the container from reaching maximum spin speed and resultantly prevents excessive vibration.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

What I claim is:

1. In a washing machine having a clothes container adapted to be rotated to extract liquid from the clothes, brake means adapted to retard rotation of the container, hydraulic means for actuating the brake means including a fluid supply line, a valve communicating with the supply line, means responsive to gyratory movement of the container adapted to actuate the valve and vary the fluid pressure in the supply line, and the hydraulic means being adapted to apply the brake means to retard the rotational speed of the container when gyratory movement of the container exceeds a predetermined value.

2. In a washing machine having a clothes container adapted to be rotated to extract liquid from the clothes, brake means adapted to retard rotation of the container, hydraulic means for actuating the brake means including a fluid supply line, a valve communicating with the supply line, and means responsive to gyratory movement of the container caused by out-of-balance loads therein adapted to open the valve and reduce fluid pressure of the hydraulic means whereby the brake means will be actuated to retard the rotational speed of the container when the fluid pressure drops to a predetermined value.

3. In a washing machine having a clothes container adapted to be rotated to extract liquid from the clothes, a drive shaft for rotating the container, brake means associated with the drive shaft, a fluid pressure motor for actuating the brake means, a fluid supply line for the motor, a bleed valve communicating with the supply line, and means responsive to eccentric movement of the container during rotation thereof adapted to open the bleed valve and reduce the fluid pressure at the motor whereby the brake means will be applied to the drive shaft when the fluid pressure drops to a predetermined value.

4. In a washing machine having a clothes container adapted to be rotated to extract liquid from the clothes, a drive shaft for rotating the container, brake means associated with the drive shaft, a fluid pressure motor for actuating the brake means, a fluid supply line for the motor, a bleed valve communicating with the supply line, said valve comprising a first valve member movably responsive to lateral movement of the drive shaft, a second valve member having peripheral sealing contact with the first valve member when the drive shaft axis remains fixed, one of said valve members being formed of rubber-like material whereby gyratory movement of the drive shaft during rotation thereof will cause an opening between said members, and opening of said valve members being adapted to bleed fluid from the hydraulic means whereby the brake means will be applied to the drive shaft when gyratory movement of the drive shaft exceeds a predetermined value.

5. In a washing machine having a clothes container adapted to be rotated to extract liquid from the clothes, a drive shaft for rotating the container, a brake for the drive shaft, and means for automatically applying said brake when gyratory movement of the container during rotation thereof and caused by out-of-balance loads therein exceeds a predetermined value.

6. The combination with a spin-drier type washing machine having pockets formed around the periphery of the clothes container adapted to receive liquid in response to out-of-balance load conditions in the container, and a valve adapted to control the supply of liquid from a pressure source to said pockets, of means utilizing said valve to automatically retard rotational speed of the container when the container gyrates beyond a predetermined safe amplitude, said means comprising a brake adapted to retard rotational speed of the container, a fluid pressure motor operatively connected to the brake, a supply line adapted to transmit fluid under pressure to the motor, a fluid connection extending from the motor to the valve, and the valve being adapted to open in response to gyrating movement of the container thereby reducing the fluid pressure available at the motor and causing said brake to be applied when the motor fluid pressure drops to a predetermined value.

7. The combination as described in claim 6 wherein a flow regulating device is inserted in the supply line whereby fluid will be delivered at a substantially constant rate despite variations in line pressure between maximum and minimum predetermined values.

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