This invention relates to a washing machine support structure.

In washing machines of the type wherein there is a centrifuging operation to remove a major portion of the water from the clothes, it becomes important to provide means to prevent excessive vibration of the machine during the centrifuging process, which requires rotation of a centrifuge unit at a relatively high speed, the weight distribution of which is somewhat variable because of the shiftable nature of the clothes load carried therein.

In the type of automatic washing machine described generally in United States Patents Nos. 2,165,884 and 2,173,603, a tub structure of cylindrical shape is positioned with its axis substantially horizontal and has a rotating cylinder or basket enclosed in the tub, which cylinder is perforated on its circumference and serves as a container for the clothes. On draining of the water from the tub, the perforated clothes cylinder is used as a centrifuge, the speed of the unit being increased materially over the washing speed. As more fully described in the aforementioned Patent No. 2,165,884, if the cylinder is of proper diameter relative to the washing speed, a satisfactory washing of the clothes will result; and also when the water is drained from the tub, the same speed of operation will cause the clothes to arrange themselves in relatively uniform position around the inner circumference of the cylinder; and if the rate of rotation of the cylinder is then increased to the centrifuging speed, the clothes will be in such position as to produce, within limits, a distributed load, and consequently the out-of-balance condition of the machine generally will not be excessive. With such a machine it has been found necessary, however, when no special shock-absorbing or other mountings are provided, to bolt the machine to the supporting floor or platform, as otherwise even the relatively small out-of-balance load which may be encountered would cause the machine to move about on the floor during the centrifuging operation. The bolt-down requirement, although entirely satisfactory in many installations, is an additional installation factor, and in some instances it is of importance that a machine be available which can be set on the floor in any room in the home without the necessity of bolting the unit to the floor.

It is therefore the primary object of the present invention to provide a support for a washing machine which will absorb the out-of-balance vibration in such manner that the machine may be set on a floor without bolting or otherwise positively securing the machine to the floor.

It is a further object to provide a washing machine support structure which will allow limited movement of the centrifuging unit in a generally horizontal direction with provision of resistance to such horizontal movements effective to reduce vibrations transmitted to a floor support.

It is another object to allow limited horizontal movement and to afford frictional resistance to such allowed horizontal movement and in addition to add resilient restraint to vertical movement.

The above and other objects of the invention will appear more fully from the following detailed description and by reference to the accompanying drawings forming part hereof, and wherein:

Figure 1 is a front elevation of a washing machine, partly in section, showing the general arrangement of the support;

Figure 2 is a section taken on the line 2--2 of Figure 1;

Figure 3 is a view, partly in section, taken on the line 3--3 of Figure 1;

Figure 4 is a view, partly in section, taken on the line 4--4 of Figure 3;

Figure 5 illustrates the position of the parts of one of the ball and cup units shown in Figure 4 when the movable part of the machine is in its maximum position toward the left, as viewed in the drawings;

Figure 6 is a view, similar to Figure 5, illustrating the opposite or right-hand position of the movable part of the machine.

Referring to the drawings, an automatic washing machine is shown which is housed in a cabinet 10. The machine is of the so-called horizontal cylinder type and employs a cylindrical tub 11 with a clothes cylinder 12 mounted for rotation therein. Other means, including a motor 7 and a belt 8, are provided to rotate this clothes cylinder at a washing speed and at a centrifuging speed. The cylinder 12 is supported by bearings 9 secured in the tub at one end only, the opposite end of the cylinder being open, as shown by the flanged opening 13 in Figure 3. A door 14 is provided in the front wall of the cabinet 10, and as shown in the structure used for illustration, a flexible connection or sleeve 15 is used to connect the outer wall of the cabinet with the wall of the tub 11, thus making it necessary to use only one door, in the outside of the cabinet, and still allow relative movement between the tub 11 and the cabinet 10. The tub 4, together with the rotating cylinder and other parts, is sup-
ported on a support frame structure 16; the other parts necessary to drive the washing and centrilizing cylinder are also carried on the same frame structure 16, including motor 1 and belt 8. A split door 11 may also be provided in the top of the cabinet with a suitable flexible connection 18 therefrom to the top of the tub 11.

As shown in Figure 1, the support frame structure 16, together with the tub unit 11 and all parts carried thereby, is mounted on three ball cup units 19, each of these three ball cup units being made up of two metal cups 20 and 21 between each of which a ball 22 is positioned. It is apparent, on an inspection of Figure 2, that the lower metal cups 21 are secured on a second support member or plate 23 in the bottom of the cabinet 10 and that the upper metal cups 20 are secured to the bottom of the frame structure 16.

The curvature of the cups is a spherical radius which for the machine illustrated has been constructed as a 4½ inch spherical radius on both upper and lower cups. Therefore, when the balls 22 are in position between these two oppositely-disposed cups, the structure 16 and the parts it supports can move on the balls 22, one maximum position of such movement being shown in Figure 5 and the opposite maximum position being shown in Figure 6.

As best shown in Figure 4, there is a resilient member, preferably a leaf spring 24, secured to a bracket 25, which is in turn supported on the plate 23 carried by the cabinet 10. The leaf spring 24 has friction pads 26 and 27 positioned at its ends, these pads connecting metal plates 28 and 29. The relative position of the parts retaining the leaf spring 24 are such that the spring holds the pads 26 and 27 positively against the plates 28 and 29, so that on horizontal movement of the frame structure 16 on the balls 22 the movement will be resisted by friction of the pads 26 and 27 on the plates 28 and 29, and any upward movement of the frame assembly off the balls 22, will also be resisted by the resilience of the spring 24.

It is preferable that the mass of the portion of the tub structure and of the frame structure in the region of the cylinder be substantially greater, and preferably on the order of about four times greater than the mass of the clothes loading plus the water which may be carried in the cylinder at the time centrifuging begins, and to accomplish this result auxiliary weights 31 and 32 are positioned preferably on the outside wall of the tub 11. In the illustration, the total of these auxiliary weights is about 120 pounds. It has also been found preferable that these weights be positioned and selected as to size so that the center of mass of the entire body carried by the frame structure 16 shall substantially coincide with the axis of rotation of the rotor 12.

It is apparent on reference to Figure 1 that in order to compensate for the weight of the driving motor 1 and the frame 16 below the axis of rotation and to bring the center of mass closer to the axis of rotation, it would be necessary to have some spring 24 in a horizontal line through the axis of rotation of the rotor 12. In order to accomplish this purpose the weight 31 may be added in the upper left-hand quadrant, the exact weights and position being determined by computation on consideration of the various weights involved and by taking moments about any assumed point. It will be found also that weight 32 in the lower right-hand quadrant as shown in Figure 1 may be balanced by sufficient weight at 31. It is apparent, therefore, that the positioning of the weights 31 and 32 as shown accomplishes the purpose of adding substantial mass to the unit while compensating for fixed weights of the several parts to bring the center of mass substantially coincident with the axis of rotation.

During the washing operation the speed of rotation of the cylinder 12 is generally sufficiently slow so that there are no particularly important vibrations set up which would be undesirable if the machine were set on the floor without fastening. However, at centrifuging speeds, which are generally 300 R. P. M. or greater, even with relatively good clothes distribution which is usually accomplished, there is a definite tendency for the unit to vibrate. With the structure above described, however, the vibration set up will cause the unit to move back and forth on the ball cup assembly in a relatively horizontal direction the major movement being in a plane perpendicular to the axis of the support frame. A clothes cylinder with limited movements allowed in other directions because of the spherical radials of the cups; and any tendency of the support frame 16 to raise off the ball cups is resiliently resisted by the leaf spring 24 and any upward movement, regardless of tendency to lift up, will be resisted by the frictional contact of the pads 26 and 27, as previously mentioned. It will be the tendency of a load which is off center in the rotating cylinder to produce a movement which will tend to require the cylinder to have a resultant movement about its center of mass as distinguished from its center of rotation. It is not possible, however, with the mounting shown herein for this result to be accomplished, as the freedom of movement afforded by the rise in the ball cup radius is relatively small and the horizontal movement is predominant; therefore, to this extent the mounting is a compromise over resilient mountings which allow freedom in all directions with suitable snubbing. The tendency of the unit to lift vertically in the device herein disclosed is counteracted by its mass and also by the high center of weight of the movable unit produced by the positioning of auxiliary weights 31 and 32, and further by the resistance to vertical movement afforded by the spring 24.

Although my invention has been described by reference to a specific structure used for illustration, it is understood that modifications may be made therein without departing from the fundamental principles hereinafter set forth; and such modifications are intended within the scope of the following claims.

I claim:
1. A support frame, a washing machine centrifuge unit mounted on said frame, a driving motor fastened to said frame, a plurality of cups secured to said support frame, a plurality of cups secured to said support member positioned to form cooperating pairs of cups, rolling means between each said pair of cooperating cups for rotating relative movement between said support frame and said support member, friction pads positioned to contact said support member thereby to produce frictional resistance against said movement, and a resilient member for holding said friction pads in contact with said support frame.
2. A support frame, a washing machine centrifuge unit employing a centrifuging machine ro-
tatable in a substantially horizontal position, a
support frame for said centrifuging member,
means to allow limited movement of said rotate-
table member horizontally comprising cooperat-
ing spherical radius concave members, interme-
diate rolling members between said cooperating
concave members, and a resiliently mounted
friction contacting member positioned to con-
tact said support frame thereby to frictionally re-
sist said horizontal movement.

3. In combination with a washing machine
structure employing a centrifuge unit mounted
for rotation on a substantially horizontal axis,
a support frame for said centrifuge unit, a sec-
ond support, cooperating sliding members be-
tween said support frame and said second sup-
port allowing relative horizontal movement of
said centrifuge unit and said support frame rela-
tive to said second support, a resilient restraining
member mounted in position for frictional con-
tact with said support frame thereby to resist said
horizontal movement and positioned also to re-
strain the vertical movements of said support
frame induced by said centrifuge unit.

4. In combination with a washing machine
structure employing a centrifuge unit mounted
for rotation on a substantially horizontal axis,
a support frame, connections to said support
frame allowing limited horizontal movement, and
a resilient member having a frictional portion
contacting a surface on said support frame in a
horizontal plane to frictionally resist horizontal
movement and positioned with said frictional
contacting portion above said surface in such
relation to said support frame as to afford re-
silient resistance to vertical movement of said
frame.

5. In a combination with a washing machine
structure, a support frame assembly including a
centrifuging unit structure with motor driving
means therefor mounted on said support frame,
said support frame assembly and centrifuging
unit being so constructed as to have a center of
mass substantially coincident with the axis of
rotation of said centrifuging unit and having a
mass of such amount that the mass supported
on said frame is at least four times greater than
the mass of the washing load intended to be op-
erated on in said centrifuging unit, connections
to said support frame allowing limited horizontal
movement, and a resilient member contacting said
support frame to frictionally resist said horizontal
movement.

6. In combination with a washing machine
structure employing a centrifuge unit mounted
for rotation on a substantially horizontal axis,
a support frame for said centrifuge, a second sup-
port member positioned under said support
frame, cooperating rolling members between said
support frame and said second support member
allowing movement of said centrifuge unit and
said support frame relative to said second sup-
port in a definite path predominantly in the
horizontal direction in a plane substantially at
right angles to the axis of rotation of said cen-
trifuge unit, and a resilient restraining member
mounted in position for frictional contact with
said support frame.

7. In combination with a washing machine
structure employing a centrifuge unit mounted
for rotation on a substantially horizontal axis,
a support frame for said centrifuge, a second sup-
port member positioned under said support frame,
cooperating rolling members between said sup-
port frame and said second support member al-
lowing movement of said centrifuge unit and said
support frame relative to said second support in
a definite path in a plane substantially at right
angles to the axis of rotation of said centrifuge
unit, and a resilient restraining member mounted
in position for frictional contact with said sup-
port frame.

HERBERT C. BOWEN.