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FLOATING SUPPORTING STRUCTURE FOR AUTOMATIC WASHERS

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This invention relates to a novel supporting structure for an automatic washing, rinsing and drying machine. It provides a means for resiliently supporting the complete operating and control mechanism for the machine within the rigid frame structure.

The instant application is a division of application Serial No. 368,190 entitled "Automatic washer" filed December 2, 1940 by Peter Eduard Geldhof and Luther Ringer and issued April 28, 1944, as Patent No. 2,347,190.

It is an object of the invention to support the mechanism of such a machine in substantially floating relation with respect to the rigid frame structure whereby the vibration or other operational shocks and jars initiated by its operation will at least be greatly minimized, if not completely eliminated.

A further object is to provide a certain degree of freedom of lateral movement for the mounting of the operating and control mechanism of automatic washing machines with respect to the rigid frame structure. This lateral movement of the mounting may be brought about by the fact that the shifting weight of the material being laundered produces an unbalanced load on said mounting. Such an unbalanced loading will create a swinging or vibratory motion of the receptacle particularly when it is rotated at high speeds, such as is the case in the drying operation.

It is the aim of this invention to provide a plurality of suspensions for a washing tub assembly embodying concentrically arranged agitating and drying mechanism in the tub and control means associated with the bottom of the tub, all of which are disposed within a housing. These suspensions extend in the space between the bottom of the tub and the wall of the housing and each such suspension includes a supporting element and has an end cushioned in dampening means whereby a floating support is provided for the entire assembly inside of the housing.

In accordance with the general features of this invention there is provided in combination with a supporting frame, a floating base resiliently supported on said frame, a tub basket rotatably mounted within said tub, an agitator mounted for oscillation about substantially a vertical axis within said basket, and driving means for said basket and said agitator depending below and supported solely by said base.

The novel features which we believe characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, both as to its manner of construction and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

Figures 1 and 2 together form a vertical sectional view through the machine, Figure 1 being the upper portion of the machine and Figure 2 being the lower portion of the machine;

Figure 3 is a horizontal section through the machine along the line III—III of Figure 1, looking down on the floating mounting for the tub and drive mechanism;

Figure 4 is a vertical section through one of the tub mechanism supporting means, as taken along the line IV—IV of Figure 3;

Figure 5 is a sectional view of one of the lower suspension pad socket members taken along line V—V of Figure 4;

Figure 6 illustrates a modified form of floating assembly employing cables as suspension members; and

Figure 7 illustrates a further modified form of floating assembly employing springs as suspension and stabilizing members.

Figures 1 to 5, inclusive, of the drawings illustrate one embodiment of the present invention.

The automatic washing machine which is shown in Figures 1 and 2 includes, in general, a casing 10 which houses the entire mechanism and control thereof. The casing 10 is closed by a cover plate 11 having a pivotally mounted lid or panel 12 mounted therein, through which the clothes and other articles to be washed may be placed into the machine.

Substantially all of the principal operating and control mechanism of the washing machine is mounted on and carried by the base member or spider 13. Referring to Figs. 1 and 2 of the drawings, which together form a vertical sectional view through the machine, it will be observed that a wash tub 31 is mounted on the base 13, and rotatably mounted within the wash tub 31 is a perforated drying basket 33. Within the drying basket 33 is an agitator 39 which is arranged to be oscillated during the washing operation. Suspended from the under side of the base 33 is a motor 40, agitator transmission 41, drier transmission 42, an extraction pump (not shown) and suitable clutch and control mechanisms (not shown).

As may be seen best in Figures 3 to 5, inclusive, substantially all of the operating mechanism of
the washer is mounted on a floating base member or casing 13, which is suspended from the side walls of the casing 10. Secured to two of the inner faces of the casing 10 are bars 14 which are bolted to the casing at 15. These bars are preferably of such length as to extend completely across the side on which they are mounted and are fastened to the adjacent corners in end portions 16. The other two inner faces of the casing 10 have angle irons 17 and 18 secured thereto by bolts 19 which pass through the casing; the end 16 of the bars 14, and the angle irons 17 and 18. A pair of suspension brackets 20 are mounted across the corners of the casing 10 adjacent the angle iron 18. These suspension brackets 20 are preferably made of relatively thick stock (for example, half-inch stock) and are apertured at one end for the reception of the mounting bolt 21 which secures the brackets to the angle iron 18. The brackets 20 are provided with a pair of tapped holes 22 in their opposite ends for receiving a pair of bolts 23 whose heads are countersunk in the bar 14 and do not extend through the wall of casing 10. The supporting base or spider 13 is suspended directly from the angle iron 17 and the suspension brackets 20 by a set of suspension rods 24 which will be described in greater detail hereinafter.

The tub, drying basket and agitator assembly, as shown in detail in Figure 1 includes a tub 37 having a base portion 43 which is centrally aperture to permit the drive shafts for the drier basket 38 and the agitator 39 to pass therethrough. The supporting base or spider 13 is also centrally apertured as at 44, into which the boss 45 of the casting 46 is fitted. The casting 46 has a threaded central opening through the boss 45 which receives the lower threaded end of the center post 47. This center post 47 has an outwardly projecting shoulder or flange 48 adjacent the threaded end portion 49 thereof. Suitable gaskets or sealing rings 50 and 51 are placed on opposite sides of the base portion 43 around the central aperture, and the center post is then inserted through this opening and threaded into the casting 46 and screwed up tight. It will be understood that this center post 47 must make a fluid-tight seal with the base portion 43 of the tub 37 in order to prevent leakage of water from the tub.

The perforated drying basket 38 is carried on a hollow shaft 52 which extends up through the center post 47. While only a few relatively small number of holes are shown in the basket 38 in Figure 1 of the drawings, it will of course be understood that the entire basket is provided with perforations to permit the passage of water therefrom. This basket 38 is mounted on the end of the hollow shaft 52 by providing an intermediate collar 53 which is press-fitted or otherwise suitably secured on the upper end of the hollow shaft 52. The collar 53 is provided with a loosely tapered shoulder 54, upon which the basket center post 55 is seated. The basket center post 55 is riveted or otherwise suitably secured to the base portion 56 of the basket 38 by means of rivets 57 or the like. A reinforcing plate 58 is also provided to stiffen the base portion 56 of the basket.

The upper end of the basket center post 55 may advantageously be keyed to the intermediate collar 53 as at 59, and a retaining ring 60 is threaded onto the upper end of the intermediate collar member 53 to force the center post 55 tightly down onto the seat 54. A sleeve bearing 61 is provided within the stationary center post 47 in which the hollow shaft 52 rotates. A packing gland or sealing ring 62 is provided at the upper end of the sleeve bearing 61.

The hollow shaft 52, upon which is carried the perforated basket 38, is arranged to be rotated at relatively high speed (such, for example, as 600 to 1200) for the purpose of centrifugally drying any clothes or other articles carried in the basket 38.

Extending up through the center of the hollow shaft 52 is a solid shaft 63 upon which the agitator 39 is mounted. More specifically, the upper end of shaft 63 is splined as at 64 and is adapted to receive a complementary formation on a collar 65, which is press-fitted or otherwise secured in the upper end of the agitator 39. The agitator may be retained in place vertically by means of a plate 66, which is bolted on the end of the shaft 63 as at 67. The shaft 63 passes up through a sleeve bearing 68 which is carried in the upper end of the hollow shaft 52.

The agitator 39 is shown as being of the multiplying type and is oscillated back and forth about a vertical axis to wash clothes and other articles in a manner well known to those skilled in the art.

The manner in which the agitator shaft 63 and the basket shaft 52 are vertically supported in the assembly may be seen best from inspection of Figure 2 of the drawings. The transmission 41 is housed within a casing formed of upper and lower castings 69 and 70, which halves are bolted together. This casing, comprising the upper and lower portions 69 and 70 is directly bolted to the under side of the base or spider 42 in a manner not shown. As shown in Figure 2, the lower casing casting 70 is provided with a depending boss 72 which is internally bored as at 73. The lower end of the agitator shaft 63 extends down into the bore 73 and is seated on a steel ball 74 which acts as a thrust bearing for the shaft. The ball 74 is illustrated as being seated in a conical end portion 75 of the bore 73.

The shaft 63 extends up through the upper casting 69 in boss 76. Since the mechanism of the transmission 70 is arranged to run in oil or other suitable lubricant, a packing gland assembly is provided for the shaft 63 which includes a cup-shaped collar 77 in which a packing ring 78 is seated. A ring or washer 79 is slipped over the shaft 63 against the packing ring 78. A coil spring 80 which extends around the shaft between the washer or ring 78 and a second washer or ring 81 normally holds the packing gland assembly in seated position. A pin 82 on the shaft 63 limits the downward movement of the lower washer or ring 81.

The basket-carrying shaft 52 is supported on and carried by the shaft 63, as may be seen from an inspection of Figure 2. More particularly, a sleeve bearing 83 is keyed or otherwise suitably secured to the lower end of the hollow shaft 52. The sleeve bearing 83 has a lower foot or thrust-bearing portion 84. Clamped on the shaft 63 below bearing 83 is a lower thrust-bearing member 85, on which the thrust-bearing foot portion 84 is seated. The member 85 is advantageously locked in place on the shaft 63 by means of a set screw or bolt 86. The lower portion of the member 85 is provided with a skirt 87 which overhangs the upper portion of the casting 69 at the point where the shaft 63 passes therethrough, to prevent foreign material from
working down into the casing which houses the transmission 41.

The driving mechanism for oscillating the agitator 39 and for working the perforated basket 38 is suspended from and moves below the base plate or spider 13. Power is derived from an electric motor 40, which is supported by a bracket 85 which straddles the motor 40 and is bolted or otherwise suitably secured to a boss 89 formed on the under side of the base member 13.

One particular manner of locating the motor 40 is to suspend it from the under side of the base member 13 in such a position that it lies directly opposite the suspension rod 24, which is carried by the angle iron 17. This particular location and orientation of the motor with respect to the point of suspension of the spider has been found to be advantageous since a substantially even distribution of weight thereon may thereby be achieved.

The motor 40 drives the agitator 39 and suitable control mechanism through the transmission 41. The motor 40 also drives the perforated basket 38 through the transmission and clutch mechanism 42. The pump (not shown) is also directly driven from the motor 40.

The transmission 41 includes a drive shaft (not shown) which is directly driven from the motor 40 by a belt drive 91. To this end a suitable pulley 92 is secured to the rotor shaft 93 of the motor 40 and a second pulley 94 is mounted on a connecting shaft 95, which, in turn, is connected to the aforementioned drive shaft of the transmission 41. The connecting shaft 95 is rotatably supported in the casing of the drier basket transmission and clutch mechanism 42.

As previously explained herein, the supporting base or spider 13 which carries the principal operating and control mechanism of the washing machine is resiliently suspended from angle iron 17 and suspension brackets 20 by means of the suspension rods 24. The details of construction of the suspension rods 24 and their associated structure may be seen best from an examination of Figures 4 and 5. The opposite ends of the suspension rods 24 are each bored and tapped for the reception of the threaded shank of a bolt 25. These bolts 25 are provided with relatively large heads 26, which have a molded rubber cushioning pad formed therearound as at 27. A nut 28 is provided on each bolt 25 to limit the extent to which the bolt may be screwed into the suspension rod 24.

Each cushioning pad 27 is contained within a suspension pad socket 29. The lower suspension pad socket 29 is closed off by means of a bracket 30 which is centrally apertured to permit free movement of the suspension rod 24 and the shank of its associated bolt 25 to freely move therein. The bracket or strap 30, however, prevents the rubber cushion pad 27 from coming out of the socket 29. The bracket or strap 30 is bolted to a pair of projecting ears 31 on the supporting base or spider 13, as at 32, and is also bolted to the lower suspension pad socket 29 by bolts 33 which extend from the base of the socket 29 alongside of the rubber pad 27 (see Figure 5).

One of the upper suspension pad sockets 29 is closed by a cover plate 34 and is directly bolted to a slightly bent-up portion 35 of the angle iron 17 by bolts 36 which extend from the base of the socket 29 through the cover plate 34 and the bent-up portion 35 of the angle iron 17. The other two suspension rods which are supported from the suspension brackets 20 are similar to the suspension rod connected to the angle iron 17 with the exception that the cover plate 34 of each of the former suspension rods and the sockets 29 are directly bolted to the brackets 20, rather than to the angle iron 17.

From the above description it will be understood that a floating mounting is provided for the supporting base or spider 13. It will also be noted that the rubber above the bolt head 26 in the lower socket 29 is under a compressive force, while the rubber below the bolt head 26 in the upper socket member 29 is subjected to a compressive force.

It has been found desirable under some circumstances to increase the mass of the base 13 above that which is necessary to provide a member with sufficient strength to support the various washing machine mechanisms. By artificially loading the base 13, i.e., by making it abnormally heavy, its inertia is increased. This tends to reduce vibration in the machine.

Two modifications of the floating base suspension are shown in Figures 6 and 7. The modifications are similar to the view showing the suspension in Figure 4.

In the first modified form of suspension as shown in Figure 6 cables 97 are employed in place of the suspension rods 24. These cables 97 are preferably three in number and have their ends secured in cross plates 98 at the top and 99 at the bottom. The cross plates 98 of each cable are bolted as at 100 to the stationary supporting frame portions 101. The lower plates 95 are bolted as at 102 to the ears 31 of the base or casting 13. The ends of the multi-strand cables 97 are preferably anchored in collars 103.

It has been found that when the base or casting 13 is supported on multi-strand cables that a particularly effective type of floating suspension is obtained since the base has greater freedom of movement laterally of itself than it has to move up and down vertically. Due to the fact that a whirling unbalanced load in the basket 67 tends to cause vibration in a horizontal plane more than in a vertical plane, it will at once be appreciated by those skilled in the art that this particular form of floating suspension is particularly advantageous for the present type of equipment.

In Figure 7 of the drawings we have illustrated a third form of floating base suspension wherein heavy coil springs 104 are employed to suspend the base or casting 13. Plugs 105 having appropriate spiral grooves therein are threaded into the ends of the coil spring 106 both at the top and at the bottom. These plugs 105 have a threaded stud portion 106 which extend through holes in the upper frame member portion 107 and the lower anchoring strap 108 and are secured thereto by nuts 109. The lower anchoring strap 108 is secured to the ears 31 of the base or casting 13 in a manner previously described.

In addition to the suspension springs 104 in the form of the invention shown in Figure 7 a set of anchoring springs 110 are also employed. The lower springs 110 have plug members 111 in each end which are similar to the plug members 105 and which are secured to anchoring straps 112 and 113 by nuts 114. The anchoring strap 112 is secured to the ears 31 of the base or casting 13 while the anchoring straps 113 are secured to stationary frame portions 115. The anchoring springs 110 in conjunction with the suspension
springs 104 tend to dampen lateral vibration of the floating assembly. The springs 104 and 110 are capable of being loaded to a greater extent than the maximum possible unit loading of the springs by the floating assembly.

While we have shown and described particular embodiments of our invention it will, of course, be understood that we do not wish to be limited thereto, since many modifications may be made, and we, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of our invention.

We claim as our invention:

1. A washing machine comprising a supporting frame, a floating base, a tub mounted on said base, a perforated basket rotatably mounted within said tub on said base, an agitator mounted within said basket on said base, a motor suspended from said base, transmission mechanism connecting said motor to selectively rotate said basket and oscillate said agitator, said transmission mechanism being suspended from said base, and three supporting arms for suspending said base from said frame, said arms being resiliently secured to three spaced points on said base at the other end, said points being so located as to form an isosceles triangle, and said motor being so located on said base as to lie in close proximity to the point forming the apex of the isosceles triangle.

2. A washing machine, a supporting frame, a floating base, a tub mounted on said base, a perforated basket rotatably mounted within said tub on said base, an agitator mounted within said basket on said base, a motor suspended from said base, transmission mechanism connecting said motor to selectively rotate said basket and oscillate said agitator, said transmission mechanism being suspended from said base, and three supporting arms for suspending said base from said frame, said arms being resiliently secured to said frame at one end and resiliently secured to three spaced points on said base at the other end, said points being so located as to form an isosceles triangle, and said motor being so located on said base as to lie substantially adjacent one of said points of support.

3. A washing machine comprising a supporting frame, a floating base, a tub mounted on said base, a perforated basket rotatably mounted within said tub on said base, an agitator mounted within said basket on said base, a motor suspended from said base, transmission mechanism connecting said motor to selectively rotate said basket and oscillate said agitator, said transmission mechanism being suspended from said base, and three supporting arms for suspending said base from said frame, said arms being resiliently secured to said frame at one end and resiliently secured to three spaced points on said base at the other end, said points being so located as to form an isosceles triangle, and said motor being so located on said base as to lie in close proximity to the point forming the apex of the isosceles triangle, said base being artificially loaded to greatly increase its normal mass, whereby vibration of said base due to an unbalanced load in said basket is substantially eliminated.

4. In a centrifugal type of washing machine, a washing tub assembly including concentrically arranged agitating and drying means in the tub and operating means for said agitating and drying mechanism associated with the bottom of the tub, a housing for said assembly, and means for supporting the assembly in the housing comprising a plurality of suspensions between the bottom of the tub and the wall of the housing, each of said suspensions including a supporting element extending in the space between the tub and the housing and having an end cushioned in dampening means, said suspensions providing a floating support for the entire assembly inside of said housing.

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