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O. HOLM-HANSEN ET AL

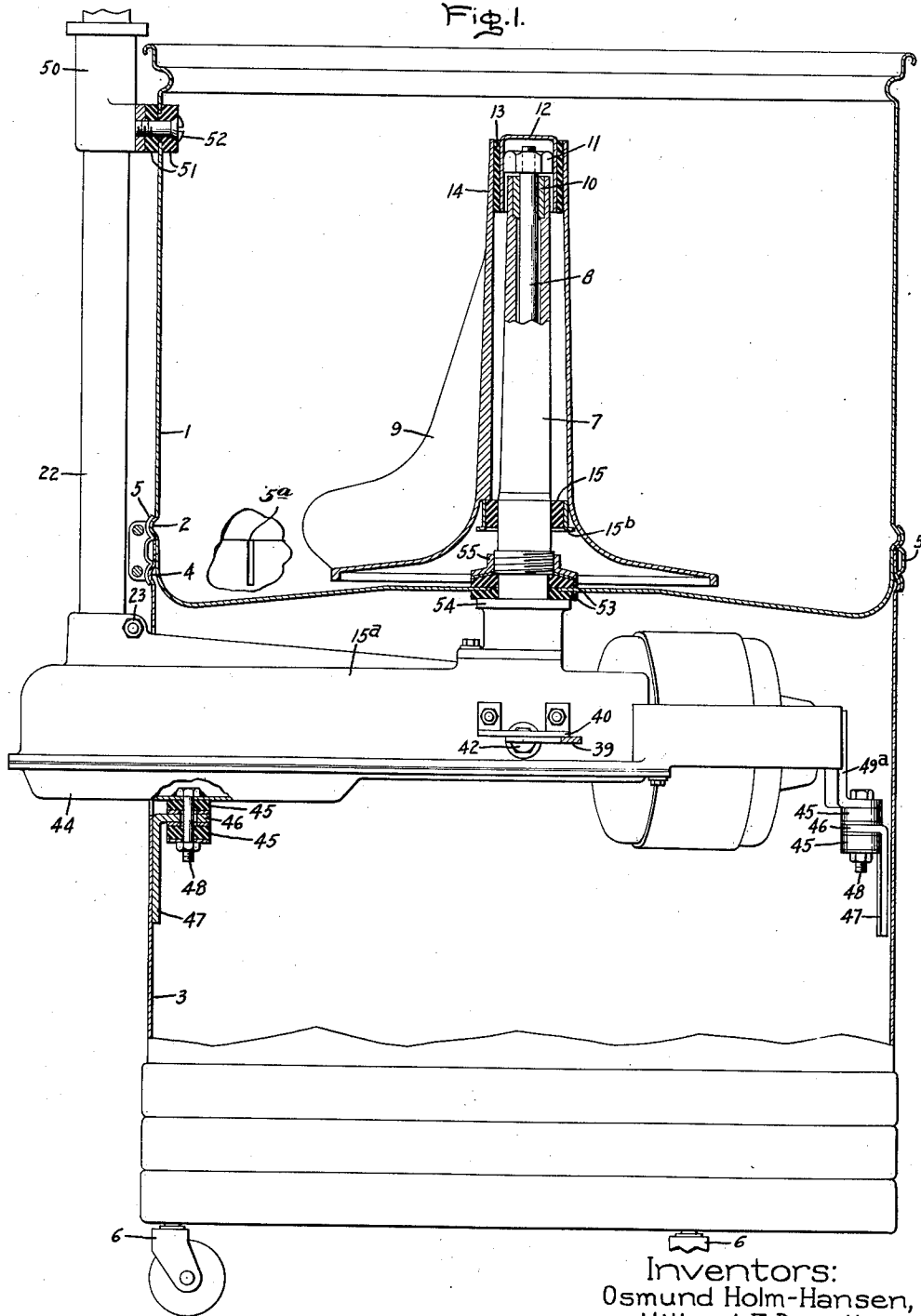
2,197,640

WASHING MACHINE

Filed Sept. 15, 1936

2 Sheets-Sheet 1

Fig. 1.



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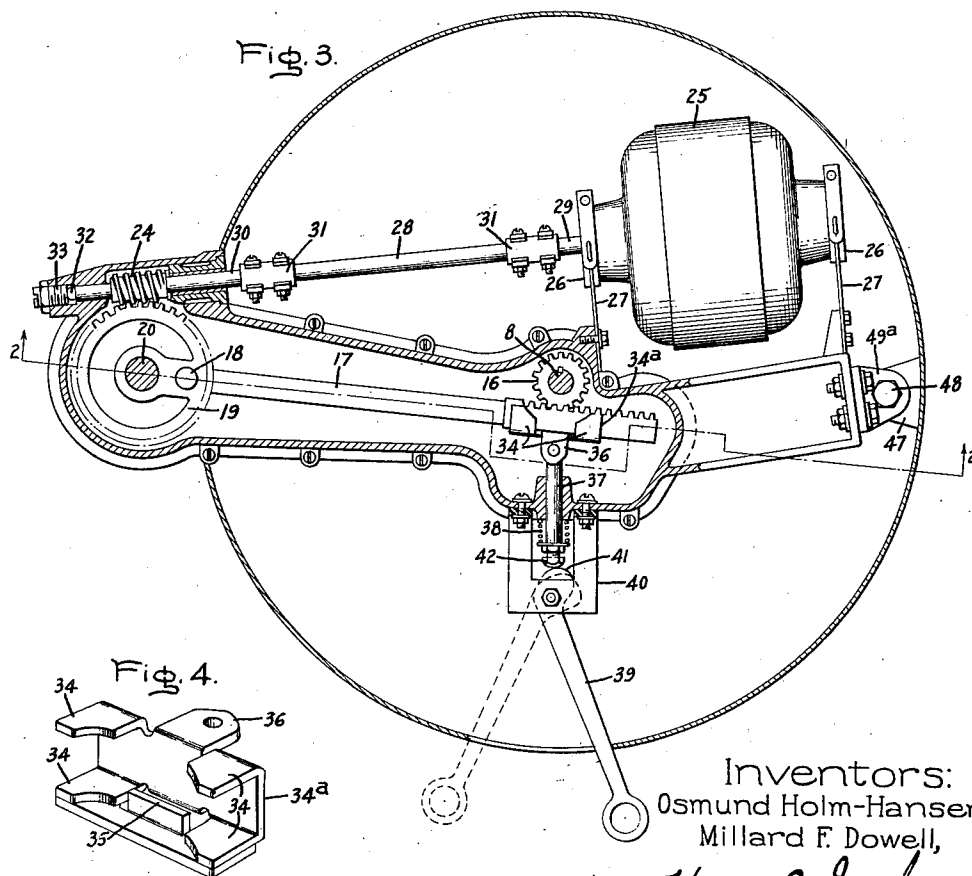
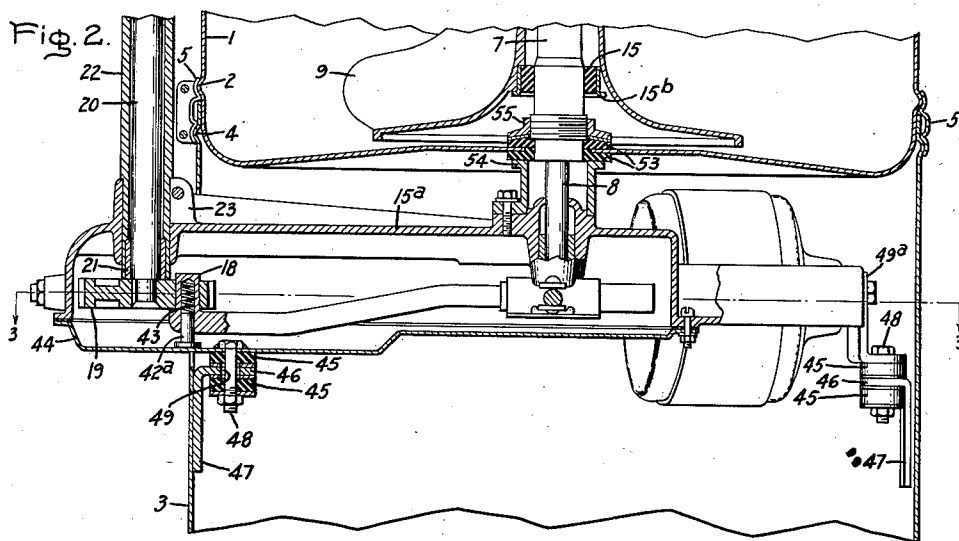
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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WASHING MACHINE

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2 Claims. (Cl. 68—133)

The present invention relates to domestic washing machines of the type in which washing is effected by the oscillatory movement of an agitator mounted within the tub.

5 In machines of this type a considerable amount of noise may be produced by the mechanism for producing the oscillating movement of the agitator.

10 The object of our invention is to provide an improved construction and arrangement in washing machines of this type which will result in quieter operation, and for a consideration of what we believe to be novel and our invention attention is directed to the following description and the claims appended thereto.

15 In the accompanying drawings, Fig. 1 is a sectional elevation of a washing machine embodying our invention; Fig. 2 is a fragmentary elevation in section along the lines 2—2 of Fig. 3; Fig. 3 is a top plan view in section along lines 20 3—3 of Fig. 2; and Fig. 4 is a perspective view of the guide for guiding the reciprocating movement of the rack.

Referring to the drawings, the tub 1, which is 25 made of relatively light sheet metal, is provided with a bead 2 which rests on the upper edge of a cylindrical sheet metal skirt 3 which serves as a support for the tub. The arrangement for securing the tub to the skirt comprises a clamping band 5 which engages the bead 2 on the tub 30 and a bead 4 on the skirt and thereby wedges the tub tightly against the upper edge of the skirt. The upper edge of the skirt may have a plurality of spaced vertical slits 5a so that the clamping band will clamp the skirt tightly 35 against the tub. The lower end of the skirt is provided with suitable supporting casters 6. A tubular sleeve or post 7 extends through a central opening in the bottom of the tub upwardly 40 to a point above the normal water level in the tub. A vertical shaft 8 for driving an agitator 9 is journaled at the upper end of the post in a bearing 10. The coupling between the shaft and the agitator comprises a nut 11 fixed to the upper 45 end of the shaft which fits into a complementary socket 12 moulded to the inner surface of a rubber sleeve 13. The outer surface of the sleeve 13 is secured to the inner surface of the tubular portion 14 at the upper end of the agitator. The 50 sleeve 13 provides a resilient support for the agitator and also provides a torsionally resilient driving connection between the oscillatory shaft 8 and the agitator. This driving connection decreases the shock resulting from the sudden reversal of the agitator, and also causes the reversal

of the agitator to occur after the reversal of the shaft 8. In other words the reversal of the agitator, i. e. the reversal of the load on the agitator shaft, occurs after the reversal of the oscillating mechanism which oscillates the agitator shaft. The load on the oscillating mechanism is therefore decreased during its reversal, with the result that noise caused by looseness in the oscillating mechanism is decreased. Since the 10 upper end of the socket 12 is closed, it prevents leakage around the shaft 8 of the water which is splashed over the upper end of the agitator. At the lower end of the agitator is an annulus 15 of rubber bonded to a metal ring 15b which is secured to the agitator. The annulus 15 bears 15 on the outside of the post 7 and provides a resilient bearing for guiding the agitator. This bearing prevents noise due to the wobbling of the agitator with respect to the post 7. The rubber bearing 15 has very low friction with water lubrication and has the further advantage that it is not harmed by particles of grit in the washing solution.

The lower end of the post 7 is bolted to the upper side of a gear casing 15a containing the 25 driving mechanism for oscillating the agitator shaft 8. The agitator shaft 8 extends within the gear casing 15a and has a pinion 16 keyed to its lower end which is adapted to mesh with a reciprocating rack 17 to cause oscillation of the 30 agitator. The left end of the rack is provided with a crank pin 18 which is rotatable in a bearing eccentrically located in a worm wheel 19. The worm wheel is fixed to the lower end of a vertical shaft 20 which is journaled in a bearing 35 21 in a tubular wringer post 22. The wringer post is clamped to the upper side of the gear casing by a split clamp 23 integral with the upper wall of the gear casing. The worm wheel 19 is rotated by a worm 24 which is driven by an electric motor 25 carried on the gear casing by rubber rings 26 clamped to supports 27. An intermediate shaft 28 is connected between the motor shaft 29 and the worm shaft 30 by flexible couplings 31. A thrust ball 32 is provided at the left 45 end of the worm shaft 30. The thrust ball is adjusted by a plug 33. With this arrangement the worm wheel 19 is continuously rotated in one direction by the motor and the crank pin 18 bearing the worm wheel causes the rack 17 to be 50 reciprocated. The body of the rack is off-set and rigid so that although the end of the rack carrying the crank pin 18 is below the teeth of the worm wheel 19, the teeth of the rack and the bearing of the crank pin are in line with the 55

teeth of the worm wheel. This reduces the load on the bearings of the shaft 20 and eliminates vertical forces in the rack thrust which would have a tendency to cause slaps, resulting in objectionable noises. The reciprocating movement of the rack is guided by a guide 34a shown in Fig. 4. The guide has flanges 34 which extend over the upper and lower sides of the rack. Secured to the lower flanges is a tongue 35 which slides in a groove on the underside of the rack and holds the rack in the guide. From the rear edge of the guide extend ears 36 which are pivoted on the inner end of a plunger 37 slidable in the walls of the gear casing 15a. The ears 36 support the rack on the plunger and the pivotal connection between the ears 36 and the plunger permits pivotable movement of the guide during the reciprocating movement of the rack. Between the outside of the gear casing and the plunger 37 is arranged a coil spring 38 which biases the plunger outwardly and thereby tends to move the plunger to a position in which the rack is out of engagement with the pinion. The plunger is moved inwardly by a control lever 39 pivoted on a bracket 40 secured to the outside of the gear casing. The inner end of the control lever is provided with a cam surface 41 which engages a set screw 42 threaded into the plunger. When the control lever is in the position shown in full lines in Fig. 3, the plunger is pushed inwardly, thereby moving the rack into mesh with the pinion. When the control lever is in the position shown in dotted lines in Fig. 3, the spring 38 moves the plunger outwardly, thereby moving the rack out of engagement with the pinion.

On the under side of the crank pin 18 is a pin 42a which is pressed by a coil spring 43 against the gear casing cover 44. The friction between the pin 42a and the cover of the gear casing tends to prevent over-travel of the reciprocating rack, and thereby reduces back lash between the worm and the worm gear. The friction between the pin 42a and the gear casing cover also tends to retard the rotation of the crank pin 18, and thereby tends to hold the crank pin against its bearing in the worm wheel 19 during all parts of the reciprocating movement of the rack and particularly during the reversal of the reciprocating movement of the rack. The frictional force between the crank pin and its bearing is always in the same direction, and causes the rack to be urged outwardly against the back of the guide 34a, thus preventing wobbling of the rack in the guide and eliminating noise from this source. When the rack is being reciprocated, it is continuously held against the back of the guide 34a and the tongue 35 is then merely a means for making sure that the rack is pulled out of mesh with the pinion in case of binding between some of the parts. The pin 42a prevents the crank pin 18 from falling from its bearing in the worm wheel 19, and also supports the wringer shaft 20.

In order to prevent transmission of noise originating in the gear casing to the tub and the skirt 3 which serves as the tub support, we have provided a resilient mounting for the gear casing for preventing metallic contact between the gear casing and any part of the tub or the skirt. This mounting comprises rings 45 of rubber or other resilient material which are arranged on either side of a flange 46 of a bracket 47 secured to the skirt 3. The parts are held in assembled relation by a bolt 48 extending through the rings 45. A clearance hole 49 in the flange 46 pre-

vents metallic contact between the bolt and the flange. A resilient support of this construction is provided between the skirt 3 and each end of the gear casing. At the left end of the gear casing, the resilient support is located between the gear casing cover 44 and the skirt. At the right end of the gear casing, the resilient support is located between a bracket 49a and the skirt. In order to prevent transmission of noise from the gear casing through the wringer post 22, we have provided a similar resilient mounting between the tub and collar 50 which is adapted to support a wringer. This mounting comprises pads 51 of resilient material which are arranged on either side of the tub and which are held in place by screws 52 threaded through clearance holes in the tub into the collar. A resilient mounting is also provided between the post 7 and the bottom of the tub. This mounting comprises rings 53 of resilient material which are arranged on either side of the tub and which are clamped between a flange 54 on the post 7 and a nut 55 threaded on the post. The rings 53 also serve as a water tight seal.

With this arrangement there is no metal to metal contact between the gear casing and the tub or the skirt 3 and the transmission of noise is prevented by a vibration cushioning connection at each point of connection between the gear casing or its connected parts and the tub or the skirt. The transmission of noise originating in the driving mechanism is therefore considerably decreased and quieter operation of the washing machine is obtained.

The resilient support for the driving mechanism for the washing machine has an additional function of preventing noise due to distortion of the gear casing. If the gear casing were rigidly attached to the skirt 3, any unevenness in the floor would cause distortion of the skirt and this distortion would produce a stress tending to bend the walls of the gear casing. The bending of the walls of the gear casing would change the mesh of the gears 19 and 24 journaled in the casing and would thereby produce an additional source of noise due to interference between the gear teeth. With a resilient mounting for the gear casing, or any equivalent mounting such as a three point suspension of the gear casing, the distortion of the skirt, due to unevenness in the floor, or to rough handling during transit does not stress the gear casing and, therefore, does not change the mesh of the gear teeth. This means that the mesh of the gear teeth is independent of inequalities in the floor and that changes in the adjustment of the mesh of the gears are not required. Also, with this construction for supporting the gear casing, the gear casing may be made less rigid.

If the resilient mounting illustrated were replaced by rigid connections, oscillating torque applied to the agitator shaft 8 would be transmitted through the agitator post 7 and through the wringer post 22 to the tub. Since the tub is made of relatively light metal, these forces would cause bending of the tub, and the reaction from the tub to the skirt 3 would tend to distort the walls of the gear casing. This distortion which would be an additional source of gear noise which is prevented by the resilient mounting of the gear casing.

Since the tub is rigidly secured to the tub support, it is solidly supported and the washing machine may be moved without exerting any force on the resilient mountings.

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

1. In a washing machine, a tub, a tubular post
5 in the tub, a shaft extending through the post
from the bottom of the tub and adapted to be
oscillated, oscillating mechanism for oscillating
the shaft, an agitator connected to and supported
on said shaft through a resilient driving con-
10 nection whereby reversal of the agitator will
occur after reversal of the oscillating mechanism,
and a resilient bearing between the agitator and
the post for guiding the oscillation of the agitator.
2. In a washing machine, a tub, a tubular post

in the tub, a shaft extending through the post
from the bottom of the tub and adapted to be
oscillated, an agitator connected to and sup-
ported on said shaft through a resilient driving
connection whereby reversal of the agitator will
5 occur after reversal of the shaft, said agitator
having a portion depending around said post,
and a rubber bearing between the depending por-
tion of the agitator and the post for guiding the
oscillation of the agitator.

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