Jan. 10, 1939. W. A. FRANTZ ET AL 2,143,730

CLOTHES WASHER

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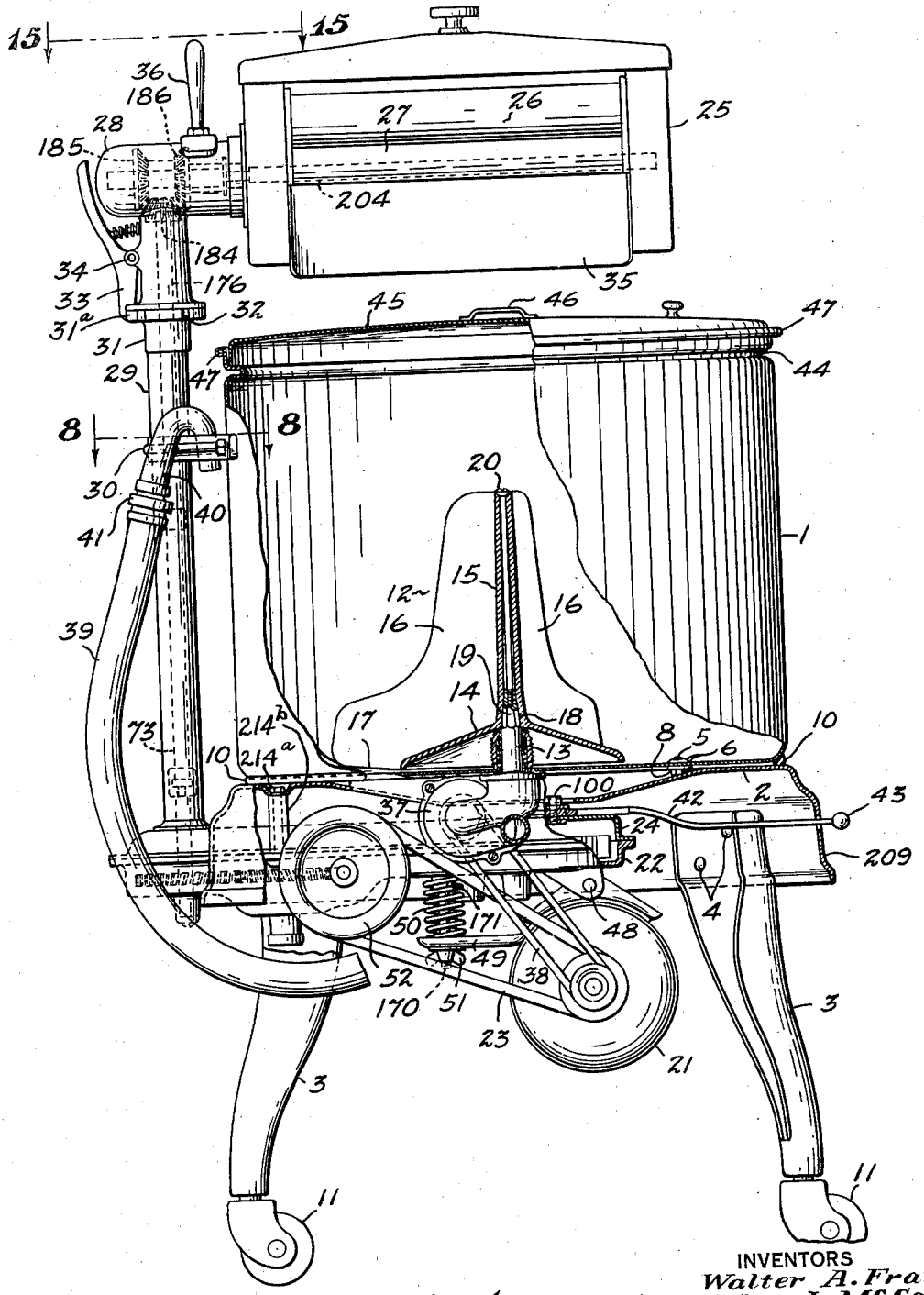

Fig. 1.

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CLOTHES WASHER

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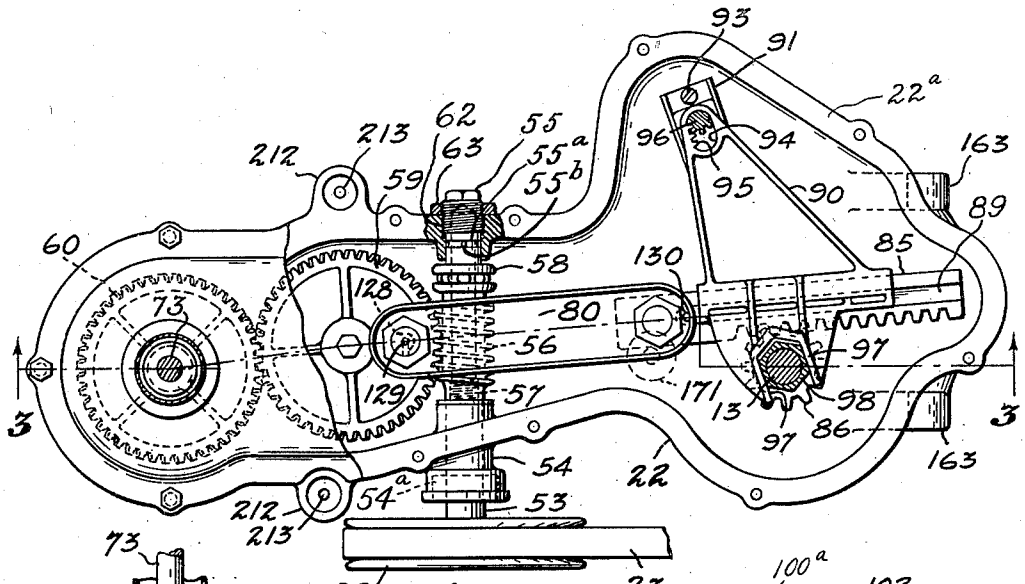

Fig. 2.

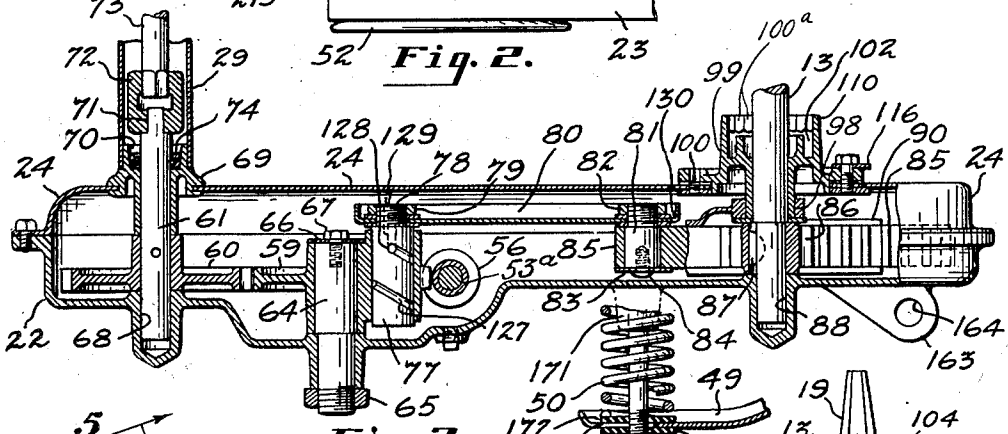

Fig. 3.

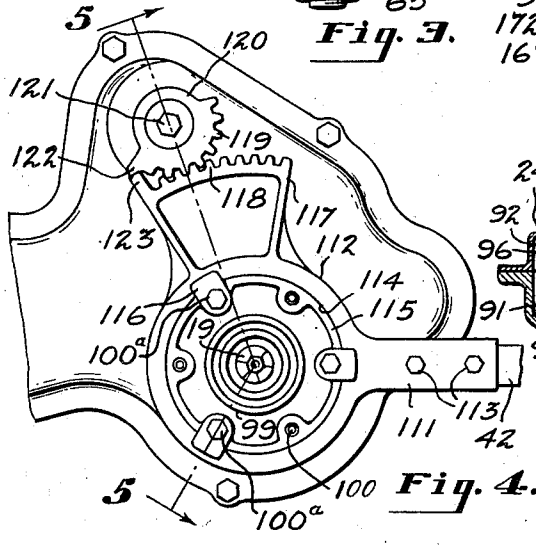

Fig. 4.

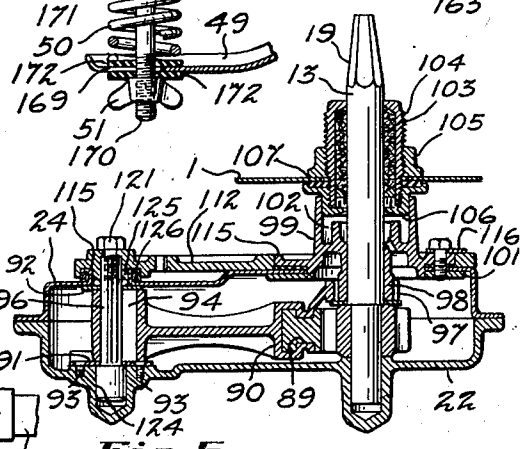

Fig. 5.

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CLOTHES WASHER

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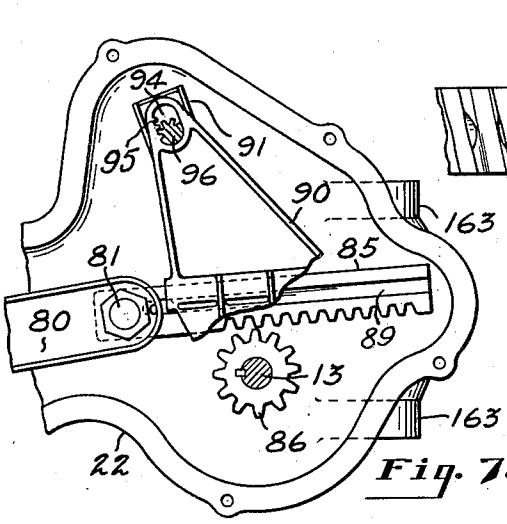

Fig. 7.

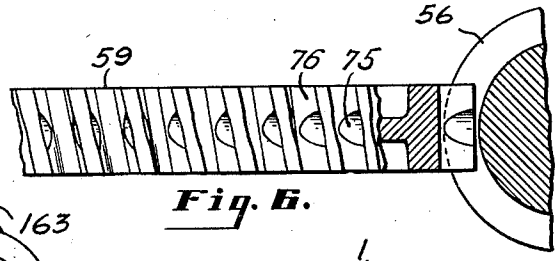

Fig. 6.

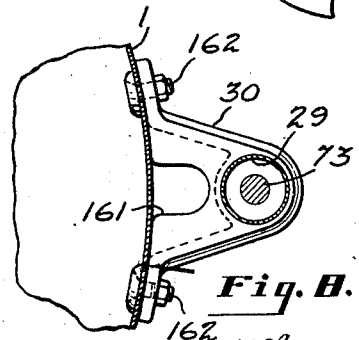

Fig. 8.

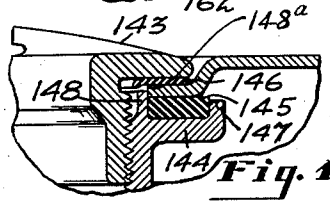

Fig. 11.

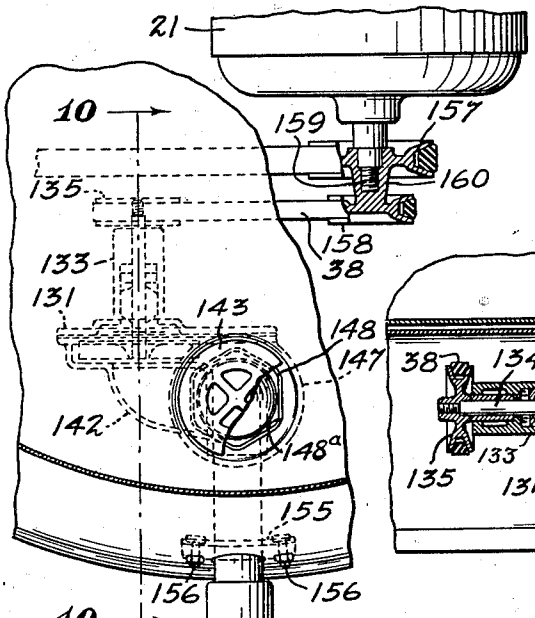

Fig. 9.

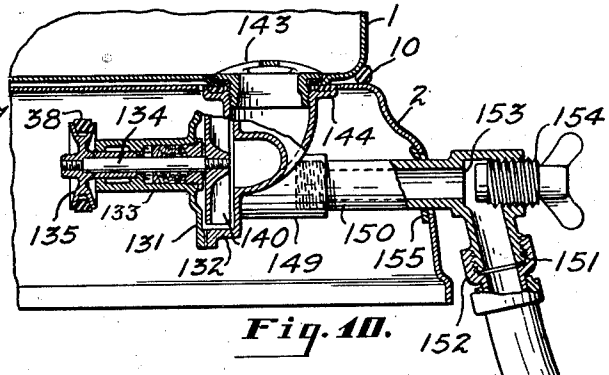

Fig. 10.

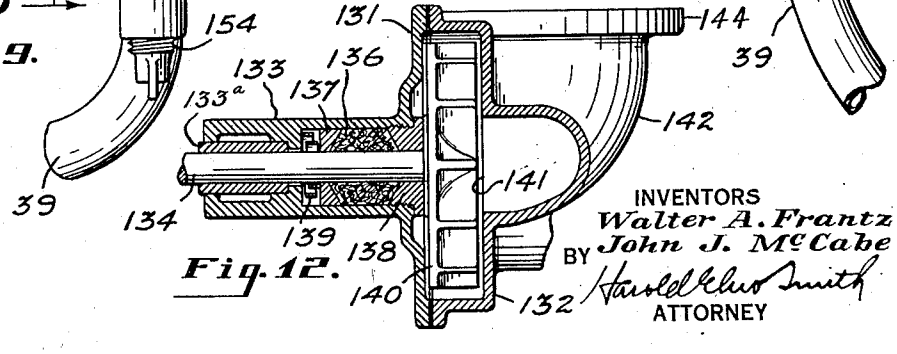

Fig. 12.

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CLOTHES WASHER

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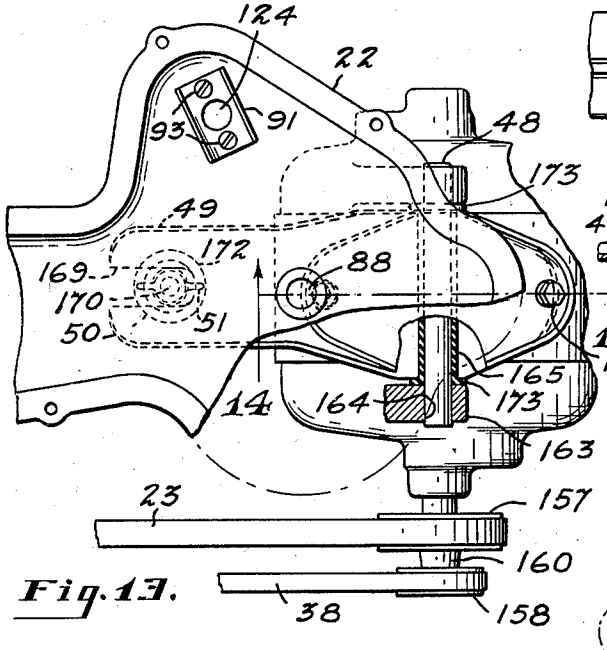

Fig. 13.

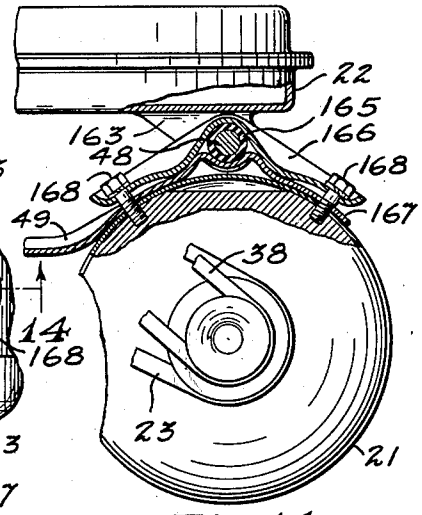

Fig. 14.

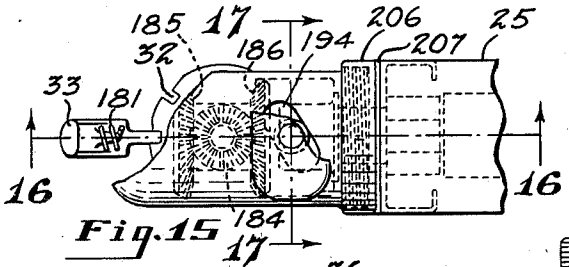

Fig. 15

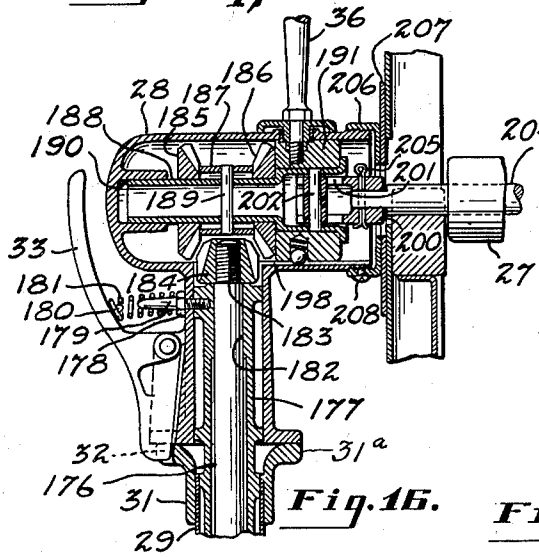

Fig. 16.

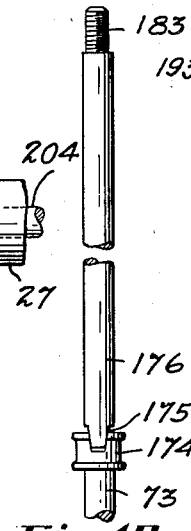

Fig. 18.

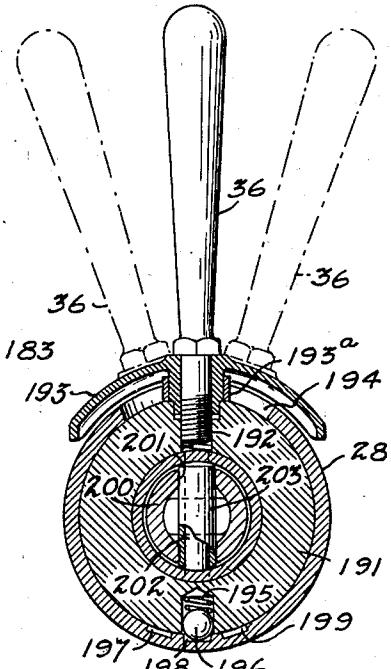

Fig. 17.

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CLOTHES WASHER

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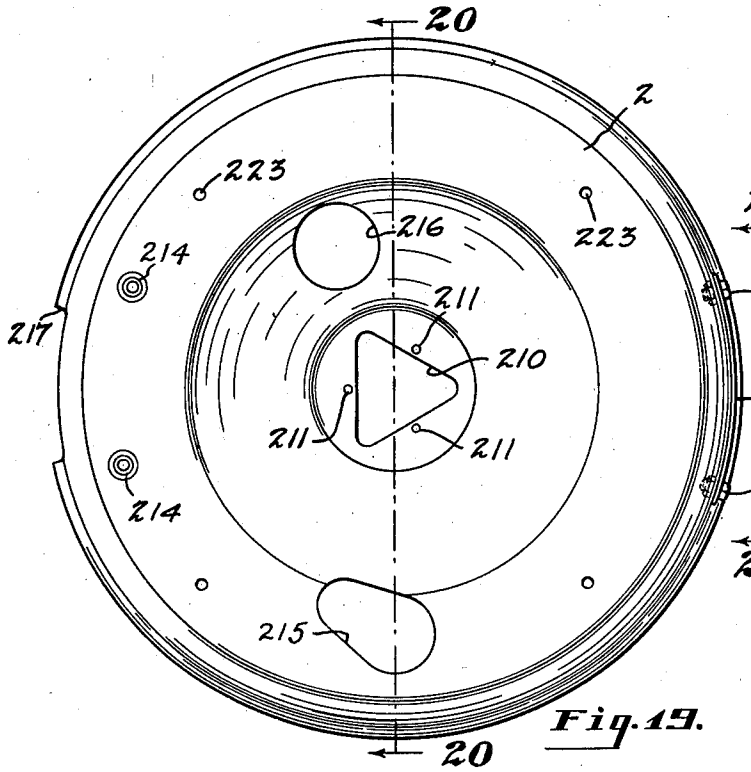

Fig. 19.

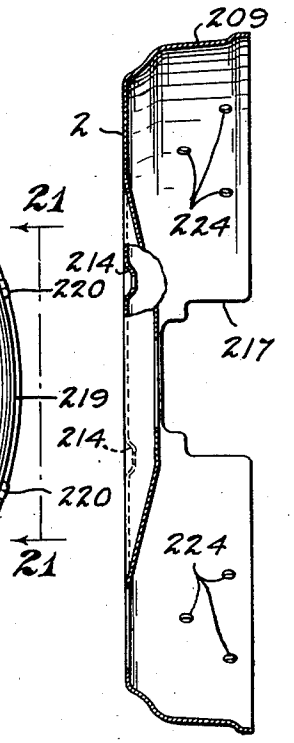

Fig. 20.

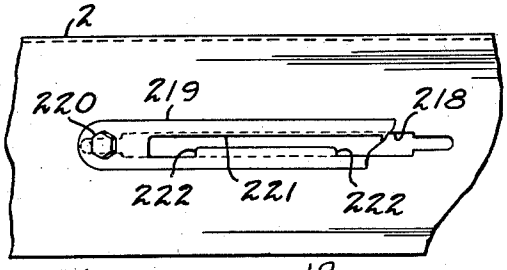

Fig. 21.

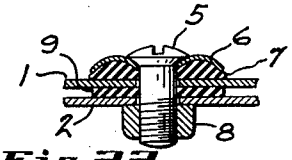

Fig. 22.

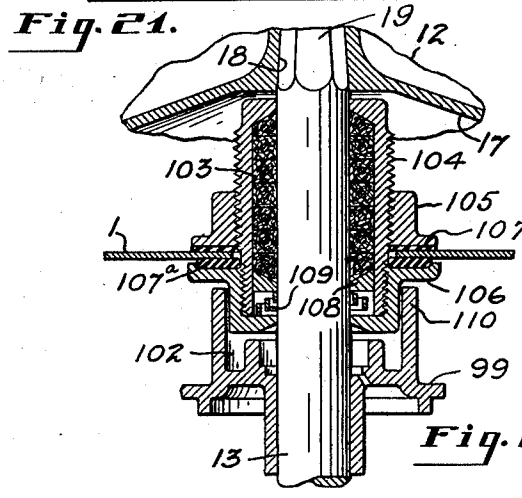

Fig. 24.

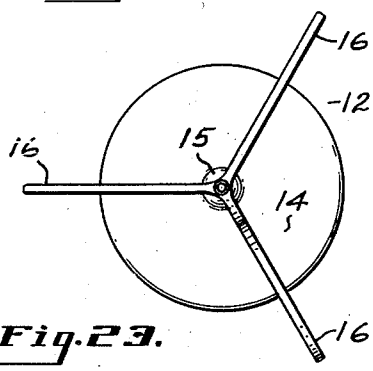

Fig. 23.

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Patented Jan. 10, 1939

2,143,730

UNITED STATES PATENT OFFICE

2,143,730

CLOTHES WASHER

Walter A. Frantz, Shaker Heights, and John J. McCabe, Cleveland, Ohio, assignors to The Apex Electrical Manufacturing Company, Cleveland, Ohio, a corporation of Ohio

Application May 27, 1932, Serial No. 613,999

9 Claims. (Cl. 68—133)

This invention relates to combined clothes washing and drying machines, and in particular machines of the so-called gyrator type in which a vertically oscillatable dasher or agitator is employed to effect the washing operation and a wringer is employed to effect the drying operation.

One of the objects of this invention is to provide in a washing machine of the type disclosed, a generally simplified and improved gearing or operating mechanism.

Another object of this invention is to provide in a washing machine of the type disclosed, an improved form of frame construction.

Another object of this invention is to provide an improved unitary washing machine gear mechanism which can be constructed, assembled and tested as an operative unit, separate from the machine.

Another object of this invention is to provide in a washing machine, an improved form of pump construction for use in quickly and conveniently emptying the contents of the washing machine tub.

Another object of this invention is to provide in a washing machine an improved shaft seal for preventing the escape of water from the tub by way of the agitator shaft which extends through the bottom of the tub, while at the same time permitting the tub to expand and contract under the influence of temperature changes.

Another object of this invention is to provide an improved and simplified gear train for driving both a washing device and a wringing device.

Another object of this invention is to provide in a machine of the type disclosed, an improved wringer operating mechanism.

Another object of this invention is to provide in a gearing of the type disclosed, an efficient and simple lubrication system of the force feed type.

Another object of this invention is to provide in a washing machine of the type disclosed, an improved control mechanism for starting and stopping the operation of the washing device.

Another object of this invention is to provide in a washing machine, an improved and adjustable mounting for the motor which operates the machine.

Another object of this invention is to provide an improved movement translating mechanism for changing rotating to oscillating movement.

Another object of this invention is to provide a resilient, sound-deadening and electrically insulating motor mounting.

Another object of this invention is to provide an improved arrangement for mounting and driving a washing machine pump.

Another object of this invention is to provide an improved and simplified form of washing machine drain valve construction.

Another object is to provide an improved form of gear case construction.

Another object of this invention is to provide an improved washing machine drain hose support.

A further object of this invention relates to the design, construction and arrangement of the operating elements of a washing machine, whereby such elements may be quickly and inexpensively produced and assembled into a finished machine by modern factory production methods.

With these and other objects in view, the invention consists of the novel construction, arrangement and combination of parts, hereinafter described and illustrated in some of its embodiments, in the accompanying drawings and particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a side elevational view, partly in section, of a washing machine disclosing one mode of practicing our invention.

Figure 2 is an enlarged plan view, partly in section, of the washer mechanism gearing, showing the agitator driving rack bar in mesh with its pinion.

Figure 3 is a sectional view of the gearing, taken on line 3—3, Figure 2.

Figure 4 is an enlarged plan view of the upper side of one end of the gear case, illustrating certain details of the mechanism provided for the starting and stopping of the washing machine agitator.

Figure 5 is a sectional view taken on line 5—5 of Figure 4, showing the agitator shaft seal and certain details of agitator driving mechanism.

Figure 6 is a developed view of the worm driven reduction gear of the mechanism.

Figure 7 is an enlarged plan view of the agitator shaft and its gearing, with certain of the parts broken away for convenience of illustration and showing the rack bar disengaged from the agitator shaft pinion.

Figure 8 is an enlarged sectional view taken on line 8—8, Figure 1, showing certain details of the combined wringer column bracket and hose supporting means.

Figure 9 is an enlarged plan view of the pump and its driving mechanism.

Figure 10 is a sectional view taken on line 10—10 Figure 9, showing the general arrangement of the pump, pump valve and pump driving mechanism.

Figure 11 is an enlarged sectional view illustrating certain details of the means used for securing the pump to the tub.

Figure 12 is an enlarged view similar to Figure 10, illustrating certain details of the pump mechanism.

Figure 13 is an enlarged plan view, partly in

section, illustrating certain details of the mounting for the electric motor.

Figure 14 is a sectional view taken on line 14—14, Figure 13.

Figure 15 is an enlarged plan view taken on line 15—15, Figure 1, illustrating certain details of the wringer drive mechanism.

Figure 16 is a sectional view taken on line 16—16, Figure 15.

Figure 17 is an enlarged sectional view taken on line 17—17, Figure 15.

Figure 18 is a side elevational view of the wringer head assembly driving shaft and its coupling.

Figure 19 is a plan view of the supporting base of the machine.

Figure 20 is a sectional view of the base, taken on line 20—20, Figure 19.

Figure 21 is a fragmentary side elevational view of the base, taken on line 21—21, Figure 19.

Figure 22 is an enlarged sectional view showing in detail one of the four bolts and associated washers used for securing the tub to the supporting base.

Figure 23 is a plan view of the agitator or dasher used for effecting the washing operation.

Figure 24 is an enlarged sectional view of the agitator shaft bearing and packing means shown in Figures 1 and 5.

Referring to the complete washing machine illustrated by Figure 1 of the drawings, the numeral 1 indicates a washing container or tub, which is carried on a stamped metal base 2. The base is provided with a plurality of supporting legs 3, secured thereto in any suitable manner such as by the rivets 4. The tub 1, is secured to base 2, by means of four circumferentially spaced screws or bolts 5.

As shown in Figure 22, the head of the screw 5 engages a rust-proof washer 6 of mushroom shape, beneath which there is provided a rubber washer 7, to prevent the leakage of water through the holes in the tub provided for receiving the screws. The screws are held in place by means of the cooperating nuts 8 which engage the underside of the base 2.

A pad or washer 9, of rubber or other suitable material is inserted between the tub and the base at each of the points where the screws or bolts 5 pass through the tub and the base, for the purpose of providing a slightly yielding securement for the tub. This arrangement is particularly desirable when a porcelain enameled tub is used, as is done in the present case. A band 10, formed of rubber or any other suitable material, is provided adjacent the bottom of the tub to give a finished appearance to the machine, and at the same time to prevent the ingress of water and other undesirable materials between the tub and the base at this point. The supporting legs 3 are provided with casters 11, for facilitating the handling of the machine in moving it about from place to place.

The washing operation of the machine is effected by means of a dasher or agitator 12 which extends upwardly from the bottom of the tub and which is supported upon the shaft 13. During the operation of the machine, the shaft 13 imparts a reversely rotating or oscillatory movement to the dasher 12 about its vertical axis.

The dasher or agitator 12 is provided with a conical base plate 14, which merges into a center post 15. Vertical radially arranged agitator vanes 16 extend from the base plate and center post. These vanes are three in number and are equally spaced about the agitator. The vanes extend for some distance beyond the edge of the base plate, and the edge of the vane which faces the tub bottom is upwardly slanted as at 17.

The purpose of extending the vanes beyond the edge of the base plate is twofold. In the first instance, a lesser amount of material is required for making the agitator by reason of using a smaller base plate and secondly, the tendency of the clothes being washed to work under the edge of the base plate is lessened by reason of the vanes projecting therefrom, as the extending portion of the vanes operate to throw the clothes away from the base and to sweep a circular clothes-free path of some width about the marginal edge of the base plate.

The underside of the agitator is provided with a tapered central opening or socket 18, having a plurality of flat sides which engage with the sides of the prismatic end 19, of the agitator shaft 13. The agitator is removably secured in position on the agitator shaft by means of an elongated screw 20.

The machine is driven by means of an electric motor 21. The motor 21 is adjustably and flexibly secured to the base portion 22, of the gear case, which houses the operating mechanism of the machine. The transmission of power between the motor and the mechanism in the gear case is accomplished by means of a V-shaped belt 23. The gear case base 22 is provided with a cover 24 which may be formed from a metal stamping, as is done in the present case.

A suitable wringer 25, having upper and lower rolls 26 and 27 respectively, is provided for the purpose of extracting the water from the clothes after the washing or rinsing operation has been completed. The wringer is carried by and secured to a wringer gear case 28, which is journaled in the wringer column 29, so that the wringer may be swung to various adjusted positions about the axis of the wringer column. The wringer column is secured at its lower end to the gear case cover 24, and at its upper end it is secured to the tub 1 by means of a bracket 30, which is die cast about the tube forming the wringer column.

A second die casting 31 is cast about the upper end of the tube of the wringer column and it is fashioned with a flange or shoulder 31a at its upper end to provide a rest or bearing for the wringer and its associated gear case 28. The flange 31a is provided with a number of notches 32 about its periphery. A locking lever 33, is pivotally secured at 34, to the gear case 28 for engaging the notches 32, to lock the swinging wringer in the position selected.

By means of construction just described the wringer may be swung about its axis and locked in several positions permitting the wringing of the clothes from the washer tub to a rinse tub, or from one rinse tub to another, or vice-versa. The wringer is provided with a combined clothes chute and drain 35, for guiding the clothes from one tub and delivering them to another, and for returning the water extracted from the clothes to the tub from which the clothes were taken.

The control of the wringer is accomplished through the operation of a shiftable control lever 36, by means of which the wringer rolls may be caused to rotate in one direction or the other, or may be maintained stationary at the will of the operator. The mechanism for actuating the wringer will be described in detail in the latter part of this specification.

A water pump 37, driven by the motor 21, through a V-shaped belt 38, is provided for the purpose of facilitating the operation of emptying the liquid contents of the tub. The inlet side of the pump is in communication with the interior of the tub and a drain hose 39 is connected at one end to the outlet side of the pump. The other end of the drain hose is provided with a gooseneck 40, which is secured to the hose by means of a swivel connection 41.

The operation of the agitator or dasher 12, is controlled by means of a lever 42, having a handgrip or knob 43 at its outer end. A combined cover seat and splash ring 44, is rolled in the upper end of the tub to furnish a seat for the tub cover 45 and to prevent the escape of washing fluid from the tub during the time the dasher is working. A handle 46 is provided for the tub cover.

The ring 44 is integrally formed with the tub and it serves to stiffen the tub and prevent distortion of the tub when heated during the enameling operation. The upper edge of the tub is rolled or turned over at 47 to give a smooth and finished appearance to the tub. The rolled edge 47 is better adapted to take a porcelain enamel finish than is a straight edge as the enamel tends to run from a sharp edge and leave it with a very thin coating. The rolled edge also strengthens the tub and prevents distortion in the same manner as does the ring 44.

The electric motor 21 is pivotally secured to the gear case base 22 by means of the shaft 48. The motor mounting includes an extended arm 49, which at its end, remote from the motor, is held between a spring 50 and a wing nut 51. The arm 49 is rigid with the motor and the tension of the belts 23 and 38 may be easily adjusted by simply turning the wing nut 51, which operation serves to swing the motor about its pivotal support.

The spring 50 is so positioned with respect to the arm 49 that it opposes the torque of the motor or the tractive effort of belts and thus provides a resilient and yielding drive for the mechanism. This arrangement tends to relieve the belts of undue strain and at the same time serves to quiet the operation of the machine.

By referring to Figure 2 it will be seen that the gearing of the machine is of simple construction, the essential elements of which comprise but four gears and a rack bar. This gearing or mechanism is driven by the motor 21, through the belt 23, which engages a pulley 52. The pulley 52 is rigidly secured to a worm shaft 53, which extends into the gear case base 22 and is supported therein by the gear case bearing 54 and the adjustable bearing 55. The bearing 54 is provided with a suitable seal 54a to prevent the escape of oil from the gear case at this point.

A worm 56 is closely fitted to the reduced portion 53a of the shaft 53 and it is threaded at one end for driving engagement with the threaded portion 57 of the said shaft. An antifriction thrust bearing 58 is carried on the shaft 53, to take the thrust of the worm 56. The worm engages a worm gear 59, to reduce the speed of the motor to a suitable speed for driving the dasher 12. The worm gear 59 is a hobbed helical gear and it meshes in driving relation with a standard helical gear 60. The gear 60 is fixedly connected to and rotatable with a stub shaft 61.

The worm shaft bearing 55 is externally threaded over a portion of its length and it is adjustably carried in the partially threaded opening 62 of the gear case. A jam-nut 63 serves to hold this bearing in its adjusted position. The end of the bearing 55 abuts against the thrust bearing 58 and thus provides a means for adjusting the worm 56 in an axial direction.

The outer surface of the adjustable worm shaft bearing 55 is unthreaded at the inner portion of its length and this part of the bearing is accurately machined so as to be concentric with the shaft receiving portion of the bearing. The unthreaded portion of the gear case opening 62 is provided for receiving the smoothly finished portion of the bearing. The bore of the opening 62 is in axial alignment with the bearing 54, and thus there is provided a means for piloting and maintaining the bearing 55 in axial alignment with the bearing 54.

The outer surface of the bearing 55 is annularly grooved at 55a and has one or more communicating holes 55b between the said groove and the interior of the bearing. The portion of the crank case which is broken away in Figure 2 to illustrate the details of the bearing, is provided with an oil hole which communicates with the annular groove 55a and thus supplies lubricant to the portion of the worm shaft that is journaled in the bearing 55.

The hobbed helical gear 59 is rotatably mounted on a stub shaft 64, which is fixedly secured to the gear case 23 by means of the lock-nut 65 engaging the lower threaded end of this shaft. The gear 59 is held in position upon its shaft by means of a disc or washer 66. A bolt 67 serves to hold the washer in place. The lower end of the stub shaft 61, provided for the gear 60, is journaled in a suitable bearing 68 formed in the base 22 and at its upper end it is journaled in a bearing member 69, which is die cast in position in a hole formed in the gear case cover 24.

The bearing 69 is provided at its upper end with a collar 70 which fits into the wringer supporting column or tube 29. The upper end of the shaft 61 has a flattened portion 71, which engages in driving relation with a coupling 72. The coupling 72 is fixedly secured to the squared end of a shaft 73 which extends through the wringer column and serves to drive the wringer. The space between the collar 70 and the shaft 61 is filled with a packing ring 74 to prevent the escape of oil from the bearing 69.

The wringer drive gearing constitutes one of the novel features of our invention, in that we have dispensed with one of the gears customarily employed in driving the wringer shaft by driving the wringer shaft gear directly off of the worm gear. This result is accomplished by using two standard helical gears 59 and 60 and by hobbing the central portion 75 of the faces of the teeth 76, of the gear 59, so that it may be efficiently driven by the worm 56.

By this arrangement an efficient drive is provided between a worm, a worm gear and helical gear. The helical gears 59 and 60 are of such width so that the surface of contact between the worm and the hobbed portion of the gear 59 is comparable to that between the worm and a conventional worm gear, while the unhobbed portion of the gear teeth 76 is of sufficient area to efficiently drive the gear 60 without undue wear on the hobbed gear 59.

The worm gear 59 is provided with an eccentrically located vertical bearing for the reception of the pin 77. This pin is formed with a threaded upper end 78, which is arranged to

receive a nut 79, by means of which one end of a channeled stamped metal connecting rod 80 is rigidly secured to the pin 77. A similarly formed pin 81 is secured to the other end of the rod 80 by means of a nut 82. The pin 81 is provided at its lower end with a retaining washer or disc 83, which is held in place by means of a drive screw 84.

The pin 81 is journaled in the end of a rack bar 85, which is provided to drive a pinion 86, fixedly secured to the agitator drive shaft 13 by means of a key 87. The lower end of the agitator drive shaft 13 is journaled in a bearing 88, formed in gear case base 22.

The rack bar 85 is longitudinally channeled at 89 and is received in a guideway of complementary form, provided by the die-cast rack guide 90. The rack guide 90 serves as a means for shifting the rack bar into and out of engagement with the agitator shaft pinion as will be explained presently.

The rack guide 90 is supported at one end between a pair of horizontally arranged plates 91 and 92, which abut against the gear case base 22 and the gear case cover 24 respectively. The lower plate 91 is of channeled construction and it is held in place by means of a pair of drive screws 93.

An oval shaped opening 94 is provided in the end of the rack guide just considered. Vertical rack teeth 95 are provided on one of the side faces of this opening. These rack teeth are engaged by an elongated mutilated pinion gear 96, by means of which the guide 90 is shifted toward and away from the agitator shaft 13 and in this manner the engagement and disengagement of the gear teeth of the rack bar 85 with the gear teeth of the agitator shaft pinion 86 is effected.

The rack guide 90 extends to a point adjacent to the agitator shaft and terminates thereat in a forked end 97, which embraces and slidably engages with the bearing surfaces formed on the downwardly extending portion 98, of the die-cast bearing member 99. By means of the arrangement just described, the rack guide 90 is slidably supported in the gear case, and it provides a relatively rigid guide-way for the rack bar 85, for its various adjusted positions.

The agitator shaft bearing member 99 is bolted to the gear case cover 24, by means of six bolts 100ª three of which are shown in Figure 4. An annular ring 101 is welded or otherwise secured to the under side of the gear case cover about an opening which is provided for reception of the bearing member 99. The annular ring and gear case cover have drilled and tapped holes 100 for receiving the bolts 100ª. The bearing member 99 is provided with an annular cup 102, for catching and retaining the small amount of oil or grease which may escape from either the packing material 103 provided to seal the shaft 13, or from the gear case itself, by way of the agitator shaft bearing.

Should an unusual amount of oil collect in the cup 102, the capillary attraction of the packing 103 will tend to take up some of it, while gravity also acts to return such oil to the gear case. If desired, the cup 102 may be packed with hard grease to better insure the lubrication of the shaft packing and the shaft bearing over an extended period of time and thus at the same time to assist in preventing the escape of water from the tub and oil from the gear case.

The packing material 103, as shown best in Figure 24, is retained in an exteriorly threaded, cup-like die-cast member 104, which is arranged to extend through a central opening provided in the bottom of the tub 1. The member 104 is held in position by means of an upper die-cast lock nut 105 and a lower die-cast lock nut 106, which engage with threads formed on the member 104 and they serve to clamp the tub between their opposite faces. Suitable gaskets 107 and 107ª are used between tub and the nuts 105 and 106 to effect a liquid tight seal at this point.

The packing material 103 is automatically maintained in fluid tight adjustment about the shaft 13, by means of a slidably fitted packing gland 108 and a flat spiral spring 109, which is interposed between the nut 106 and the gland 108.

The lower nut 106 and the inner face of the upwardly extending sleeve or collar 110 of the bearing member 99, are formed with a plurality of complementary flat sides, those of the bearing member being referred to by the numeral 110. The nut 106 is loosely fitted in the sleeve 110 of the bearing member 99. The complementary flat sides of the nut 106 and the sleeve 110, cooperate with each other to prevent the nut from unthreading itself from the cup 105 and they also serve to hold the nut from turning thus facilitating the application or removal of the upper nut 105. The packing means just described, is supported entirely by the tub bottom and is free to move on the shaft which it seals to take care of irregularities in the fitting of the parts of the machine and to permit relative movement between the tub and the operating mechanism.

The shifting of the rack bar 85, into and out of mesh with the pinion 86, is effected by means of the lever 42 and its associated control handle 43. The lever 42 is bolted to an outwardly extending arm 111, of the die-cast quadrant 112, by means of bolts 113. The quadrant 112 is provided with a circular aperture 114 for receiving the annular collar 115 of the bearing member 99.

A plurality of small retainer plates 116 are secured to the bearing member by certain of the retaining bolts 100ª, to retain the quadrant 112 in a rotatable manner on the bearing member 99. A gear sector 117 is integrally formed with the quadrant 112. The gear teeth 118 of the sector, mesh with the gear teeth 119 of a die-cast segmental gear 120. The segmental gear has a toothed socket for receiving the upper end of the rack shifting pinion 96 and it is securely held in place thereon by means of the bolt 121.

The segmental gear 120 is provided with a stop 122, which cooperates with a stop 123 formed on the gear sector 117. These stops are fitted with respect to each other so that the rack bar 85 and pinion 86 are in proper driving relation when the stops are in engagement with each other. In the event of wear taking place between the pinion 86 and the rack bar 85, a small amount of material is filed or otherwise removed from the contacting portions of the stops 122 and 123 to compensate for such wear and thus a very fine adjustment can be obtained between the rack bar and the pinion of the agitator shaft.

The rack bar shifting pinion 96 is provided with an enlarged portion at its lower end which is received in a bearing socket 124, formed in the gear case base 22. An upwardly flanged ring 115 is pressed out of the gear case cover to receive the bearing portion 125 of the segmental gear 120. A packing washer 126 of cork or other suitable material, is engaged between a downwardly extending annular flange of the gear 120 and the ring 115 of the gear case cover to prevent

the escape of oil from the gear case at this point.

Special provision is made for the lubrication of the rack bar, its guideway, the agitator shaft and pinion and the bearing pins 77 and 81. This is accomplished in the following manner: A spiral groove 127 is cut in the face of the pin 77. The groove starts from the bottom of the pin and terminates in a laterally drilled port 128, located a slight distance from the top of the bearing portion of the pin. The port 128 communicates with a centrally drilled hole 129 in the top of the pin. The channeled connecting rod 80 has a hole 130, located adjacent to the pin 81 and above the end of the rack bar 85 for the escape of the oil supplied to the rod.

During the operation of the motor 21, oil from the lowest part of the gear case, into which the pin 77 dips, is forced up the spiral groove 127 to the port 128 and delivered out of the hole 129 to the channel of the rod 80. The oil received in the channeled rod 80, escapes by way of the hole 130, from where it is delivered to the top of the end of the rack bar. From this point the oil flows over the rack bar and effectively lubricates the pin 81, the rack bar 85, the pinion 86 and its shaft 13.

The pump structure, indicated generally by the numeral 37, and best illustrated by Figures 9 to 12, comprises a base plate 131 and a cover plate 132. These pump parts may be formed from die castings so as to reduce the machining operations necessary to manufacture the pump. The base plate 131 is provided with tubular extended portion 133. An oil-less or self lubricating bushing 133a is pressed into this portion of the pump to provide a bearing for the pump shaft 134.

A pulley 135 is threaded to the outer end of the pump shaft 134. The tubular portion 133 of the base plate is hollowed out at its inner end to receive the packing material 136. The packing material 136 is compressed between a packing gland 137, loosely received in one end of the hollowed-out portion of the tubular extension 133 and a gland nut 138, threadably received in the opposite end of such hollowed-out portion. A flat spiral spring 139 is positioned behind the gland 137 and it urges the gland against the packing to automatically maintain it in sealing relation about the pump shaft.

The innermost end of the pump shaft 134 is provided with an impeller fan 140, which is fixedly secured to this shaft. The fan 140 rotates in a snail-shaped housing that is provided by the cover plate casting 132. The central portion of the fan housing has an inlet opening 141, which communicates with a drain opening formed in the bottom of the tub 1, by way of a conduit 142, integrally formed with the cover plate casting 132 of the pump.

The conduit 142 is internally threaded at the end which connects with the drain opening of the tub and it is securely held in place thereat by means of a combined screen and lock nut 143. The threaded end portion of the conduit 142 terminates in an annular flange 144. A pair of gaskets, including a lower gasket 145, resting on the flange 143 and an upper gasket 146 underlying the nut 143, are provided so that when the lock nut 143 is tightened, the pump is clamped in leak-proof manner to the tub.

The flange 144 as shown in Figures 9 and 11, has an upstanding annular bead 147 at its outer edge and an upstanding hexagonal bead 148 at its inner edge. The tub is slightly depressed about its drain opening so as to fit in the space between beads 147 and 148, with the hexagonal marginal edges 148a of the tub opening engaging the outer edge of the hexagonal bead 148. This arrangement locates and rigidly holds the pump in proper alignment and at the same time facilitates the application of the lock nut 143 by preventing the pump conduit 142 from turning when the nut is being tightened.

The conduit 142 and nut 143 cooperate to provide the sole means for supporting and securing the pump to the tub. This arrangement provides a simple and inexpensive method of securing and installing the pump in position on the washer, and it also facilitates changing a pump equipped machine to one without a pump, or vice-versa, by the use of an interchangeable drain valve of the type shown in our copending application Serial No. 614,000 filed concurrently herewith.

The snail shaped chamber of the fan case communicates with a pump outlet conduit 149, which is interiorly threaded for the reception of an L-shaped valve or drain cock 150. An exteriorly threaded outlet portion 151 is provided by the valve to receive the hose coupling 152. A valve seat 153 is formed about the passageway extending through the valve body.

The flow of water through the valve is controlled by means of a threaded valve member 154, which is received in a threaded opening provided in the side of the valve body and which cooperates with the valve seat 153 to control fluid flow therethrough. The valve member 154 is of novel construction in that it is formed from a flexible, yielding material such as rubber so that there is no tendency for the escape of liquid about its threads, as would occur if a metal to metal contact were provided at this point. A supporting plate 155, closely fitted about the body of the valve, is secured to the washing machine base by means of a pair of bolts 156. This plate is provided to rigidly support the exposed end of the valve.

As stated before, the pump is directly driven by the motor which drives the washing machine mechanism. The motor 21 has a pair of pulleys 157 and 158 fixedly carried on the end of its shaft. The larger of these pulleys, namely 157, is provided to drive the washer mechanism belt 23, and the smaller pulley, namely 158, is provided to drive the pump mechanism belt 38. The outer end of the motor shaft is threaded at 159 to receive a threaded hub 160, on which the pulleys 157 and 158 are rigidly carried.

If it is desired to manufacture the machine without the pump, the double motor pulley is replaced by a single pulley (not shown), which screws onto the threaded end 159 of the motor shaft. The drain opening of the tub is then fitted with a standard drain cock (not shown). Such a machine could readily be converted into a pump model machine by simply replacing the drain cock with the pump structure shown and by changing the single motor pulley to the double pulley shown.

These operations could be performed by relatively unskilled workmen. As a further advantage of this construction of washing machine, two distinct types of machines can be built with substantially the same parts. The dealers engaged in selling the machines can operate with smaller stocks by reason of the ease with which the pump can be attached to or removed from the machine, thus dispensing with the need of

carrying a complete stock of both types of machines.

The wringer column supporting die casting 30 is provided with an aperture or slot 161, between the wringer column and the washing machine tub. This slot provides an opening for the reception of the goose neck 40 of the drain hose which is conveniently located for use by the operator of the machine. The die casting 30 is secured to the tub by means of the bolts 162.

The gear case base 22, has a pair of downwardly extending ears 163, providing a pair of aligned openings 164, for the reception of the motor supporting shaft 48. The shaft 48 is surrounded by a rubber sleeve 165. A pair of stamped plates 166 and 167 receive the rubber sleeve 165 in matched channels formed in the opposite plates. The plates are further provided with matched openings for the reception of the bolts 168, by means of which the plates are secured in assembled relation and fastened to the motor frame.

The lower plate 167 is provided with an extending arm 49, which has a slot 169 at its outer end. This slot is provided for the reception of a threaded rod 170, which is surrounded by the spring 50. The rod 170 at its upper end is threaded into a tapped hole formed in the boss 171 of the gear case base and at its lower end it carries the wing nut 51.

A pair of electrically insulating washers 172, separate the spring 50 and nut 51 from the arm 44, so that the motor is electrically insulated from the rest of the machine by such washers and the sleeve 165. As an added precaution to insure the insulation of the motor from the rest of the machine, the sleeve 165 is provided with flanged ends 173, so that the motor cannot slip sideways on the sleeve 165 and thus become grounded.

The wringer clutching and reversing mechanism is an improvement of the mechanism disclosed in Patent Number 1,830,406 issued to J. L. Perkins et al., November 3, 1931, and differs therefrom in several important details as will be pointed out presently.

The wringer gear housing 28 is formed from a single die casting and the mechanism inclosed therein is arranged and constructed so that the operating elements of the wringer may be assembled and installed in this case by way of the necessary shaft openings, through which the driving and the driven shafts of the mechanism extend. This construction eliminates the use of either a cover plate or a sectional case, as are customary forms of construction for this element of a washing machine.

As shown in Figures 1, 16, 17 and 18 the wringer is driven by means of the vertical shaft 73, which is connected in driven relation with the washer mechanism contained within the washer gear case. The shaft 73 is provided at its upper end with a coupling 174, which has a slotted opening for receiving the flattened end 175, of the wringer shaft 176. The shaft 176 is journaled in a bearing member 177 which is in the form of an elongated exteriorly ribbed tube of die cast construction. The tube 177 is of such a size as to freely, yet closely fit the inner diameter of the wringer supporting column tube 29 and it is secured in place in the wringer gear case 28 by means of a bolt 178.

The bolt 178 has an elongated narrow head 179, which cooperates with a cylindrical lug or boss 180, formed on the swing-control handle 33, to provide a stop for such handle. The aforesaid stops provided by the elements 179 and 180 also cooperate to form guiding and holding means for the spring 181, which is used to maintain the control handle 33 in one of the notches 32 of the bearing member 31.

The inside diameter of the major portion of the bearing member 177 is of slightly larger diameter than the shaft 176. The upper end portion of the bore of the bearing member 177 is of such size as to provide a suitable bearing 182 for the upper end of the shaft 176. The purpose of this arrangement is to take care of any slight misalignment that may occur between the shafts 176 and 73. The shaft 176 is threaded at 183 to receive the threaded beveled pinion 184. The beveled pinion is positioned between a pair of similarly formed beveled gears 185 and 186 respectively.

The beveled gears 185 and 186 are secured to each other by means of a sleeve 187 to which the gears are welded. The gears, in turn, are mounted upon a hollow shaft 188 and are secured thereto by means of a pin 189. A bearing 190, is provided in one end of the gear case for the rotatable reception of the shaft 188. The other end of the shaft 188 is journaled in the rotatable bearing block 191.

The bearing block 191 is rotatably supported or journaled in the casing 28 and is axially movable to various adjusted positions by means of a handle 36, which is received in the threaded hole 192 of the bearing block. The handle 36 is utilized to secure a cover plate 193 over the cam slot 194. The portion of the cover plate receiving the handle 36 is fitted with a rotatable annular sleeve or bushing 193a, which engages the sides of the cam slot 194 formed in the top part of the casing 28 and acts as a roller bearing to prevent undue wear on either the cam slot or the cover plate.

The lower portion of the bearing member 191 is provided with a blind hole for receiving in the order named, a spring 195 and a ball 196. The lower portion of the interior face of that part of the housing 28 which is adjacent to the wringer, is provided with three slots 197, 198 and 199. These slots receive the spring pressed ball 196 and serve to maintain operating lever 36 and the bevel gears 185 and 186 in neutral, forward or reverse driving positions respectively.

As viewed in Figure 1, when the handle 36 is pushed away from the operator, the gear 186 is brought into mesh with the pinion 184 and the wringer is driven in a direction to carry clothes away from the tub. With the parts in this position, the ball 196 is in the slot 199 and serves to maintain the gears in mesh. When the handle is in a vertical position the gears are in neutral position and the ball engages the slot 198. The wringer is driven in a reverse direction by moving the handle toward the operator as viewed in Figure 1, whereupon the gear 185 is brought into mesh with the pinion 184 and the ball 196 engages the slot 197 to hold the gears in mesh.

The movement of the bevel gears is transmitted to the wringer rolls by means of a coupling 200, which is slotted at 201 for receiving the pin 202 and its rotatable bearing sleeve 203. The pin 202 is fixedly secured in the hollow shaft 188 and is rotatable therewith. The shaft 204 of the lower wringer roll 27 is flattened at its end for reception in a similarly formed opening provided by the coupling member 200. The coupling member is secured to the roll shaft by means of a cotter pin 205.

An exteriorly threaded cup 206 is welded or otherwise secured to the side member or stile 207 of the wringer frame. The cup 206 is received on the exteriorly threaded end of the wringer gear case 28. A set screw 208 is provided to lock the cup 206 in its proper position. This arrangement illustrates a simple and inexpensive way of detachably securing the wringer to the wringer gear case.

The angle between the axis of the vertical and horizontal portions of the gear case 28 is slightly in excess of 90° so that the sagging due to the weight of the wringer and the necessary clearances between the bearing member 177 and the tube 29 and case 28 are compensated for, and when assembled, the wringer assumes a substantially horizontal position.

The tub supporting frame or base 2, as shown in Figure 19, is formed from a single stamped metal piece with a depending skirt 209 at its marginal edge to give it strength and rigidity. A triangular piece is punched out of the central portion of the base to provide an opening 210 for the accommodation of the bearing member 99 and the three bolts 100a which are used initially to secure the bearing member to the gear case cover 24 and to hold the plates 116 in place. Three bolts (not shown), are used to secure the agitator shaft end of the gear case to the base 2. These bolts extend through the holes 211, which are pierced in the base and are received in threaded holes 100 of the gear case cover.

Adjacent to the opposite end of the gear case, there is provided a pair of ears 212, which extend out beyond the edge of the gear case cover 24. The gear case at these points has threaded holes 213, which line up with the holes which are pierced in the depressed cups 214 of the base when the gear case is in position on the base. The stated holes are provided for receiving suitable bolts 214a for securing the wringer shaft end of the gear case to the base. Accurately fitted spacer tubes 214b surround the bolts 214a and bridge the space between the base 2 and ears 212 of the gear case. The centrally grouped holes 211 of the base and the spaced holes 214 at the edge of the base define three rather widely spaced localities at which the gear case is secured to the base.

The base 2 is pierced with a hole 215 for permitting the connection of the pump to the drain opening of the tub. The hole 216 is provided in the base for adjusting the rack shifting gearing after the gear case has been secured to the base and before the tub has been installed. Four holes 223 are pierced in the top of the base for receiving the tub holding bolts 5. The skirt of the base is pierced at 224 for receiving the rivets 4, which hold the legs 3 in place.

The skirt 209 of the base is cut away at 217 to accommodate the wringer shaft end of the gear case upon which the wringer column 29 is supported. On the side of the base opposite to the cut-away portion 217, a slot 218 is punched out of the skirt to provide a slot for the accommodation of the rack shifting lever 42. By referring to Figure 1 it will be seen that the top part of the base 2 is spaced a slight distance from the tub bottom so as to define a substantially dead air space therewith to prevent excessive heat losses by way of the tub bottom.

A locking plate 219, for the control lever 42, is secured over the slot 218 by means of a pair of bolts 220, which extend through the narrowed end portions of the slot 218. The plate 219, has a slot 221 which registers with the slot 218 of the base. Each end of the slot 221 is notched as at 222, to provide a catch for the lever 42 for the purpose of holding the rack bar and its control elements in either an operative or inoperative position. The lever 42 is slightly sprung in a downward direction for the purpose of maintaining it in either one of the notches 222.

The plate 219 may be laterally adjusted to shift the position of the control lever notches 222 so that the stops 122 and 123 are in contact with each other when the control lever is in its "on" position. This adjustment is of considerable utility when assembling the machine or for effecting the proper relation of the control elements after the pinion and segment stops 122 and 123 have been adjusted to compensate for wear between the rack bar 85 and its pinion 86.

As a means for reducing the manufacturing costs of the machine, the use of stampings and die castings is resorted to wherever possible. Such products can be held very closely to a uniform size, and in addition to a lower piece cost the generous use of stampings and die castings also makes it possible to lower assembly costs on account of the uniformity of the individual pieces which are used to make up the complete machine.

The stamped metal elements used in the construction of this machine comprise the tub 1, the base 2, the legs 3, the gear case cover 24, the motor supporting plates 166 and 167 and a large number of such smaller pieces as are customarily formed from stampings.

The die cast parts of the machine comprise the agitator 12, the wringer gear case 28, the wringer column supporting member 30, and collar 31, the bearing members 69 and 99, the rack bar guide 90, the pump base 131, the pump cover 132, the valve 150, and a number of smaller parts which are of such shape as to be most economically formed from die castings.

The operating unit comprising motor and gear case, is arranged to be assembled and tested as a unit separate from the rest of the machine. After test this unit is secured to the base of the machine in the manner previously described. The three centrally located bolts 100a and the two bolts 214a, securing the spaced ears 212 to the base, provide in effect a substantially three-point suspension for the operating unit.

The surfaces of the ears 212 are ground level with the top of the gear case 22 thus providing a ground surface from which to work is assembling the operating elements of the machine. The other point of contact between the base 2 and the gear case is by way of the die casting 99, which is supported by the stamped cover 24, which in turn rests on the ground surface 22a of the top of the gear case base 22. Most of the machining operations performed on the gear case are made with reference to the ground surface 22a, referred to.

By building the machine from a ground surface as described, and by the use of stampings and die castings, very close limits of tolerance can be maintained with ease, resulting in a uniformity product in which the spacing and alignment of the various operating elements easily can be within the permissible limits of accuracy.

Cracking and chipping of the porcelain enameled tub is greatly reduced, if not entirely prevented, by the use of a floating seal for the agitator shaft. This construction takes care of the slight differences in level between the gear case and tub bottom and at the same time allows the

tub to freely expand and contract under the large temperature changes to which it is subjected.

Furthermore, it is to be understood that the particular forms of apparatus shown and described, and the particular procedure set forth, are presented for purposes of explanation and that various modifications of said apparatus and procedure can be made without departing from our invention as described in the appended claims.

Having thus described our invention, what we claim is:

1. In a laundry machine, the combination of a one-piece sheet metal base member comprising a centrally depressed circular plate having a depending peripheral skirt, a tub carried by and secured at its bottom to the top of the plate of said base member in spaced relation with respect thereto, washing means in said tub, and operating mechanism for said washing means supported from the underside of the plate of said base member.

2. In a laundry machine, the combination of a supporting base, operating mechanism secured to and depending from the underside of said base, said mechanism including an upstanding shaft projecting through said base, said base having a central aperture adapted for the reception of the shaft of said mechanism, and manually movable means for controlling the operation of the shaft of said mechanism including cooperating devices on top of said mechanism for limiting the movement of said control means, said base member having an aperture for permitting access to the cooperating devices of said control means.

3. In a laundry machine, the combination of a base member of unitary construction having a circular top plate with a depending skirt at its outer margin, and an operating mechanism comprising a gear case, gearing in said gear case and adjustable gearing control means therefor located between said gear case and said base member, the skirt of said base member being cut-away for the accommodation of a projecting end of said gear case and said top plate of said base being apertured for permitting access to a portion of said gearing control means.

4. In a laundry machine, in combination, a base member, operating mechanism for said machine, an elongated gear case for said mechanism secured beneath said base member, said gear case being secured to said base member at points adjacent to the center and outer edge thereof, a liquid containing tub supported on the top of said base member with the center thereof free to move slight amounts with respect to said base member, laundering means in said tub having a shaft operatively connected with said mechanism, and sealing means for said shaft, said sealing means being supported entirely by said tub bottom whereby the center of the tub bottom is free to move a slight amount toward or away from said gear case.

5. In a laundry machine, a supporting base, a liquid holding tub carried on said base, bolts traversing the bottom of said tub and base for securing said tub on said base, relatively soft rubber-like members interposed between the heads of said bolts and tub and between said tub bottom and base to prevent leakage about the bolts and to flexibly secure said tub to said base, said tub bottom being otherwise unsecured with respect to said base, laundering means inside said tub, operating means for said laundering means carried by said base beneath said tub having a vertical shaft extending through the bottom of said tub, and sealing means for said shaft at the place where it enters said tub, said sealing means being carried solely by said tub bottom whereby said tub is free to move a slight amount axially of said shaft.

6. In a washing machine, a support having a top wall with an opening therein, a tub carried by said support with its bottom spaced from the top wall of the support and having an opening in line with the opening thereof, a plurality of gaskets around said opening engaging the bottom of the tub at the opposite sides thereof, a gear case suspended from said support and having one end fixedly secured to the support below the opening thereof, an operating shaft extending from said gear case and traversing said tub and support openings, shaft sealing means in said tub resting on the upper of said gaskets and hermetically sealed with respect to the tub bottom, and means interposed between said tub and said support whereby the tub is resiliently mounted on the support without direct contact therewith.

7. In a frame and supporting construction for washing machines, in combination, a metal base of relatively light weight having a flange formed at its outer edge, a porcelain enameled, steel, liquid holding tub carried on said base, said tub having a bottom wall and side walls extending upwardly therefrom, bolts traversing said base and the bottom of said tub for securing the tub to the base, rubber washers interposed between the head of said bolt and tub and between said tub and base to provide a leakproof flexible securement for said tub, and an inverted dished washer bearing upon one of said rubber washers and having a central recess for reception of and engagement by the head of said bolt.

8. A laundry machine comprising, a support, a tub secured on top of said support with the center of the tub bottom free to move slight amounts with respect to said support, laundering means in said tub having a shaft projecting through the bottom of the tub, mechanism operatively connected to said shaft, a gear case for said mechanism secured to said support beneath said tub, and sealing means for said shaft supported entirely by the bottom of said tub whereby the sealing means may move with the tub bottom a slight amount toward or away from said gear case.

9. In a laundry machine, the combination with a support, of a porcelain enameled, steel, liquid holding tub carried on said support, said tub having a bottom wall and side walls extending upwardly therefrom, bolts traversing said support and the bottom of said tub for securing the tub to the support, rubber washers interposed between the head of each of said bolts and the tub bottom and between the tub bottom and support to provide a leakproof flexible securement for said tub, and an inverted dished washer bearing upon one of said rubber washers and having a central recess for reception of and engagement by the head of each of said bolts.

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