Nov. 3, 1936. R. R. MILLER 2,059,264

WASHING MACHINE DRIVE MECHANISM

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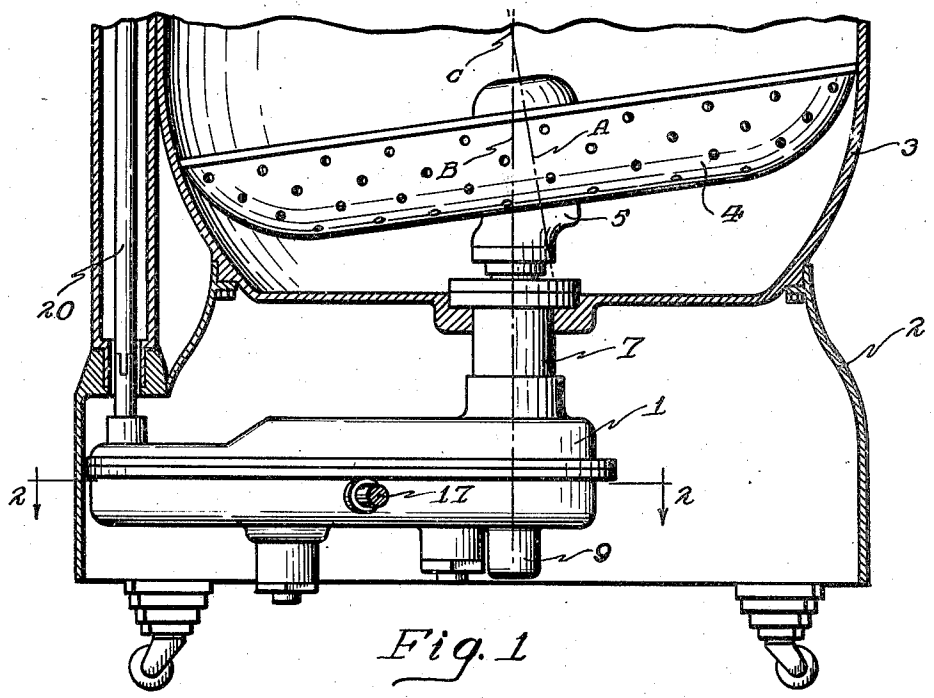


Fig. 1

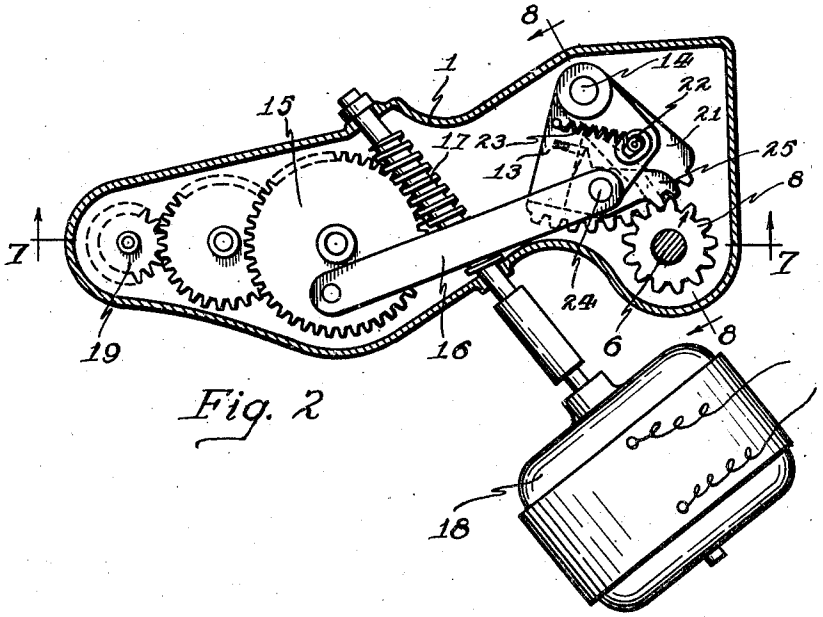


Fig. 2

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Fig. 3

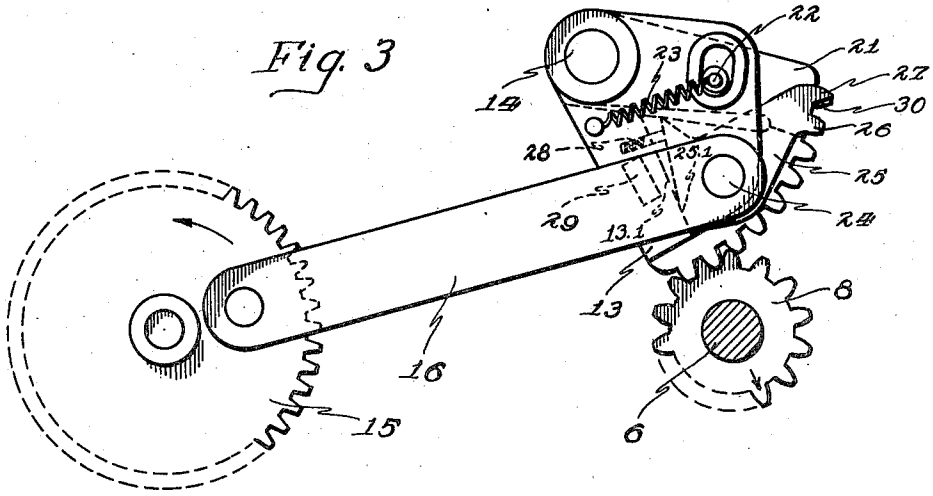


Fig. 4

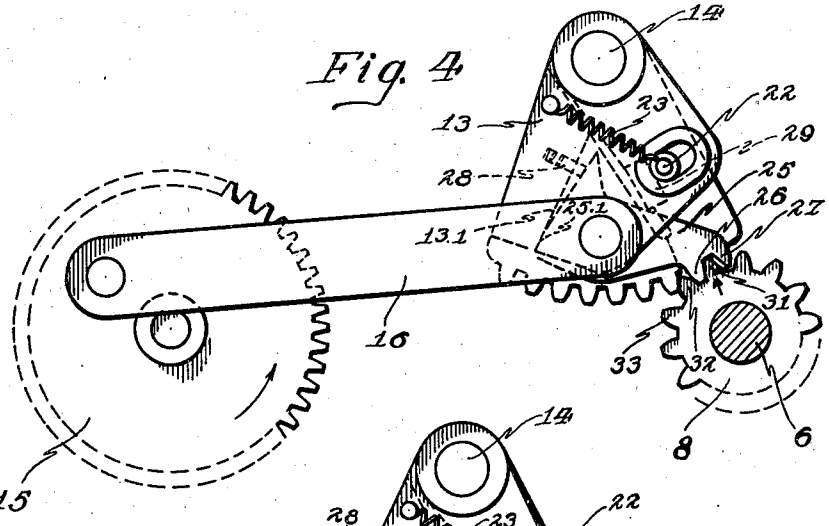
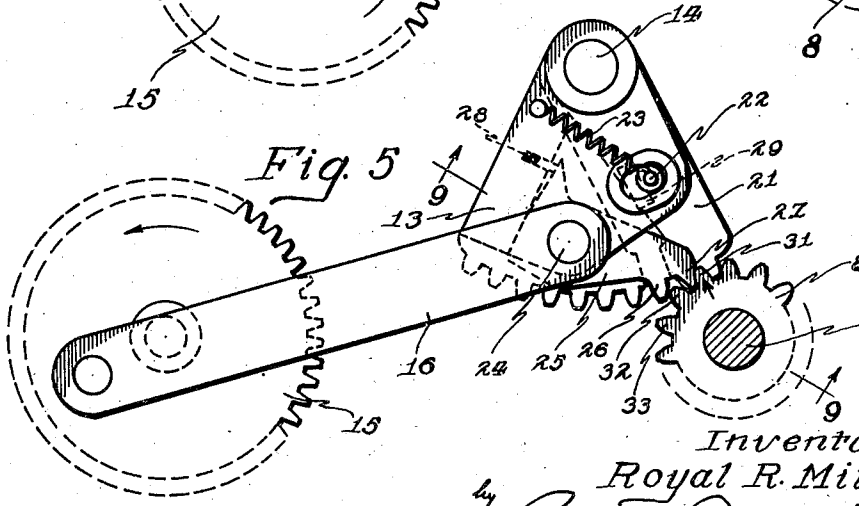


Fig. 5



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Fig. 6

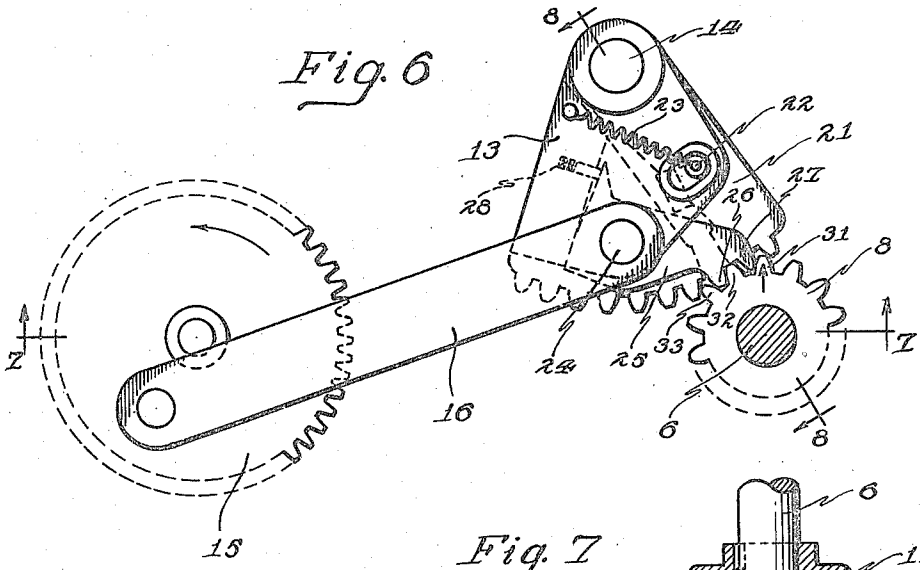


Fig. 7

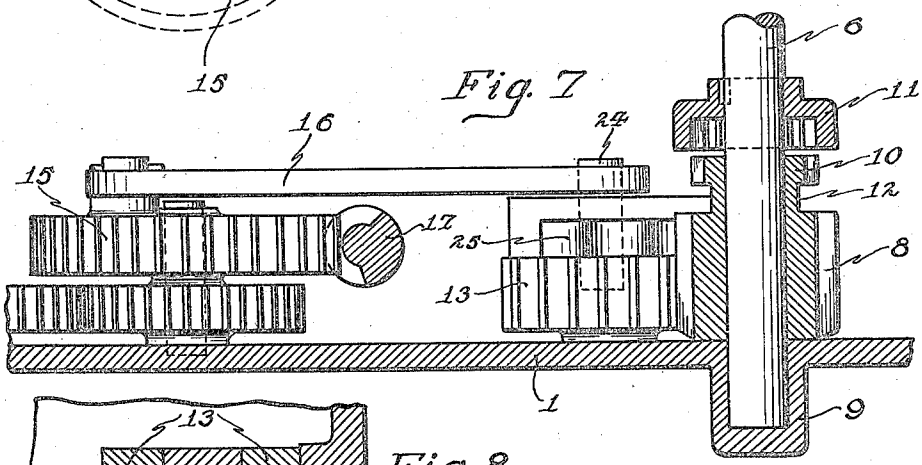


Fig. 8

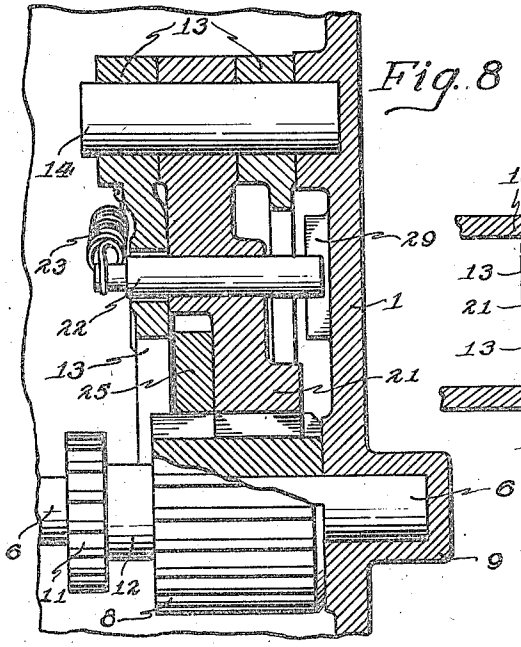
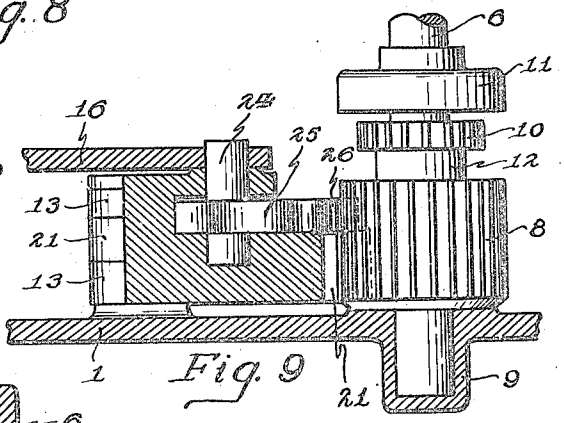


Fig. 9



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UNITED STATES PATENT OFFICE

2,059,264

WASHING MACHINE DRIVE MECHANISM

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Application June 26, 1935, Serial No. 28,484

11 Claims. (Cl. 74—81)

This invention relates to drive mechanisms for oscillating devices and particularly to such mechanisms for washing machines of the oscillating agitator type wherein the agitator is actuated back and forth about a vertical axis.

The main objects of this invention are to provide an improved drive mechanism for an oscillating driven member wherein the driven member is given a greater angular motion in one direction than in the other; to provide an improved drive mechanism arranged to progressively rotate a driven member in one angular direction about a fixed axis while simultaneously oscillating the said driven member within predetermined angular limits about the same axis; to provide an improved oscillating driving gear mechanism arranged to engage a greater number of teeth of a meshed driven pinion when moving in one angular direction than when moving in an opposite direction; and to provide an improved washing machine mechanism by which an agitator is oscillated simultaneously about a horizontal axis and a fixed vertical axis while rotating progressively in one direction about the vertical axis.

A specific embodiment of this invention is shown in the accompanying drawings in which:

Figure 1 is a fragmentary sectional view of a washing machine showing the relationship of the agitator and the driving mechanism as associated in the washing machine.

Fig. 2 is a plan view of the driving mechanism appearing as though its casing were sectioned on line 2—2 of Fig. 1.

Fig. 3 is an enlarged view showing the main driving elements as positioned at the end of their motion in a forward angular direction (to the right) and the beginning of their motion in the opposite direction (to the left).

Fig. 4 is a similar view showing the position of the elements when the pinion has reached the limit of its backward angular motion (to the left).

Fig. 5 is a similar view showing the position of the elements at the beginning of their forward angular motion (to the right) and after the driving gear segment mechanism has been actuated to increase the number of driving teeth thereon.

Fig. 6 is a view similar to Fig. 5 but showing the elements after the pinion has been driven one tooth forward (to the right).

Fig. 7 is an enlarged partly sectional view of the gearing as taken on line 7—7 of Figs. 2 and 6.

Fig. 8 is an enlarged fragmentary sectional view of the gearing as taken on line 8—8 of Figs. 2 and 6, and

Fig. 9 is an enlarged fragmentary sectional view of the same as taken on line 9—9 of Fig. 5.

The improved drive mechanism is shown herein applied to a clothes-washing machine of the type disclosed in my copending application, Serial No. 9,803, filed March 7, 1935, wherein a gyratory oscillating agitator, arranged to gyrate around a fixed vertical axis while simultaneously oscillating relative to a horizontal axis, is provided.

Agitators driven so as to oscillate about a vertical axis are well known. However, an improved and more efficient result is had by imparting a constantly progressive rotary motion about the vertical axis in addition to the simple oscillating motion ordinarily employed, whereby an entirely new water action is developed and a more efficient agitation of the material being washed is achieved.

Such a combination of a constantly progressive rotary motion and simple oscillating motion about a common fixed axis is readily accomplished by the hereindescribed improved drive mechanism. However, when this mechanism is employed to drive the aforementioned gyratory oscillating agitator, the motion of the water held in the washer, and consequently the agitating effect on the material held therein, becomes very complex, due to the fact that the movement of the agitator is not only one of progressive gyration in one direction about the vertical axis, combined with oscillation about the vertical axis and oscillation about a horizontal axis, but is also a wave-like motion due to a constantly progressive rotation and swinging back and forth, about the vertical axis, of the plane in which the agitator oscillates about the horizontal axis.

As shown in the drawings, my improved drive mechanism is housed in a casing 1, suitably mounted in the base of a washing machine 2 which comprises a bowl or tub 3 having mounted therein a dish-shaped agitator 4. The mounting of the agitator 4 is not shown in detail but is fully described in my aforementioned copending application, Serial No. 9,803. As shown the agitator 4 is carried by an arm or crank 5 having a crank pin whose axis, indicated at A in Figure 1, is inclined upwardly toward the axis B of the crank shaft, intersecting the axis B at the point C.

The crank 5 is fixed on the upper end of the crank shaft 6 which extends through the bottom of the washing machine, by way of a journal housing 7, into the gear casing 1 where it is connected with the gear driving mechanism. The agitator 4 is journaled on the crank pin so as to be freely rotatable about the axis A and as will be

readily understood, as the shaft 6 is rotated, the axis A is gyrated around the axis B of the shaft 6 and describes an imaginary conical surface having its apex at the intersection C of the axes A and B.

The bowl or tub 3 is of spherical shape adjacent the agitator 4 and the agitator is so positioned that the intersection C of the axes A and B will be the spherical center of the bowl or tub 3.

As shown in Figs. 2 and 7, the shaft 6 extends into the gear casing or housing 1 through a pinion 8 and into a step bearing 9 projecting downwardly from the bottom of the casing 1. The pinion 8 is freely rotatable on the shaft 6 and is provided at its upper end with a clutching portion 10 adapted to be engaged by a clutch 11 which is keyed or otherwise fixed to the shaft 6. The pinion 8, being freely mounted on the shaft 6, is also vertically shiftable and any suitable shifting means, not shown, may be employed to engage the pinion, in the annular groove 12 located just below the clutch portion 10, and shift the pinion upwardly so as to bring the clutch portion 10 into engagement with the clutch 11, thus connecting the shaft 6 with the pinion 8 and the driving mechanism.

In the form of driving mechanism shown in the drawings, the pinion 8 is engaged by a segment gear 13 which is arranged to be oscillated back and forth by a crank arm to drive the pinion first in one direction and then in the opposite direction. As shown, the segment gear 13 is pivotally mounted on a stub shaft 14 and is connected to a crank wheel 15 by means of a crank arm 16 whereby, upon rotation of the crank wheel 15, the segment gear is caused to oscillate back and forth on the stub shaft 14 and thus oscillate the pinion 8.

The crank wheel 15 is rotated by means of a worm gear 17 which is driven by any suitable means, such as an electric motor 18. As shown in Figs. 2 and 7 the crank wheel 15 is also arranged to drive, through a chain of gears, a pinion 19 which is connected by suitable shafting 20, Fig. 1, to drive a wringer, not shown, preferably mounted at the top of the machine.

As shown, the segment gear 13 is split radially so as to provide a shiftable gear portion 21 which is in the nature of a second gear segment, positioned along side the main segment 13 so that when the two segments are in contact with each other the gear teeth continue uniformly from one to the other.

The shiftable segment 21 is also pivoted on the stub shaft 14, as shown in Figs. 2 and 8, and is positioned in a cored-out portion of the body of the segment 13 with its toothed portion overhanging the lower margin of the segment 13 so as to be of the same width as the toothed portion thereof, as shown in Fig. 8.

As shown the segment 21 is provided with a pin 22 which extends beyond each face of the segment 21 and through suitable openings in both the upper and lower surfaces of the main gear segment 13. A spring 23 having one end fastened to the pin 22 and the other end fastened to the body of the main gear segment 13 is provided to normally hold the shiftable segment 21 in contact with the main gear segment 13, so that the gear teeth on the combined segments will be continuous.

As shown in Figs. 2 and 9 the crank arm 16 is attached to the gear segment 13 by crank pin 24 and pivotally mounted on this same crank pin 24 is a shiftable dog 25 also housed in the cored-out portion of the body of the gear segment 13. As shown, the dog 25 is provided with two teeth 26 and 27 and is so arranged that when the dog 25 is in its normal position, to which it is urged by a spring plunger 28, the teeth 26 and 27 will be exactly alined vertically with the teeth of the gear segment 21, as shown in Figs. 3 and 4. As shown the dog 25 is so shaped that the teeth 26 and 27 cannot be projected beyond the teeth of the gear segments 13 and 21 because of engagement of a shoulder 25.1 on the dog with a wall 13.1 of the cored-out portion of the body of the gear segment 13.

In the form shown, the segment 21 is provided with two teeth and the dog 25 is so proportioned that the teeth 26 and 27 thereof will register exactly with the teeth of the segment 21. Thus were the two gear segments 13 and 21 held together throughout the entire stroke of the crank arm 16, the two gear segments and the dog would mesh exactly with the teeth of the pinion 8 without interference or interruption.

Means are provided, however, so that on the return stroke of the crank arm 16, to the left in the drawings, as driven by the crank wheel 15, the segment 21 is stopped just before the crank arm 16 reaches the end of its return stroke, as shown in Fig. 4, allowing the main segment 13 to be pulled away from the segment 21, as shown in Fig. 5. This means is a lug or stop member 29 projecting upwardly from the bottom of the case 1 so as to engage a downwardly extending portion of the pin 22, as shown in Fig. 8. Upon engagement of the pin 22 with the lug or stop member 29 and the stopping of movement of the gear segment 21, the pinion 8 is also stopped, due to engagement of a tooth 31 thereof between the two teeth of the gear segment 21.

As the crank arm 16 approaches the end of its backward stroke causing the gear segment 13 to separate from the segment 21, the dog 25, because of its pivotal mounting on the crank pin 24, rides or cams over the pinion tooth 31 engaged and locked between the two teeth of the segment 21, the dog being forced inwardly relative to the teeth of the gear segments against the action of the spring actuated plunger 28. In order to permit the tooth 27 to ride smoothly over the locked tooth 31 of the pinion 8 a portion of the inner face of the tooth 27 is cut away, as at 30, to provide a better camming surface. Preferably a sufficient amount of the tooth 27 is cut away so that when the crank arm 16 has reached the end of its stroke and the tooth 27 drops into position behind the pinion tooth 31 held between the two teeth of the gear segment 21, the tooth 27 will not slap against the pinion tooth 32.

The crank wheel 15 and the crank arm 16 are so arranged that when the arm 16 has been pulled to the end of its backward stroke, the gear segments 13 and 21 will be separated by an amount equivalent to the pitch of the teeth on the gear segments; thus when the tooth 27 has passed over pinion tooth 31 engaged by the segment 21, the tooth 26 will be so positioned as to be exactly alined with, or centered above, the space between the first tooth of the gear segment 13 and the last tooth of the segment 21. Thus, upon the beginning of the forward stroke of the crank arm 16, the outer face of the tooth 27 will engage the tooth 31 on the pinion 8, as shown in Fig. 5, causing the pinion to begin to rotate in a forward direction, to the right) and bringing the next successive pinion tooth 32 into position to be engaged by the tooth 26 of the dog 25, which acts on the

tooth 32 of the pinion to continue the forward movement thereof and cause the pinion tooth 33 to be picked up by the leading tooth of the gear segment 13; thus permitting a continuous driving rotation of the pinion 8 as the crank arm continues its forward stroke. As the teeth of the gear segment 13 come into engagement with the pinion 8, the gear segment 21 becomes released therefrom so that it may be pulled back into its normal position against the segment 13 by the action of the spring 23.

Thus if the gear segment 13 is provided with seven teeth, as shown, and the segment 21 is provided with two teeth, and the gear segments are separated by an amount equivalent to the pitch of the segment gear teeth during one complete stroke in a backward direction, the dog 25 will serve to fill in that space and the gear segment will in effect be lengthened by one tooth causing the pinion 8 to rotate a distance equivalent to eight teeth during its forward movement. The closing together of the gear segments 13 and 21 for the return or backward stroke eliminates the extra tooth and the pinion 8 will rotate through an angular distance backward of only seven teeth.

In this manner the pinion will rotate eight teeth forward and seven teeth backward during each cycle of the crank arm 16 and progress in a forward direction a distance of one tooth during each crank arm cycle. Thus, if there are sixteen teeth on the pinion 8, the pinion will make one complete forward revolution for each sixteen oscillations or cycles of the crank arm 16.

Such operation of the mechanism and rotation of the shaft 6 will cause the crank 5 and the agitator 4 to oscillate back and forth horizontally about the axis B of the shaft 6 and at the same time gyrate progressively in one direction about the axis B, making one gyration while making sixteen oscillations.

At the same time and because of the agitator being rotatably mounted on the inclined axis A, the agitator will tend to oscillate vertically about the point C, as described in my aforementioned application, Serial Number 9,803; thus providing simultaneous vertical and horizontal oscillation of the agitator while the same is being gyrated about a vertical axis.

The main advantages of my improved drive mechanism as associated with a washing machine are had in the improved agitation of the water and the material being washed so that the material not only tends to move continuously from the side to the center of the washing machine bowl and then back to the side while being shifted back and forth about the vertical axis of the machine, but also is positively and continuously carried around the said vertical axis in one direction. Such motion assures a positive turning over of each piece of material in the washer while at the same time obviating any possibility of the material becoming bunched, tangled or knotted even though the pieces are long and stringy, or thin and flimsy. Also the agitation is such that the thinnest or lightest of materials will not be torn or strained during the washing operation.

Although but one specific embodiment of this invention is herein shown and described, it is to be understood that details as set forth may be altered or omitted without departing from the spirit of the invention as defined by the following claims:

I claim:

1. A drive mechanism comprising a driven shaft, a pinion on said driven shaft, a driving member having a toothed surface in engagement with said pinion, means to shift said driving member back and forth in a fixed plane to cause said pinion to oscillate on its axis, and means arranged to cause a greater length of toothed surface on said driving member to engage said pinion during a movement of said driving member in one direction than during a movement of the same in the opposite direction.

2. A drive mechanism comprising a driven shaft, a pinion on said driven shaft, a driving member having a toothed surface in engagement with said pinion, means to shift said driving member back and forth in a fixed plane to cause said pinion to rotatably oscillate on its axis, said driving member being arranged to disengage from said pinion before reaching the end of its movement in one direction, and means arranged to cause driving engagement between said driving member and said pinion as said driving member begins its movement in the opposite direction.

3. A drive mechanism comprising a driven shaft, a pinion on said driven shaft, a driving member having a toothed surface in engagement with said pinion, means to shift said driving member back and forth to cause said pinion to rotatably oscillate on its axis, said driving member being arranged to disengage from said pinion before reaching the end of its movement in one direction, means to stop rotation of said pinion as said driving member disengages therefrom, and means arranged to cause driving engagement between said driving member and said pinion as said driving member begins its movement in the opposite direction.

4. A drive mechanism comprising a driven shaft, a pinion on said driven shaft, a driving member having a toothed surface in engagement with said pinion, means to shift said driving member back and forth to cause said pinion to rotatably oscillate on its axis, said driving member being arranged to disengage from said pinion before reaching the end of its movement in one direction, means to stop rotation of said pinion as said driving member disengages therefrom, and a shiftable toothed dog carried by said driving member and arranged to engage said pinion as said driving member disengages therefrom, said dog being arranged to provide driving engagement between said driving member and said pinion as said driving member begins its movement in the opposite direction.

5. A drive mechanism comprising a driven pinion, a driving member having a toothed surface in engagement with said pinion, and means to shift said driving member back and forth to cause said pinion to rotatably oscillate on its axis, said driving member comprising two sections each having a toothed surface successively engageable with said pinion and one of which is positively connected with said shifting means, the other of said sections being shiftable away from the first section and being arranged to engage said pinion before the first section reaches the end of its stroke, means to stop rotation of said pinion as said other section becomes engaged therewith and permit separation of said sections, and means arranged to provide driving engagement between said driving member and said pinion in the space between said sections and upon separation of the same.

6. A drive mechanism comprising a driven pinion, a driving member having a toothed surface in engagement with said pinion, and means to

shift said driving member back and forth to cause said pinion to rotatably oscillate on its axis, said driving member comprising two sections each having a toothed surface successively engageable with said pinion and one of which is positively connected with said shifting means, said sections being arranged with their toothed surfaces in substantially the same plane, the other of said sections being shiftable away from the first section and being arranged to engage said pinion before the first section reaches the end of its stroke, means to stop rotation of said pinion as said other section becomes engaged therewith and permit separation of said sections, and means arranged to provide driving engagement between said driving member and said pinion in the space between said sections and upon separation of the same.

7. A drive mechanism comprising a driven pinion, a driving member having toothed engagement with said pinion, and means to shift said driving member back and forth to cause said pinion to rotatably oscillate on its axis, said driving member comprising two gear segments rotatably mounted on a common pivot and arranged to successively engage said pinion, one of said segments being positively connected with said shifting means, the other of said segments being angularly shiftable away from the first segment and being arranged to engage said pinion before the first segment reaches the end of its shifting movement in one direction, means to stop rotation of said pinion as said other segment becomes engaged therewith and permit angular separation of said segments, and means arranged to provide driving engagement between said driving member and said pinion in the space formed between said segments upon angular separation of the same when said driving member begins its shifting movement in the opposite direction.

8. A drive mechanism comprising a driven pinion, a pivotally mounted segment gear arranged to engage said pinion, driving means connected with said segment gear to oscillate the same on its pivot and cause said pinion to rotatably oscillate on its axis, said segment gear being divided radially into two sections, the first of which is connected with said driving means and the second of which is shiftable angularly away from the first, said second section being arranged to engage said pinion before the first section reaches the end of its movement in one direction, means arranged to engage said second section and stop the same when it becomes engaged with said pinion to permit angular separation of said sections, and means arranged to provide driving engagement between said segment gear and said pinion in the space formed between said sections upon angular separation of the same when said first section begins its movement in the opposite direction.

9. A drive mechanism comprising a driven pinion, a pivotally mounted segment gear arranged to engage said pinion, driving means connected with said segment gear to oscillate the same on its pivot and cause said pinion to rotatably oscillate on its axis, said segment gear being divided radially into two sections the first of which is connected with said driving means and the second of which is shiftable angularly away from the first, said second section being arranged to engage said pinion before the first section reaches the end of its movement in one direction, means arranged to engage said second section and stop the same when it becomes engaged with said pinion to permit angular separation of said sections, and a dog mounted on said first section and arranged to drivingly engage said pinion in the space formed by the separation of said sections when said first section begins its movement in the opposite direction.

10. A drive mechanism comprising a driven pinion, a pivotally mounted segment gear arranged to engage said pinion, driving means connected with said segment gear to oscillate the same on its pivot and cause said pinion to rotatably oscillate on its axis, said segment gear being divided radially into two sections the first of which is connected with said driving means and the second of which is shiftable angularly away from the first, said second section being arranged to engage said pinion before the first section reaches the end of its movement in one direction, a shiftable dog mounted parallelly on said first section and having gear teeth arranged to normally register with the teeth of said second section, spring means normally urging said dog to a position wherein its teeth are alined with the teeth of said second section, and means arranged to stop movement of said second section when it becomes engaged with said pinion and cause angular separation of said sections as said first section continues its movement in said one direction, said dog being arranged to cam over the teeth of said pinion upon separation of said sections and drivingly engage said pinion when said first section begins its movement in the opposite direction.

11. A drive mechanism comprising a driven pinion, a pivotally mounted segment gear engaged with said pinion, said segment gear being split radially into two side-by-side sections one of which is larger than the other, means normally holding said sections together whereby the tooth surface thereof continues uniformly from one to the other, a shiftable dog mounted on one face of the larger of said sections and extending over the face of the other section, said dog having gear teeth arranged to engage said pinion, means normally urging said dog into position to engage said pinion, a reciprocating driving means connected to the larger of said sections to oscillate said segment gear on its pivot and cause said pinion to rotatably oscillate on its axis, said driving means being arranged to bring the smaller of said sections into engagement with said pinion before reaching the end of its stroke in one direction, and means stopping movement of said smaller section when it is engaged with said pinion whereby said sections become separated angularly, said dog being arranged to cam over the teeth of said pinion during separation of said sections and provide driving engagement between said segment gear and said pinion in the space formed between said sections whereby the number of gear teeth driving said pinion is increased during movement of said segment gear in the opposite direction.

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