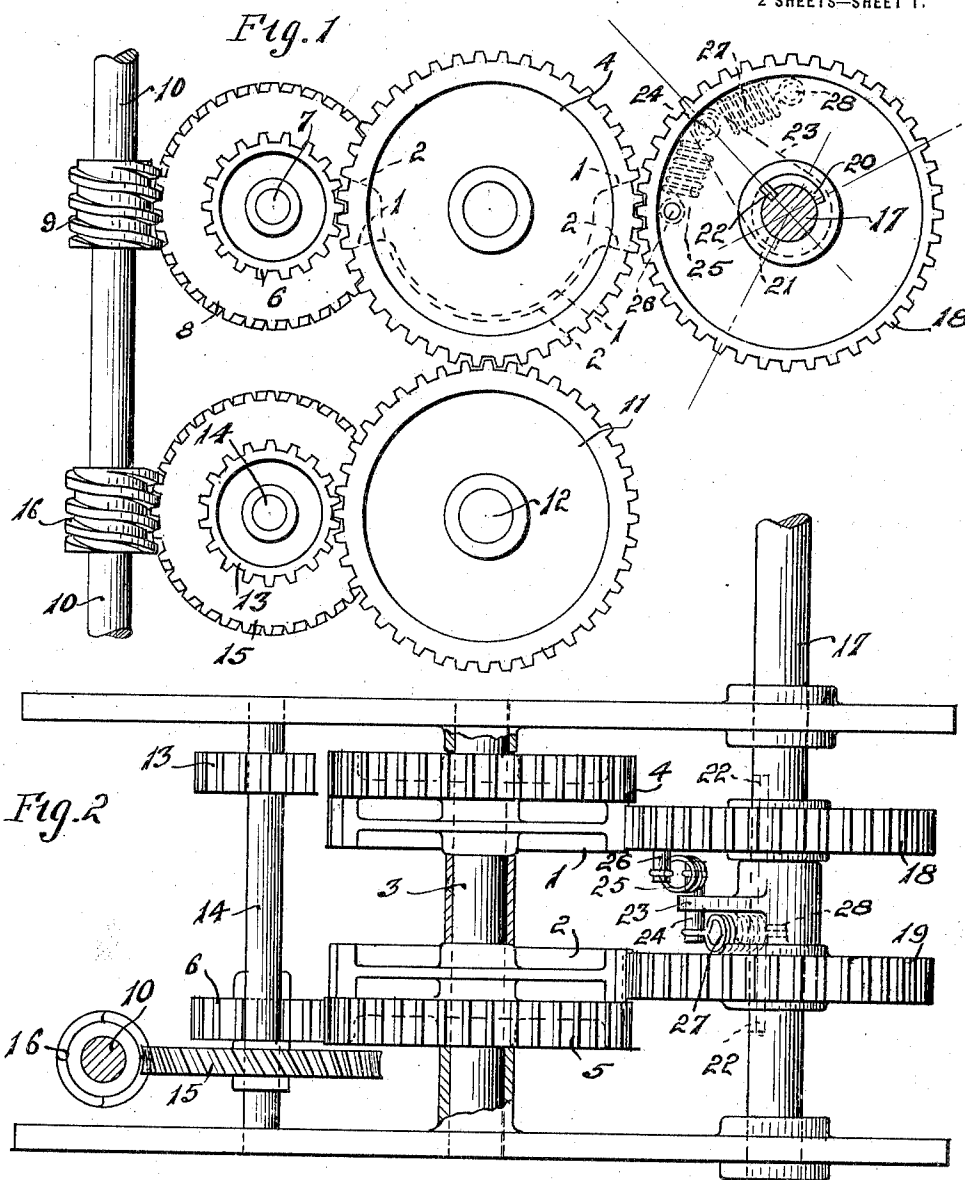


1,321,902.

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MECHANICAL MOVEMENT.
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Patented Nov. 18, 1919.
2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

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Fig. 3

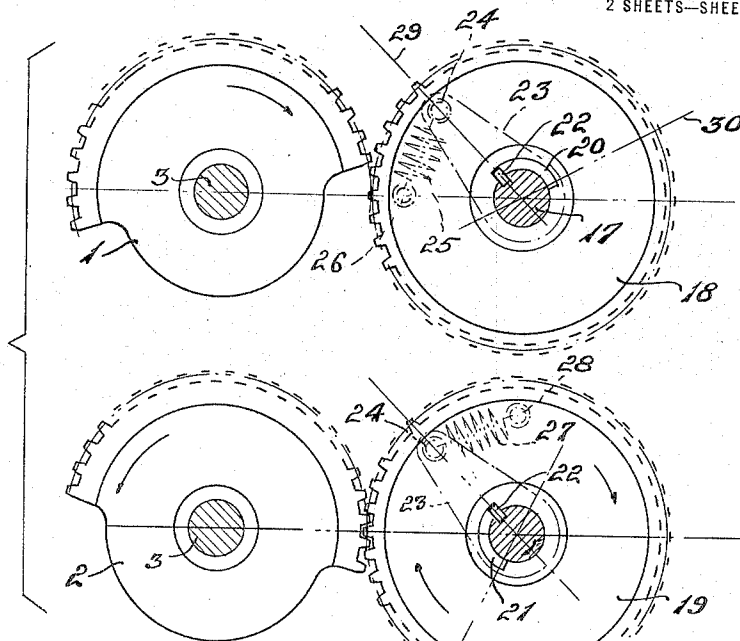


Fig. 4

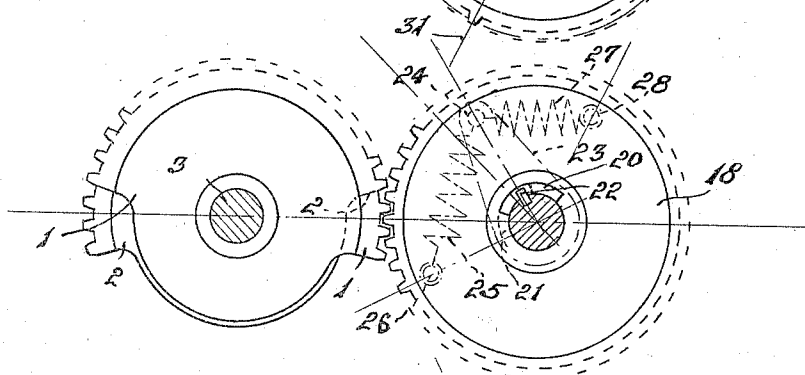
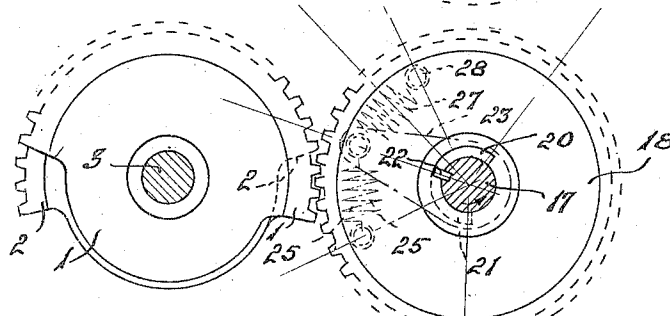


Fig. 5



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MECHANICAL MOVEMENT.

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To all whom it may concern:

Be it known that I, BERNARD P. ELKER, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Mechanical Movements, of which the following is a specification.

This invention relates to mechanical movements and more particularly to a shaft reversing mechanism particularly adapted for use with a washing machine having a tub or cylinder adapted to be rocked or rotated in one direction and then reversed to be rocked or rotated in the opposite direction, but which apparatus may be adapted to a great diversity of arts aside from the washing machine art. The device has for its principal objects; the provision of a reversing mechanism that reverses the shaft carrying the load with a minimum of shock to the driving medium and the motor; the provision of a gear driven reversing mechanism wherein the driving gears moving in opposite directions are meshed with the gears of the load shaft before the reversing action takes place, whereby the gears are not liable to be stripped owing to insufficient engagement of the teeth at the time the shaft is reversed; the provision of a reversing mechanism wherein proper meshing of interrupted gears is insured at all times whether the motor be stopped or running; the provision of a reversing mechanism that yieldingly slows up the load before its reversal, and such other objects as may hereinafter appear. One embodiment of the invention is illustrated in the accompanying drawing, wherein—

Figure 1 is a plan view of the form of reversing mechanism best adapted to illustrate the principle of the device; Fig. 2 is a side elevation of the mechanism with one of the gears removed; Fig. 3 is a diagrammatic showing of the relative position of the reversing elements placed side by side for clearness; and Figs. 4 and 5 are diagrammatic showings of the same elements superimposed, showing the relative position of parts at different stages of the operation.

Referring to the drawings, the mechanism comprises a pair of interrupted gears 1 and 2 mounted for rotation upon an auxiliary shaft 3, and are adapted to be driven continuously in opposite directions of rotation by means of spur gears 4 and 5, respectively.

These spur gears 4 and 5 may be cast integral with the interrupted gears or they may be secured thereto in any preferred manner. The spur gear 5 is driven by a pinion 6 which is keyed to a shaft 7 carrying at its lower end a worm wheel 8 adapted to mesh with a worm 9 secured to the shaft 10 which is adapted to be driven by any suitable motor. The spur gear 4 is rotated in the opposite direction to that of the spur gear 5 through the medium of a gear 11 mounted for rotation upon a shaft 12 (Fig. 1). The gear 11 is driven by a pinion 13 keyed to a shaft 14 carrying at its lower end a worm wheel 15 meshing with a worm 16 also keyed to the motor shaft 10.

The worms 9 and 16 have the same direction of pitch and therefore rotation of the shaft 10 will cause the interrupted gear 1 to be rotated in one direction and the interrupted gear 2 to be rotated in the opposite direction continuously.

It is the object of this mechanism to cause the rotation of a load shaft 17 first in one direction for a certain interval and then to cause its direction of rotation to be reversed. It is another object of this invention to provide means for carrying out and to cause this reversal of the load shaft 17 with a minimum shock to the driving mechanism and the motor and the apparatus connecting the load shaft 17 with the interrupted gears for accomplishing this end consisting of a pair of driven gears 18 and 19 adapted to mesh with the interrupted gears 1 and 2, respectively, when the interrupted gears are rotated into operative engagement therewith.

Referring to Fig. 3 the interrupted gears 1 and 2 and the driven gears 18 and 19 are diagrammatically shown side by side for the purpose of clearness, and it will be seen that the gears 18 and 19 are provided with arcuate keyways 20 and 21, respectively, which permit limited relative movement of the gears with respect to the load shaft 17. The rotary movement of the gears upon the shaft 17 is limited by a key 22 of sufficient length to be engaged by both the gears 18 and 19.

Between the gears (see Fig. 2) is keyed against relative movement with respect to the shaft 17 an arm 23 which extends radially from the shaft and carries a pin 24 at its outer extremity. The gear 18 is held in one extreme limit of movement with respect to the shaft 17, as shown in Fig. 3,

by means of a tension spring 25 which is secured at one end to the pin 24 and at the other end to a pin 26 carried by the gear 18. The gear 19 is held in the extreme limit of movement relative with the shaft 17, as illustrated in Fig. 3, by means of a tension spring 27 secured at one end to the pin 26 and at the other end to a pin 28 carried by the driven gear 19. It will be seen, therefore, that the gears 18 and 19 are normally yieldingly held in a predetermined relation with respect to each other and with respect to the shaft 17 with the tension of the springs tending to rotate the gears 18 and 19 in opposite directions. It will be seen by reference to Fig. 3 that the center of the key 22 and the pin 24 are on the same radial line 29 and that this radial line splits or bisects a tooth of the gears 18 and 19. This being the case, the teeth of both gears are normally held in longitudinal alinement by the tension springs 25 and 27.

It will also be seen by reference to Fig. 3, that the disengaged end of the keyway 20 of the gear 18 terminates so that if this end of the keyway were moved into engagement with the key 22 the limit of movement would bring the key 22 into position that it would be bisected by the radial line 30, which also bisects or splits a tooth of the gear 18. The same is true of the disengaged end of the arcuate keyway 21 of the gear 19, which is so terminated that when the key 22 is in engagement with this end of the keyway 21 the key will be bisected by the radial line 31 which splits or bisects a tooth of the gear 19. Therefore, when the gears 18 and 19 are in their extreme limit of rotary movement with respect to the shaft 17 the teeth of the gears will be longitudinally alined.

In assembling the gears 18 and 19 with their respective interrupted gears 1 and 2, the gears are placed together so that the interrupted gears are in mesh at the same time with their respective driven gears 18 and 19, and so that they will assume the relation indicated in Fig. 3 when the gears are so rotated to bring them to the position shown. Therefore, in view of the fact that the driven gears 18 and 19 are normally held in a predetermined relation with respect to one another and with respect to the shaft, they will always be in proper position for meshing with the interrupted gears when such interrupted gears are rotated into operative engagement with the driven gears because the interrupted gears are rotated in opposite directions at equal velocities of rotation and because the teeth of the interrupted gears were longitudinally alined at the time of their assembly with relation to the driven gears. Therefore, there is no danger of the interrupted gears not properly meshing with the driven gears so long as the driven

gears are in their extreme limit of movement with respect to the shaft 17.

Referring to Fig. 3, the interrupted gear 1 is shown as being rotated clockwise and the interrupted gear 2 counter-clockwise. These gears are so assembled that they will assume the relative positions shown in Fig. 3 at this particular stage of the operation wherein the gear 1 is just about to enter into mesh with the gear 18 prior to the time at which the interrupted gear 2 will release its engagement with the gear 19. It will, therefore, be apparent that in view of the fact that both interrupted gears are rotated with equal velocity in opposite directions that the gear 1 will be in full mesh with the gear 18 prior to the time of the disengagement of the gear 2 from the gear 19. Therefore, the gear 1 will be in full mesh before it is called upon to assume the entire load carried upon the shaft 17 which is a very desirable feature of this invention.

Referring to Fig. 1, the gears 1 and 2 and 18 and 19 respectively, are shown superimposed with the gears 1 and 18 uppermost. Here the interrupted gear 1 is shown in the position that it will occupy just at about the instant of release of the interrupted gear 2 from engagement with the gear 19. This view also shows approximately the relative position of the gears 18 and 19 with respect to the shaft 17 and the key 22. It will be seen that during this interval of movement of the interrupted gear 1 from the position shown in Fig. 3 to the position shown in Fig. 4 certain relative movement of the gears 18 and 19 has taken place resulting in certain movement of the shaft 17 in the direction it was being rotated by the gear 19 when the parts were in the position shown in Fig. 3. When the parts were in such position the gear 19 is being rotated clockwise by means of the interrupted gear 2 and the spring 27 which in this case is of sufficient strength to carry the load and is causing the shaft 17 to be rotated counter-clockwise with the gear 19. As soon, however, as the teeth of the gear 1 come into mesh with the gear 18 the counter-clockwise movement of the shaft 17 will be opposed by the tension of the spring 25 which is at such time being moved counter-clockwise by the interrupted gear 1. This tension of the spring 25 tends to gradually overcome the inertia of the load being rotated by the shaft 17 in a clockwise direction, and therefore the rotation of the shaft 17 will be gradually retarded. During the interval between the engagement of interrupted gear 1 with the gear 18 and the disengagement of the gear 2 from the gear 19 as shown in Fig. 4, the under gear 19 will continue to be rotated clockwise by the spring 27, but as this action is opposed by the spring 25 the spring 27 will be elongated under tension and the

shaft and arm 23 will assume approximately the position indicated in Fig. 4, the spring 25 being elongated the most because of the inertia of the load in being retarded.

5 The instant the teeth of the interrupted gear 2 are disengaged from the the gear 19, the spring 25 will contract and draw the arm 23 in a counter-clockwise direction, therefore rotating the shaft 17 in the reverse direction, as indicated in Fig. 5, which shows the relative position of the parts immediately after the spring 25 has contracted. As soon as the release of the interrupted gear 2 from the gear 19 has taken place the gear 19 is free to rotate counter-clockwise and is moved to the position shown in Fig. 3 by reason of the contracting of the spring 27.

10 It will be seen from the foregoing that the load is first retarded by the spring 25 and accelerated in the reverse direction by the same spring when the gear 19 has released. Therefore the load shaft 17 is first retarded and then reversed by means of an elastic connection between the load and the motor, thereby reducing the shock to a minimum.

15 It will be seen from Fig. 5 that the gears 18 and 19 are in the same relative position with respect to each other and with respect to the shaft 17 as they occupied when the parts were in the position shown in Fig. 3, and that when the interrupted gear 2 is rotated so as to come into engagement position with the gear 19 the operation will be the same except in a reverse order and that the shaft 17 will be reversed so as to move clockwise as soon as the interrupted gear 1 moves out of engagement with the gear 18.

20 In the device here illustrated, it will be seen that the load shaft 17 will be reversed after every movement through approximately 180 degrees or a half revolution, which might be desirable for some forms of washing machines of the oscillating type wherein the tub is adapted to be rotated through 180 degrees and then reversed, this particular action serving best to illustrate the principle involved. It is the purpose, however, to provide a reversing mechanism for a machine wherein the washing tub is to be rotated through four or five complete revolutions before the load shaft has reversed, in which case it is obvious that this object would be accomplished simply by having one-fourth or one-fifth the number of teeth on the gears 18 and 19 that are provided on the interrupted gears 1 and 2, respectively.

25 In the device illustrated the tension of the springs 25 and 27 when contracted is preferably sufficient to carry the load, or in other words rotate the cylinder so that when the motor is shut off the loaded tub or cylinder will be rotated into one extreme limit

of rotation of the shaft with respect to the driven gear in engagement with the interrupted gear. Otherwise the load in the tub might rotate the shaft 17 out of engagement with its driving gears 18 and 19 whichever the case may be, so that the gears would not properly mesh with the disengaged interrupted gear when the motor was again started.

30 It is not essential, however, that the springs be sufficiently strong to carry the load if a clutch is provided between the load and the shaft 17 which is adapted to hold the load stationary when the clutch is disengaged from driving action with the shaft 17. In this case the function of the springs 25 and 27 would simply be for positioning the gears 18 and 19 with respect to the shaft and for serving as shock absorber in opposing the inertia of the shaft prior to a reversing action.

35 In fact the arm 23 is not essential to the successful operation of the mechanism as the gears 18 and 19 might be held in a predetermined relation with respect to the shaft and with each other, by means of a spring connecting directly the pins 26 and 28 carried on the gears 18 and 19, respectively.

40 It is obvious that compression springs may be substituted for the tension springs 25 and 27 by making suitable provision for their anchorage so that they will serve to hold the gears 18 and 19 in their proper relation with respect to the shaft 17. The construction illustrated may be further changed so that the interrupted gears 1 and 2 may have lost motion connection with their respective driving gears 4 and 5 and may be held in a predetermined relation with respect to the gears 4 and 5 by means of suitable springs. In this case the gears 18 and 19 should be keyed against relative rotary movement with respect to the shaft 17. It will readily be seen that the lost motion necessary for proper operation would be provided by the interrupted gears.

45 It is also obvious that numerous other changes may be made in the details of the construction, and the invention is therefore not limited to the specific structure herein illustrated and described.

What I claim is:

1. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, and a pair of driven gears on the shaft, yieldingly mounted thereon for limited rotary movement with respect to each other and to the shaft and adapted to be operatively engaged by the interrupted gears, the said interrupted gears being so arranged relatively that one interrupted gear operatively en-

gages one of the driven gears prior to the disengagement of the other interrupted gear from the other driven gear.

2. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, and a pair of driven gears on the shaft, yieldingly mounted thereon, for limited rotary movement with respect to the shaft and adapted to be operatively engaged by the interrupted gears, the said interrupted gears being so arranged relatively that one interrupted gear operatively engages one of the driven gears prior to the disengagement of the other interrupted gear from the other driven gear.

3. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged by the interrupted gears, the said interrupted gears being so arranged relatively that one interrupted gear operatively engages one of the driven gears prior to the disengagement of the other interrupted gear from the other driven gear, and means for predetermining the relative positions of the driven gears with respect to the shaft whereby the disengaged driven gear will be moved to proper position for meshing with the disengaged interrupted gear by the engaged driven gear.

4. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged by the interrupted gears, the said interrupted gears being so arranged relatively that one interrupted gear operatively engages one of the driven gears prior to the disengagement of the other interrupted gear from the other driven gear, and yielding means for predetermining the relative positions of the driven gears with respect to the shaft whereby the disengaged driven gear will be moved to proper position for meshing with the disengaged interrupted gear by the engaged driven gear.

5. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the

shaft and adapted to be operatively engaged by the interrupted gears, the said interrupted gears being so arranged relatively that one interrupted gear operatively engages one of the driven gears prior to the disengagement of the other interrupted gear from the other driven gear, and spring means for predetermining the relative positions of the driven gears with respect to the shaft whereby the disengaged driven gear will be moved to proper position for meshing with the disengaged interrupted gear by the engaged driven gear.

6. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged intermittently by the interrupted gears whereby the shaft is rotated in one direction while one of the gears is in mesh with one of the driven gears, and rotated in the opposite direction while the other interrupted gear is in mesh with the other driven gear, and means connecting the driven gears with the shaft whereby the gears are yieldingly held in a predetermined relation one with the other.

7. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged intermittently by the interrupted gears whereby the shaft is rotated in one direction while one of the gears is in mesh with one of the driven gears, and rotated in the opposite direction while the other interrupted gear is in mesh with the other driven gear, and spring means connecting the driven gears with the shaft whereby the gears are yieldingly held in a predetermined relation one with the other with the effect of the spring means tending to rotate the said driven gears in opposite directions.

8. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged intermittently by the interrupted gears whereby the shaft is rotated in one direction while one of the interrupted gears is in mesh with one of the driven gears, and rotated in the opposite direction while the other interrupted gear is in mesh with the other driven

gear, and spring means connecting the driven gears with the shaft whereby the gears are yieldingly held in a predetermined relation one with the other with the effect of the
 5 spring means tending to rotate the said driven gears in the direction opposed to the direction of rotation of the gears when driven by its respective interrupted gear.

9. A reversing mechanism comprising in
 10 combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be rotated in opposite directions to impart reverse movement to the shaft, a pair of driven
 15 gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged intermittently by the interrupted gears whereby the shaft is rotated in one direction
 20 while one of the gears is in mesh with one of the driven gears, and rotated in the opposite direction while the other interrupted gear is in mesh with the other driven gear, and means connecting the driven gears whereby the gears are yieldingly held in a
 25 predetermined relation one with the other.

10. A reversing mechanism comprising in combination, a shaft, a pair of driving gears having interrupted teeth and adapted to be
 30 rotated in opposite directions with equal velocity to impart reverse movement to the shaft, a pair of driven gears on the shaft, mounted thereon for limited rotary movement with respect to the shaft and adapted to be operatively engaged intermittently by
 35 the interrupted gears whereby the shaft is rotated in one direction while one of the gears is in mesh with one of the driven gears, and rotated in the opposite direction while the other interrupted gear is in mesh with
 40 the other driven gear, and means connecting the driven gears with the shaft whereby the gears are yieldingly held in a predetermined relation one with the other.

11. A reversing mechanism comprising in
 45 combination, gearing composed of a pair of gear wheels and a pair of interrupted gears disposed in driving engagement, and shaft means for said gearing, a part of said shaft means adapted to be rotated in opposite directions upon rotation of said gearing, and
 50 a part of said gearing provided with a lost motion connection with said shaft means operative during rotary movement of both parts of said gearing.

12. A reversing mechanism comprising in combination, gearing composed of a pair of
 55 gear wheels and a pair of interrupted gears disposed in operative engagement therewith and adapted to be rotated in opposite directions, shaft means for said gearing, a part of said shaft means adapted to be rotated in opposite directions by the interrupted gears, and a lost motion connection between the
 60 shaft means and the gearing operative during the rotary movement of both interrupted

gears when said interrupted gears are simultaneously operatively engaged with the said gear wheels.

13. A reversing mechanism comprising in combination, a shaft, a pair of driving gears
 70 having interrupted teeth and adapted to be rotated in opposite directions with equal velocity to impart reverse movement to the shaft, and a pair of driven gears on the shaft, mounted thereon for limited rotary
 75 movement with respect to the shaft and adapted to be operatively engaged by the interrupted gears, the said interrupted gears being so arranged relatively that one interrupted gear operatively engages one of the
 80 driven gears prior to the disengagement of the other interrupted gear from the other driven gear.

14. A reversing mechanism comprising in combination, a driven shaft, an auxiliary
 85 shaft, a pair of interrupted gears mounted upon the auxiliary shaft, means for rotating the interrupted gears in opposite directions at predetermined relative velocity, a pair of driven gears mounted upon the driven shaft
 90 for limited relatively rotary movement upon the said shaft, and means for limiting the rotary movement of the driven gears with respect to the shaft so that the teeth of the driven gears will be in a predetermined relative
 95 relation in both extremes of rotary movement with respect to the shaft whereby when one driven gear is in mesh with its respective interrupted driving gear, the other driven gear will, when the driven gears are
 100 in any extreme of movement upon the driven shaft, mesh with the other interrupted driving gear when it is rotated into operative engagement with the other driven gear.

15. A reversing mechanism comprising in
 105 combination, a driven shaft, an auxiliary shaft, a pair of interrupted gears mounted upon the auxiliary shaft, means for rotating the interrupted gears in opposite directions at predetermined relative velocity, a pair of
 110 driven gears mounted upon the driven shaft for limited relative rotary movement upon the said shaft, and means including a key and lost motion keyway for limiting the rotary movement of the driven gears with respect to the shaft so that the teeth of the
 115 driven gears will be in a predetermined relative relation in both extremes of rotary movement with respect to the shaft whereby when one driven gear is in mesh with its respective interrupted driving gear, the other
 120 driven gear will, when the driven gears are in any extreme of movement upon the driven shaft, mesh with the other interrupted driven gear when it is rotated into operative engagement with the other driven gear.

16. A reversing mechanism comprising in combination, gearing composed of a pair of
 125 gear wheels and interrupted gear means disposed for driving engagement therewith, and

shaft means for said gearing, a part of said shaft means adapted to be rotated in opposite directions upon rotation of said gearing, and a part of said gearing provided with a lost motion connection with said shaft means operative during rotary movement of both parts of said gearing.

17. A reversing mechanism comprising in combination, shaft means, a pair of gears on the shaft means mounted thereon for limited rotary movement with respect to the shaft means, and interrupted gear means adapted to operatively engage the gears, the said interrupted gear means being so arranged that both gears on the shaft means are intermittently in operative engagement with the interrupted gear means at the same time and rotated in opposite directions thereby.

18. In a reversing mechanism for washing machines, the combination of a pair of shafts, and segmental and driven gearing carried by said shafts, said driven gearing capable of limited rotary movement with respect to its shaft and provided with a yielding device operative during said movement, and members of said segmental gearing rotatable in opposite directions to impart reverse movement to the shaft carrying the members of the driven gearing, and being so arranged relatively that one segmental gear member meshes with a driven gear member to operate said yielding device prior to the disengagement of the other segmental gear member from the other driven gear member.

19. A reversing mechanism comprising in combination, shaft means, a pair of gears on the shaft means adapted to rotate the shaft means, and interrupted gearing adapted to operatively engage the gears and when rotated, adapted to intermittently rotate one gear in one direction and the other in the opposite direction, the said gears having a

lost motion connection with the shaft means permitting limited relative movement with respect to the shaft means whereby the gears may be rotated through a limited angle with respect thereto without causing the rotation of the shaft means.

20. A reversing mechanism comprising in combination, shaft means, a pair of gears on the shaft means mounted thereon for limited rotary movement with respect to the shaft means, interrupted gearing adapted to operatively engage the gears, the said interrupted gearing being so arranged that both gears on the shaft means are intermittently in operative engagement with the interrupted gear means at the same time and rotated in opposite directions thereby, and means for yieldingly holding the gears normally in a predetermined relation with respect to each other.

21. In a reversing mechanism for washing machines, the combination of a pair of shafts, and segmental and driven gearing carried by said shafts, said driven gearing capable of limited rotary movement with respect to its shaft and provided with a yielding device operative during said movement, and members of said segmental gearing rotatable in opposite directions to impart reverse movement to the shaft carrying the members of the driven gearing, and being so arranged relatively that one segmental gear member meshes with a driven gear member to operate said yielding device prior to the disengagement of the other segmental gear member from the other driven gear member, said device having a driving lever connection with said driven gear shaft and adapted to yieldingly hold the driven gearing members in a predetermined relation with respect to each other.

BERNARD P. ELKER.