

June 27, 1939.

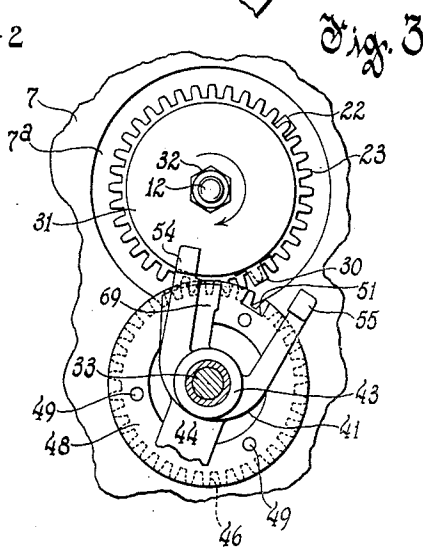
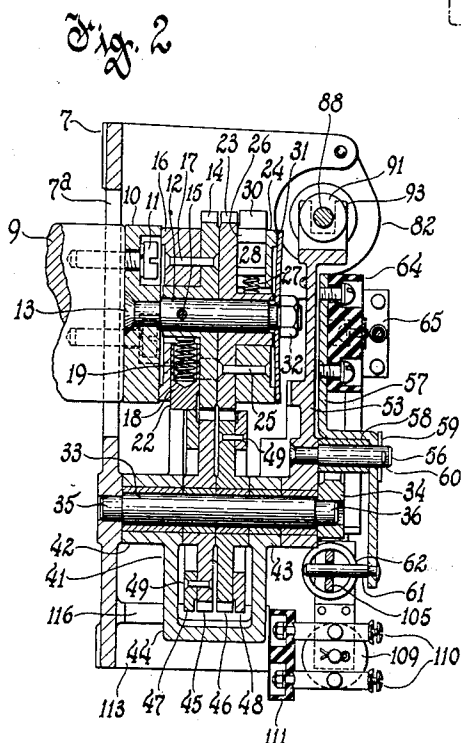
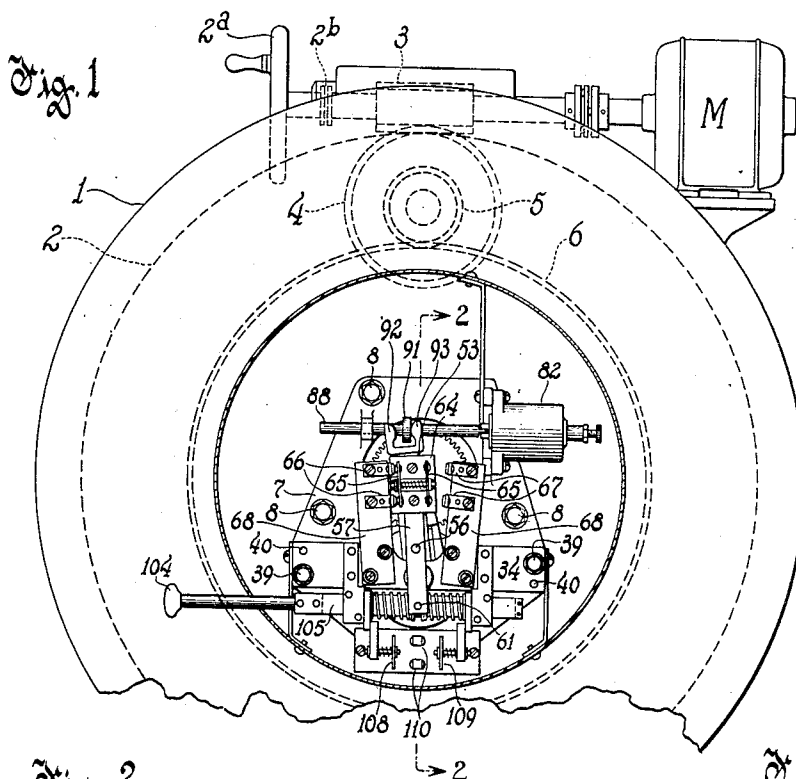
R. G. LOCKETT

2,164,037

CIRCUIT CONTROLLING DEVICE

Filed May 3, 1937

3 Sheets-Sheet 1



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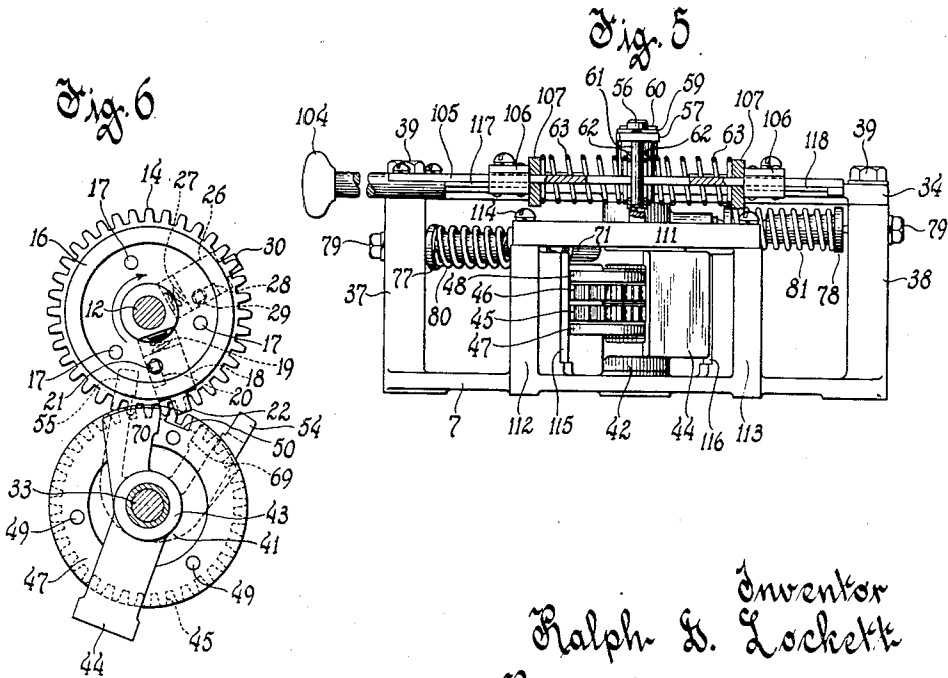
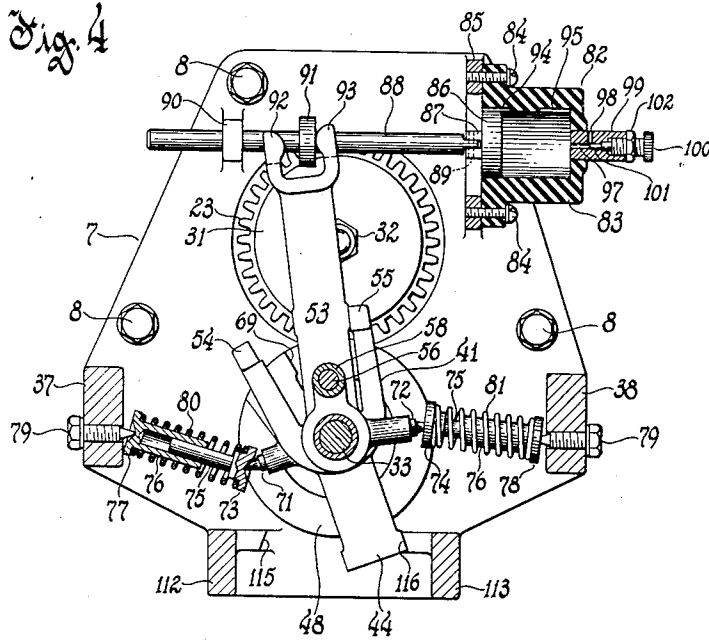
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CIRCUIT CONTROLLING DEVICE

Filed May 3, 1937

3 Sheets-Sheet 2



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CIRCUIT CONTROLLING DEVICE

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3 Sheets-Sheet 3

Fig. 7

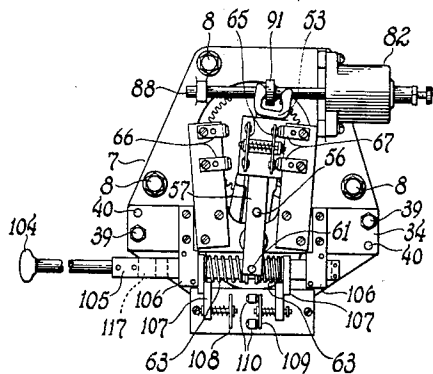


Fig. 8

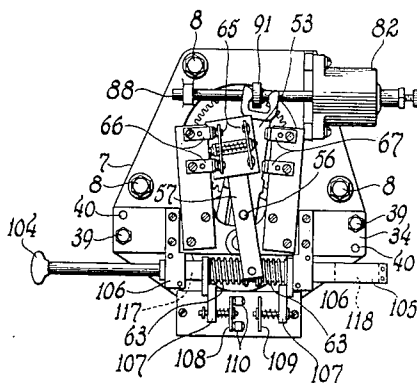
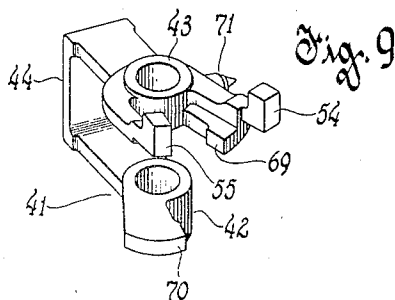
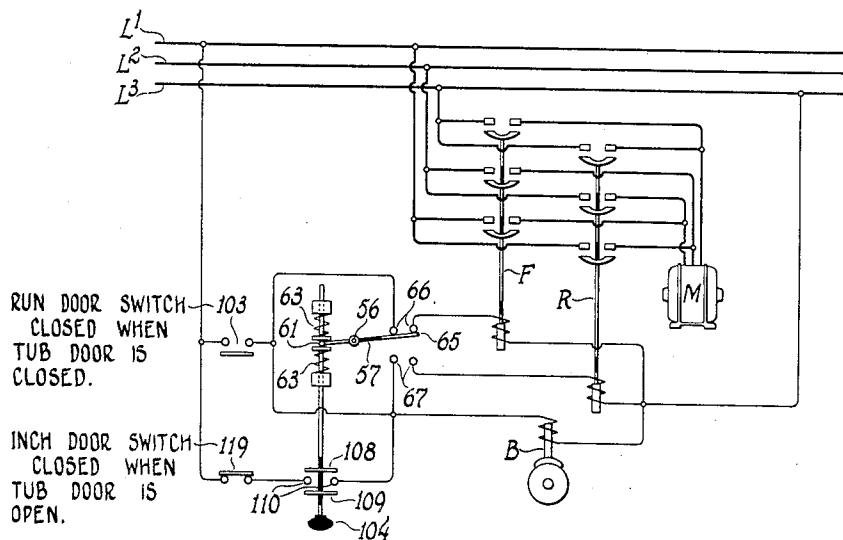


Fig. 10



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UNITED STATES PATENT OFFICE

2,164,037

CIRCUIT CONTROLLING DEVICE

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Application May 3, 1937, Serial No. 140,360

20 Claims. (Cl. 200—34)

This invention relates to circuit controlling devices and more particularly to power operated control devices which are especially applicable to the control of reversible electric driving motors for commercial laundry washing and like machinery which is arranged to be operated in cycles comprising equal numbers of revolutions in opposite directions.

It is desirable and important to be able to control the driving means of laundry and dyeing machines so as to insure operation thereof in the manner aforementioned. It is a fact well known to those familiar with the laundry industry that when clothes and fabrics are tumbled about in the rotating cylinders of machines of the character aforementioned a certain amount of wadding and tangling of the articles or material occurs. If the number of revolutions in one direction is made to equal the number of revolutions in the other direction, this wadding is avoided or minimized, since the wads which are rolled during operation of the cylinder in one direction are unrolled during operation of the cylinder in the other direction. However, if the numbers of revolutions of the cylinder in opposite directions are unequal, the cumulative difference in the numbers of revolutions results in increasingly tighter tangling and wadding of the material. This is very objectionable inasmuch as the cleansing or dyeing liquids are unable to properly penetrate the material.

In order to secure the aforescribed desired character of operation of such machines I propose to employ a control device which is operated by the machine itself. The proposed device incorporates an over-center spring operating mechanism which tends to move a switch member from one circuit commutating position to another with a snap action, suitable timing means being associated with the snap operating mechanism to retard its action, whereby a predetermined lapse of time occurs between movement of the switch member from one position to the other to provide a period wherein the cylinder coasts at a diminishing speed before being driven in the opposite direction. Unlike certain prior devices of this general character, provision is made, as will be disclosed herein, to insure against stopping of the switch member in an open circuit position in the event of stoppage of the machine during the time of transit of the switch member from one circuit commutating position to the other. The present device obviates the use of such measures as have been heretofore employed, such as a normally open push button switch

shunting the switch member, to provide for starting of the machine in the event of the occurrence of the aforescribed emergency.

An object of the invention, generally, is to provide an improved control device for the driving motors of machines of the aforementioned character to insure the aforescribed desired character of operation of such machines.

Another object is to provide an improved motor control device of the aforementioned character which is arranged to be operated by a moving part of the driven machine.

Another object is to provide a motor control device of the aforementioned character having means whereby the number of revolutions of a driven machine in opposite directions may be increased or diminished as required.

A further and important object is to provide a positive acting circuit commutating device of the aforementioned character including adjustable means for delaying completion of both forward and reverse circuit connections whereby the coasting period of the machine between reversals of its direction of rotation may be increased or diminished as required.

Another object is to provide a control device of the aforementioned character including manually operable means whereby completion of circuits for inching operation of the machine in either direction is insured regardless of the circuit conditions previously set up mechanically by the device.

Another object is to provide a control device of the aforementioned character which may be readily and conveniently adjusted with respect to its control functions to adapt the same to a wide range of operating conditions of the machine to be controlled.

Another object is to provide a sturdy and reliable operating mechanism for devices of the aforementioned character.

Other objects and advantages of the invention will hereinafter appear.

The accompanying drawings illustrate an embodiment of the invention which will now be described, it being understood that the invention is susceptible of embodiment in other forms without departing from the scope of the appended claims

In the drawings,

Figure 1 is a front elevational view of a control device embodying the invention, the same being shown as mounted on the end of a washing machine casing, the enclosing cover for said device being shown in section. For purposes of

illustration the device is shown substantially larger in proportion to the size of the machine than is actually the case.

Fig. 2 is a vertical sectional view taken substantially on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary front elevational view illustrating certain of the operating elements of the device shown in Figs. 1 and 2.

Fig. 4 is a front elevational view of the operating mechanism of the device, illustrating the same in one extreme operating position.

Fig. 5 is a bottom plan view, partly in section, of the device shown in Figs. 1, 2 and 4.

Fig. 6 illustrates certain elements of the operating mechanism of the device shown in Figs. 1 and 2 as viewed from a point directly opposite to that which affords the view of Fig. 3.

Figs. 7 and 8 are front elevational views of the device, illustrating two positions, respectively, of the movable contact member as effected by the manually operated means.

Fig. 9 is a perspective view of one of the elements comprising the operating mechanism of the device.

Fig. 10 is a schematic and diagrammatic view illustrating an adaptation of my improved control device, in combination with a pair of electromagnetically operable reversing switches and suitable washing machine door operated switches, to control the energization, de-energization, and direction of operation of the driving motor for a washing machine.

Referring to Fig. 1 of the drawings, the numeral 1 designates the outer casing or tub of a washing machine within which a washer cylinder 2 is rotatably supported. Said cylinder is arranged to be rotated in opposite directions by a reversible driving motor M through the medium of a suitable non-locking worm 3, a worm gear 4 having a pinion 5 fixed thereto, the latter being engaged with a large gear 6 which is fixed to the shaft of said cylinder. A hand wheel 2^a for effecting rotation of cylinder 2 through a clutch 2^b may be provided for accurately positioning the cylinder after the motor has been de-energized.

The operating mechanism and switching elements of the control device are supported by a frame 7 which is adapted to be secured to the end of the washing machine casing 1 by the screws or bolts 8. In Fig. 2 is shown a portion of the shaft 9 of the washing cylinder 2 which is adapted to project through an opening 7^a in the base of frame 7. A circular plate 10 is secured to the end of shaft 9 by screws 11, said plate being thus arranged to rotate with said shaft. A bearing shaft 12 is also arranged to rotate with shaft 9, shaft 12 having an inner end portion of smaller diameter than that of the shaft proper penetrating a central opening in plate 10, said inner end portion being riveted or upset, as shown at 13, to non-rotatably secure the bearing shaft to the plate. The reduced inner end portion of said bearing shaft provides a shoulder which abuts against the outer face of said plate.

A gear 14 is fixed upon shaft 12 for rotation therewith, as by means of a drive pin 15, said pin extending through said shaft and through a hub portion which projects from the inner face of said gear. A circular plate 16 of substantial thickness is mounted upon the hub of gear 14 and is fixed to the inner face of said gear by rivets 17 (Figs. 2 and 6).

The outer face of plate 16 is provided with a radial slot to receive a plunger 18, said plunger

being confined between the inner face of gear 14 and the walls of said slot. The inner end of plunger 18 is provided with a cylindrical recess within which is located a compression spring 19, said spring being seated against the hub of gear 14 to bias said plunger outwardly. One side of plunger 18 is provided with a rectangular notch 20, as best shown in dotted lines in Fig. 6, the inner end wall of which is adapted to engage a pin 21 to limit outward movement of said plunger, said pin having a portion adapted for a drive fit thereof in an opening which extends through the plate 16. The outer end of plunger 18 is provided with a tooth 22, the end of which is biased by spring 19 to extend outwardly to a degree corresponding to the outer circumference of gear 14,—the purpose of which plunger will be described hereinafter.

A second gear 23, substantially identical in form with gear 14, is rotatably mounted on bearing shaft 12, said gear being arranged with its inner face adjacent to the outer face of gear 14. The hub of gear 23 projects outwardly and has mounted thereon a circular plate 24 which is substantially identical in form with plate 16. Said plate 24 is fixed to the outer face of gear 23 by rivets, one of which is shown at 25. Plate 24 has associated therewith a plunger 26, and in a manner similar to that described in connection with plunger 18, said plunger 26 is confined between the outer face of gear 23 and the walls of a radial slot in the inner face of plate 24. Outward movement of plunger 26 under the bias of a compression spring 27 is similarly limited by engagement of the inner end wall of a notch 28 in the side of said plunger with a pin 29 which is pressed into an opening extending through plate 24. Plunger 26 is provided at its outer end with a projecting tooth 30, the end of which is coextensive with the outer circumference of gear 23.

During normal operation of the control device, gear 23 and plate 24 are arranged to be rotated with cylinder shaft 9, said gear and said plate being frictionally held between the outer face of gear 14 and the inner face of a large washer 31. Said washer is mounted on the outer end of shaft 12 and is clamped against the outer face of plate 24 by a nut 32, the outer end portion of said shaft being threaded to receive said nut. Any suitable means (not shown) may be provided for locking nut 32 against loosening.

A second bearing shaft 33 is supported between the base of frame 7 and a substantially rectangular plate 34. The end portions of said shaft are of reduced diameter, said reduced portions 35 and 36 being arranged within openings in said base and in said plate, respectively. Plate 34 is supported at its ends by a pair of posts 37 and 38 (Figs 4 and 5) and is secured thereto by screws 39 and drive pins 40. Posts 37 and 38 are formed integrally with frame 7 and project outwardly from opposite ends of said frame.

An oscillatable actuating member 41, (best illustrated in Figs. 2 to 6, inclusive, and Fig. 9) is provided with spaced bearings or hubs 42 and 43 which are joined by an integral downwardly extending U-shaped portion or yoke 44. Hub 42 is arranged adjacent to the inner face of the base of frame 7 and together with hub 43 serves to locate a pair of gears 45 and 46 which are rotatably mounted on bearing shaft 33 between said hubs. Gears 45 and 46 are adapted to mesh with gears 14 and 23, respectively, and it is apparent that upon rotation of washer cylinder

shaft 9 the former set of gears will be driven by the latter set.

A pair of flat ring members 47 and 48 are fixed to the inner face of gear 45 and to the outer face of gear 46, respectively, as by means of the rivets 49 (Figs. 2, 3 and 6). The outside diameters of said ring members are substantially the same as the outside diameters of the gears 45 and 46. It will be noted that each of said rings 47 and 48 is provided with a rectangular peripheral notch, as at 50 and 51, respectively (Figs. 3 and 6). Under predetermined conditions of operation, to be described, the teeth 22 and 30 of plungers 18 and 26 are adapted to enter the respective notches 50 and 51.

An oscillatable carrier arm 53 is pivotally mounted on bearing shaft 33, the hub of said arm being positioned outwardly from and adjacent to hub 43 of actuating member 41. Carrier arm 53 is adapted to be moved in opposite directions by the spaced arms 54 and 55 which project from opposite sides of hub 43 and are disposed upwardly to either side of said carrier arm, as best shown in Fig. 4.

Arm 53 carries an outwardly projecting pivot pin 56 (Figs. 2, 4 and 5) which is spaced upwardly from the bearing shaft 33. A contact carrying arm 57 is mounted on pin 56, said arm being spaced outwardly from arm 53 by a tubular spacer element 58 arranged on said pin. Said arm is retained on pin 56 by an overlying washer 59 and a cotter pin 60 which penetrates an opening near the outer end of said pin. Contact arm 57 extends downwardly from pivot pin 56 and is provided at its lower end with an inwardly projecting pin 61. Pin 61 is disposed between a pair of washers 62, 62 and is normally held in a substantially central position by a pair of coiled compression springs 63, 63. With pin 61 thus yieldably held, contact arm 57 pivots thereon and is shifted into opposite extreme positions by movement of carrier arm 53, through the medium of pin 56.

Contact arm 57 also extends upwardly from pivot pin 56 and carries at its upper end an insulating block 64 upon which is mounted a pair of bridging contact members 65, 65. Said contact members are adapted to bridge the pairs of stationary contacts 66, 66 and 67, 67 in opposite extreme positions, respectively, of contact arm 57. Said sets of stationary contacts 66, 66 and 67, 67 are carried by suitable insulating members 68, 68 which in turn are secured to the outer face of plate 34.

A more detailed description of the operation and adjustment of the device will now be given. It will be noted from an examination of Figs. 3 and 6 that the gears 14 and 23 are each provided with thirty-six teeth whereas gears 45 and 46 are each provided with thirty-five teeth. It is to be understood, however, that while I have specified, in connection with the present embodiment of the invention, numbers of teeth to be carried by the gears of the respective sets which, for all practical purposes, provide for an adequate degree of adjustability of certain of the characteristics of control to be obtained with the device, it may be desirable, in some instances, to employ sets of gears having other numbers of teeth.

Considering the illustrated device, it is apparent that upon rotation of the cylinder shaft 9 (Fig. 2) in one direction, clockwise for example, as indicated in Fig. 3, each revolution of said shaft will effect an advance of one tooth of the set of gears 14, 23 with respect to the set of gears 45, 46, and

upon rotation of said shaft in the opposite direction, as indicated in the reverse view of Fig. 6, each revolution thereof will effect a return of one tooth of the former set of gears with respect to the latter set. This well-known arrangement is utilized in the present device to effect control of the motor M in a manner whereby the direction of rotation of the washer cylinder 2 is reversed after a predetermined number of revolutions thereof. The present arrangement provides for a range of operation of the washer cylinder of from one to thirty-four revolutions in each direction, as will be apparent from the drawings and from the foregoing and the following description.

Fig. 3 illustrates a point in the cycle of operation of the control device wherein tooth 30 of plunger 26 is about to enter the notch 51 in ring 48. Following such engagement, further movement of the sets of gears (in the direction of the arrow) effects engagement of said tooth with an arm 69 on the actuating member 41 whereby said member is rotated counterclockwise about the bearing shaft 33. As best shown in Fig. 4 the aforescribed movement of actuating member 41 effects engagement of its associated arm 55 with the right-hand side of carrier arm 53 to effect movement of the latter into the position shown.

It is to be noted that tooth 30 and arm 69 are arranged to move through arcs which diverge before actuating member 41 has completed its full range of movement. I provide a positive driving device which tends to complete the latter portion of the movement of said member 41 with a snap action, which device is subject to adjustment whereby the speed of movement of said member 41 is provided with a pointed projection 71 on the left-hand side of hub 43 (Fig. 4), and carrier arm 53 is provided with a similar projection 72 on the right-hand side of its hub. Said projections pivotally engage the recessed ends of a pair of spring carrying elements 73 and 74, respectively, each of which is provided, as shown in Fig. 4, with a projecting shank portion 75, which shank portions telescope into the tubular portions 76, 76 of a pair of spring carrying elements 77 and 78. The recessed ends of elements 77 and 78 are pivotally engaged with a pair of pointed screws 79, 79 which are threaded into the posts 37 and 38, the pointed ends of said screws projecting beyond the inner faces of said posts. A relatively heavy spring 80 is carried by the left-hand set of elements 73 and 77 and is compressed between enlarged outer end portions of said elements, while a relatively lighter spring 81 is carried by the right-hand set of elements 74 and 78 and is compressed between enlarged outer end portions of said latter elements.

Thus when actuating member 41 is rotated counterclockwise projection 71 compresses spring 80 until the axis of the latter is moved to a position below the pivot (bearing shaft 33) of member 41 (as shown in Fig. 4). Spring 80 then drives member 41 to effect movement of carrier arm 53 to the left by means of arm 55. Spring 81 acts as a resilient detent for carrier arm 53 until after the axis of spring 80 has moved to a position below the pivot (bearing shaft 33) of carrier arm 53 and thereafter supplements the driving force of spring 80. Spring 80 is necessarily heavier than spring 81, since during initial movement of carrier arm 53 the latter spring is being compressed.

It will be apparent from the drawings and from

the foregoing description that contact arm 57 will not be moved until spring 80 becomes effective, since carrier arm 53 is yieldingly held by spring 81, and the arms 54 and 55 of actuating member 41 are so arranged with respect to said carrier arm as to provide a degree of lost motion therebetween sufficient to permit spring 80 to become effective before one or the other of said arms engages said carrier arm. Thus if the cylinder 2 is stopped after member 41 has been moved but before spring 80 becomes effective, contact arm 57 will remain stationary, and the motor can be started through one or the other of the sets of contacts 65, 66 or 67, 67. If the cylinder is stopped after spring 80 becomes effective, contact arm 57 will be positively moved to provide for completion of circuit for starting the machine.

As hereinbefore described contact arm 57 is shifted between its circuit making positions by the carrier arm 53, and it will be evident from the foregoing description of the operation of the control mechanism that contact arm 57 will be moved from the position wherein the right-hand bridging contacts 65 engage stationary contacts 67, 67 to the position wherein the left-hand bridging contacts 65 engage stationary contacts 66, 66, as shown in Figs. 1 and 10. However, a delay is effected between disengagement of one set of stationary contacts and engagement of the other set as by means of a dash-pot 82 to provide an interval during which the washer cylinder 2 may coast substantially to rest before being driven in the opposite direction. The interval required by the washer cylinder to coast to rest varies to some extent, according to the size of the load therein and depending upon whether or not tub 1 is full of water. Therefore, it is desirable to be able to regulate the flow of air into and out of dash-pot 82 in order to control the interval of delay between disengagement of one set of stationary contacts and engagement of the other set.

Dash-pot 82 preferably comprises a molded insulating cylinder 83 secured by screws 84 to a bracket 85 formed integrally with frame 7. A molded insulating piston 86 is slidably fitted within cylinder 83 and is provided with a molded-in outwardly projecting member 87 having a slot in its forward end to receive the reduced flat end of a rod or link 88. A drive pin 89 penetrates openings in the slotted member 87 and the end of link 88. Said link is adapted to slide longitudinally within an opening in a bearing bracket 90 formed integrally with frame 7. Said link is provided at a point intermediate its ends with a cylindrical flange or enlargement 91 which is adapted to be engaged at opposite sides thereof respectively by the fingers 92 and 93 of the bifurcated upper end of carrier arm 53. The fingers 92 and 93 are slotted as shown in Fig. 2 to accommodate link 88.

The cylindrical inner wall of dash-pot cylinder 83 is grooved to provide escape passages 94 and 95 adjacent to the outer and inner ends respectively of said cylinder, passage 94 extending toward the open end of said cylinder and being of a slightly greater length than the length of piston 86, and passage 95 extending outwardly a corresponding distance from the end wall of said cylinder. The arrangement is such that a portion of the cylinder wall between the adjacent ends of the passages 94 and 95 is ungrooved. Thus piston 86 moves relatively rapidly during the initial portion of its travel in either direction to provide for a relatively quick disengagement of one

of the bridging contacts 65 from one of the sets of stationary contacts 66, 66 or 67, 67. During the intermediate portion of its travel said piston is adapted to move relatively slowly to provide an interval during which the washer cylinder 2 coasts, and thereafter said piston moves relatively rapidly during the final portion of its travel to provide for a relatively quick engagement of the other of bridging contacts 65 with the other set of stationary contacts.

The intermediate portion of the travel of piston 86 in either direction is adapted to be regulated to provide for relatively rapid or relatively slow or any intermediate speed of movement of said piston, depending upon the period required for the washer cylinder to coast substantially to rest. This is accomplished by adjusting the flow of air into and out of the dash-pot cylinder as by means of an adjustable orifice comprising a longitudinally drilled passage 97 and a communicating transverse passage 98 in a cylindrical member 99, which latter member is molded into or otherwise rigidly secured within the end wall of cylinder 83. Passage 97 communicates with the interior of cylinder 83 and the flow of air through said passage is restricted as required by means of an adjusting screw 100 which is threaded into the outer end of passage 97 and serves to close the same. The inner end of adjusting screw 100 is provided with a reduced shank portion 101 which closely fits the passage 97, and restricts the opening of passage 98 to a greater or less degree upon manipulation of said adjusting screw. A lock nut 102 is preferably provided to insure retention of screw 100 in any adjusted position.

Fig. 10 illustrates the driving motor M and a pair of reversing switches F and R which are adapted to selectively connect said motor to lines L¹, L², L³ of an alternating current supply to provide for operation of said motor in opposite directions. Numeral 103 designates the "Run door switch," a switch which is operated by the washing machine tub door and is adapted to be closed when said door is closed. Thus with switch 103 closed and assuming that switch R has previously been energized, the aforescribed operation of the control mechanism, resulting in opening of contacts 67, effects de-energization of switch R. Contact arm 57 is moved upwardly (Fig. 10), as aforescribed, to close contacts 65, 66 subject to the delay afforded by dash-pot 82, during which interval the washer cylinder coasts at a diminishing speed. Closure of contacts 66 energizes switch F, the circuit for said switch extending from line L¹ through door switch 103, contacts 65, 66 and the winding of switch F to line L³. Motor M is energized to drive washer cylinder 2 in its "forward" direction, thus rotating gears 14 and 23 in a counterclockwise direction (with reference to Fig. 3).

At the beginning of the first revolution of said gears, tooth 30 of plunger 26 again engages with the walls of notch 54, but upon each revolution thereafter said tooth strikes the periphery of ring 48 at points removed a distance corresponding to one gear tooth (gears 14, 23, etc.) per revolution from said notch, in a counter-clockwise direction with respect to said notch. Each time tooth 30 strikes the periphery of ring 48, plunger 26 is depressed against the bias of its spring 27. At the same time tooth 22 of plunger 18 is approaching notch 50 in ring 47, in a sort of step-by-step movement, at the rate of one gear tooth per revolution in a counter-clockwise direction with re-

spect to said notch. Said tooth 22 strikes the periphery of ring 47 at each revolution and is depressed against the bias of its spring 19 to prevent engagement of said tooth with arm 70 of actuating member 41, until upon completion of a predetermined number of revolutions tooth 22 engages notch 50, as represented by the showing in Fig. 6. Immediately following its engagement of notch 50 tooth 22 engages arm 70 of actuating member 41, rotating said member to the left (Fig. 6, or to the right in respect of Figs. 3 and 4). Spring 80 is compressed until its axis is moved to a position above the pivot of member 41 (Fig. 4) whereupon it tends to drive said member with a snap action to effect movement of carrier arm 53 and contact arm 57 toward the right; such movement being subject, as aforescribed to the delaying action of dash-pot 82. Such movement of contact arm 57 opens contacts 65, 66 de-energizing switch F (Fig. 10) and subsequently closes contacts 67 to energize switch R.

The number of revolutions which washer cylinder 2 is arranged to complete in opposite directions is determined by the relative positions of the plungers 18 and 26 with respect to their cooperating notches 50 and 51. The arrangement shown in Figs. 3 and 6 provides for completion of ten revolutions in each direction, said plungers being separated by the space of ten gear teeth, the notches 50 and 51 being shown in alinement with each other. In order to increase or decrease the number of revolutions to be made by the washing cylinder the relative positions of plungers 18 and 26 and, incidentally, the positions of notches 50 and 51 are required to be changed, which is accomplished as follows:

By loosening nut 32 gear 23 is rendered free to rotate on shaft 12. To effect an increase in the number of revolutions to be made by the washing cylinder, gear 23 is rotated manually one complete revolution plus the space of one gear tooth in a counter-clockwise direction (Fig. 3) for each revolution increase in the operation of said washing cylinder. On the other hand each revolution decrease is obtained by rotating gear 23 one complete revolution minus the space of one gear tooth in a clockwise direction. Gear 46 is rotated by gear 23 on shaft 33 during such adjustment and said gear having one less tooth than gear 23, each revolution in the adjustment of gear 23 changes the relationship of plunger 25 with respect to notch 51 in ring 40 and thus the relationship of said plunger and said notch to plunger 18 and notch 50 in ring 47, associated with gears 14 and 45 respectively. Said gears 14 and 45 are held stationary during adjustment of gears 23 and 46, due to gear 14 being fixed to shaft 12, and the latter being fixed to cylinder shaft 9.

Manual control of contacts 65 for effecting inching operation of motor M is accomplished by means of an operating handle 104. Movement of said handle to the left effects closure of contacts 67 while movement of said handle to the right effects closure of contacts 66, contact arm 57 pivoting on pin 56 as shown in Figs. 7 and 8, respectively. Handle 104 is fixed to a slide bar 105 which is slidably supported by a pair of spaced brackets 106, 106 fixed to plate 34. A pair of contact carrying members 107, 107 is slidably carried by slide bar 105, said members being normally abutted against the inner faces of the respective brackets 106 by springs 63. Members 107 carry spring mounted bridging contacts 108 and 109, respectively, which are adapted upon movement of operating handle 104 to selectively engage

stationary contacts 110. Contacts 110 comprise a pair of spaced posts, preferably having suitable contact surfaces fixed thereto, said posts being fixed to an insulating block 111. Block 111 is secured to a pair of spaced posts 112 and 113 as by screws 114 (Fig. 5), said posts being formed integrally with and projecting outwardly from the lower end of frame 7. The inner faces of posts 112 and 113 are provided with abutments 115 and 116, respectively, which are adapted to cooperate with the opposite sides of yoke 44 of actuating member 41 to limit movement of the latter in opposite directions.

Plates 117 and 118 are rigidly fastened to the inner surface of slide bar 105 at opposite ends thereof, respectively (Figs. 5 and 7). The arrangement is such that said plates penetrate the openings in brackets 106 and respectively engage the outer faces of contact carrying members 107. Thus when handle 104 is moved to the left as shown in Fig. 7, plate 118 moves the right-hand contact carrying member 107 toward the left to effect bridging of contacts 110 by contact 109. Movement of said right-hand member 107 compresses the right-hand spring 63, moving pin 61 to the left against the left-hand spring 63, whereupon contact arm 57 is moved on pivot pin 56 to effect bridging of stationary contacts 67 by contacts 65. However, as indicated by the position of carrier arm 53 the contacts 67 were already closed, but if said carrier arm had been in the position shown in Fig. 4, contact arm 57 would have been shifted in the manner aforescribed.

When handle 104 is moved to the right as shown in Fig. 8, plate 117 moves the left-hand contact carrying member 107 to the right to effect bridging of contacts 110 by contact 108. Movement of said member 107 compresses the left-hand spring 63, moving pin 61 to the right against the right-hand spring 63, whereupon contact arm 57 is moved on pivot pin 56 to effect bridging of stationary contacts 66 by contacts 65.

It will be apparent from the foregoing that selective inching operation of motor M in either direction is insured regardless of the instant position of the contact arm 57. Referring to Fig. 10, it will be seen how the inching circuits for motor M are established through operation of handle 104. Numeral 119 designates the "Inch door switch", a switch which is operated by movement of the washing machine tub door and is adapted to be closed when said door is open. With the inch door switch closed as shown, upon operation of handle 104 in the direction to effect bridging of contacts 110 by contact 108, an energizing circuit is established for the winding of switch F, which circuit may be traced from line L¹, through switch 119 and contacts 108 and 110, through contacts 65 and 66 and thence through the winding of switch F to line L³. Operation of handle 104 in the direction to effect bridging of contacts 110 by contact 109 also effects bridging of contacts 67 by contact 65, establishing an energizing circuit for the winding of switch R, which circuit may be traced from line L¹ through switch 119, contacts 109 and 110, through contacts 65 and 67 and thence through the winding of switch R to line L³.

Also shown in Fig. 10 is an electromagnetically releasable brake B which may be of any suitable type, the same being adapted to effect stopping and holding of the washing cylinder in any desired angular position. The winding of brake B is adapted to be energized to effect release of the brake upon closure of the run door switch 103

or upon bridging of contacts 110 by contacts 108 or 109 when the inch door switch 119 is closed.

What I claim as new and desire to secure by Letters Patent is:

5 1. A switch mechanism comprising, in combination, a part to be rotatably driven, a movable switch member having two switch-closed positions, operating means therefor comprising means operable by said driven part, an element
10 movable by said means in one direction or the other in accordance with the direction of and upon a given amount of rotation of said driven part, means associated with said element and tending to effect snap operation of said switch
15 member from one of said switch-closed positions to the other upon a given movement of said element, and means associated with said snap operating means to retard operation of said switch member between said switch-closed positions.

20 2. In a switch mechanism, in combination, a rotatably driven part, a movable switch member having two switch-closed positions, operating means therefor comprising means operable by said driven part, an element movable by said
25 means in one direction or the other in accordance with the direction of and upon a given amount of rotation of said driven part, means associated with said element and tending to effect snap operation of said switch member from
30 one of said switch-closed positions to the other upon a given movement of said element, means associated with said snap operating means to retard operation of said switch member between said switch-closed positions, and means affording
35 manual operation of said switch member to move the same into either of said switch-closed positions at will independently of the aforementioned means.

3. In a switch mechanism, in combination, switch means comprising a pair of spaced contacts, a contact member relatively movable with respect to the latter to engage the same selectively, operating means for said switch means comprising an element to be rotatably driven
45 in opposite directions, a second element rotatable by said first element, parts carried by the respective elements and arranged for interengagement upon completion by said elements of a predetermined amount of rotation in one direction
50 or the other, means including snap operating means adapted to be actuated by said elements upon interengagement of the aforesaid parts to effect operation of said switch means, whereby to effect separation of said contact member from
55 one of said contacts and to tend to effect engagement thereof with the other of said contacts with a snap action, and means associated with said last mentioned means to delay such engagement for a selected period of time.

60 4. In a switch mechanism, in combination, a rotatably driven part, a switch member movable alternately from one circuit closing position to another, means operable by said driven part upon completion thereby of a predetermined amount
65 of rotation in one direction or the other including means tending to effect snap movement of said switch member from one of said positions to the other, and means associated with said last mentioned means to retard the movement of said
70 member.

5. In a switch mechanism, in combination, a part to be reversibly driven, a pair of spaced contacts, a contact member movable with respect to the latter to alternately engage the same, means
75 operable by said driven part including snap oper-

ating means actuated upon completion by said part of a predetermined amount of rotation in one direction or the other to tend to effect snap movement of said contact member from one of said contacts to the other, and means associated with said last mentioned means to restrict said contact member during a portion of its movement to a predetermined relatively slow speed, whereby to delay engagement of said contact member with said latter contact for a selected time interval.

6. In a switch mechanism, in combination, a part to be rotatably driven in opposite directions through predetermined equal angular distances, a pair of spaced stationary contacts, a pivotally mounted contact member alternately engageable with the latter, means operable by said driven part including snap operating means arranged to be actuated upon rotation of said part through the aforesaid angular distance in one direction or the other to tend to effect snap movement of said contact member from one of said contacts to the other, and means associated with said last mentioned means to retard at least a portion of the movement of said member to a preselected lower rate of speed.

7. In a switch mechanism, in combination, a part to be rotatably driven in opposite directions for predetermined equal numbers of revolutions, a pair of spaced stationary contacts, a pivotally mounted contact member alternately engageable with the latter, means operable by said driven part including snap operating means adapted to be actuated upon completion by said part of the aforesaid amount of rotary movement in one direction or the other to tend to effect snap movement of said contact member from one of said contacts to the other, means associated with said last mentioned means to retard at least a portion of the movement of said contact member to a preselected lower rate of speed, whereby to delay engagement of said contact member with said latter contact for a selected time interval, and means to provide for manual operation of said contact member at will independently of the aforesaid means.

8. In a switch mechanism, in combination, a part to be rotatably driven in opposite directions for predetermined equal number of revolutions, a pair of spaced stationary contacts, a movable contact member alternately engageable with the latter, means operable by said driven part including snap operating means adapted to be actuated upon completion by said part of the aforesaid amount of rotary movement in one direction or the other to tend to effect snap movement of said contact member from one of said contacts to the other, means associated with said last mentioned means to retard at least a portion of the movement of said contact member to a preselected lower rate of speed, whereby to delay engagement of said contact member with said latter contact for a selected time interval, and means to provide for manual operation of said contact member into engagement with either of said contacts at will independently of the aforementioned means.

9. In a switch mechanism, in combination, a pivotally mounted contact member arranged for oscillatory movement between two circuit commutating positions, means for moving said contact member comprising a rotatable driven element, a second element arranged for rotation by said first element, parts carried by the respective elements and adapted for interengagement upon completion by said elements of a predetermined

number of revolutions in one direction or the other, a pivotally mounted lever arranged for oscillation between given limits, snap operating means associated with said lever, the aforesaid parts carried by said elements being adapted upon interengagement to trip said lever and render said last mentioned means effective to tend to move said contact member from one of said circuit commutating positions to the other with a snap action, and means for retarding at least a portion of the operation of said snap operating means, whereby complete movement of said contact member to the other of said commutating positions is effected only after lapse of a predetermined period of time.

10. In a switch mechanism, in combination, a part to be rotatably driven, a pivotally mounted contact member arranged for oscillatory movement between two circuit closing positions, operating means for said contact member comprising means operable by said part, said means including snap operating means to be actuated upon completion by said part of a predetermined degree of rotation in one direction or the other to tend to effect movement of said contact member from one of said circuit closing positions to the other with a snap action, and means comprising adjustable means associated with said snap operating means to retard at least a portion of the operating movement of the latter.

11. In a switch mechanism, in combination, a rotatably driven part, a switch member arranged for movement between two circuit closing positions, operating means for said switch member comprising a member carried by said driven part for rotation therewith, a second member rotated by said first member, parts carried by the respective members and arranged for interengagement upon completion by said members of a predetermined amount of rotation in one direction or the other, each of said rotating members comprising elements adapted for adjustment relative to each other for varying the relationship of said interengageable parts, whereby to provide for varying the amount of rotation of said members which is required to effect interengagement of said parts, means actuated upon interengagement of said parts including means tending to effect snap operation of said switch member from one of said positions to the other, and means associated with said snap operating means and operative upon movement of said switch member from one circuit closing position to retard movement of said switch member to the other circuit closing position.

12. In a switch mechanism, in combination, a rotatably driven part, a switch member arranged for movement between two circuit commutating positions, operating means for said switch member comprising means operable by said driven part and including snap operating means to be actuated upon completion by said part of a predetermined number of revolutions in one direction or the other to tend to effect movement of said switch member from one of said positions to the other with a snap action, and means associated with said snap operating means to retard at least an intermediate portion of the movement of said switch member thereby to a predetermined relatively slow speed, said means comprising a dashpot having an adjustable orifice.

13. In a switch mechanism, in combination, a part to be rotatably driven, a member arranged for movement between a plurality of circuit commutating positions, operating means for said member including means operable to tend to ef-

fect snap movement of said member from one of said positions to another, means operable by said driven part upon completion thereby of a predetermined number of revolutions in one direction or the other to render said snap operating means effective, means providing against movement of said member from one of said positions toward another until after said snap operating means is rendered effective, and means associated with said snap operating means to retard at least a portion of the movement of said member thereby, for the purpose set forth.

14. In a switch mechanism, in combination, a part to be rotatably driven, a member arranged for movement between two circuit commutating positions, operating means for said member including means operable to tend to effect snap movement of said member from one of said positions to the other, means operable by said driven part upon completion thereby of a predetermined degree of rotation in one direction or the other to render said snap operating means effective, means comprising yieldable detent means to provide against movement of said member from one of said positions toward the other until after said snap operating means is rendered effective, means associated with said snap operating means for retarding operation thereof to a preselected lesser speed, whereby to delay movement of said member to the other of said positions for a predetermined time interval, and means providing for manual operation of said member for either of said positions to the other at will independently of the aforementioned means.

15. In combination, a rotatably driven part, a switch mechanism including a yieldably held pivot member, a switch member arranged for oscillatory movement about said pivot member between two circuit controlling positions, operating means for said switch member comprising an oscillating carrier arm, a second pivot member carried by the latter and cooperating with said switch member, means operable by said driven part including snap operating means to be actuated upon completion by said part of a predetermined degree of rotation in one direction or the other to tend to effect movement of said carrier arm in one direction or the other with a snap action, whereby to effect movement of said switch member from one of said positions to the other, adjustable means associated with said carrier arm to retard at least a portion of the operating movement thereof, whereby to delay movement of said switch member into said last mentioned position for a predetermined time interval, and means associated with said first mentioned pivot member to provide for movement of the same manually, whereby said switch member is moved about said second mentioned pivot member from either of said circuit controlling positions to the other selectively.

16. In a device of the character described, in combination, a rotatably driven part, a switch member movable between two circuit closing positions, operating means for said switch member comprising a pivotally mounted lever operable between given limits, a pair of driving gears each having a like number of teeth, said gears being associated with said driven part and arranged for rotation therewith, a pair of driven gears cooperating respectively with said driving gears and each having a like number of teeth differing by at least one from the number carried by each of said driving gears, means including a depressible, radially projecting member

associated with each gear of one of said pairs, each gear of the other pair having an annular flange associated therewith, and each flange having a peripheral notch formed therein, said projecting members or said notches, or both, being angularly spaced, the arrangement being such that one or the other of said projecting members engages one or the other of said notches upon completion by said gears of a predetermined degree of rotation in one direction or the other, depending upon the angular spacing of said parts, to trip said lever toward one or the other of its limits, means associated with said lever including means operable upon tripping thereof to tend to complete operation of the same into said limit with a snap action, means operable by said lever to move said switch member from either of its circuit closing positions to the other in accordance with the direction of operation of said lever, and means for retarding at least a portion of the snap operating movement of said lever, whereby movement of said switch member into said last mentioned circuit closing position is delayed, for the purpose set forth.

17. In a reversing mechanism, in combination, a rotatably driven part, a pivotally mounted lever operable between given limits, a pair of driving gears each having a like number of teeth, said gears being associated with said driven part and normally arranged for rotation therewith, a pair of driven gears cooperating respectively with said driving gears and each having a like number of teeth differing by at least one from the number carried by each of said driving gears, means including a depressible, radially projecting member associated with each gear of one of said pairs, each gear of the other pair having a substantially circular flange associated therewith and each flange having a peripheral notch formed therein, said projecting members or said notches, or both, being angularly spaced, the arrangement being such that one or the other of said projecting members engages one or the other of said notches upon completion by said gears of a predetermined degree of rotation in one direction or the other, depending upon the angular spacing of said parts, to trip said lever toward one or the other of its limits, means associated with said lever and operable upon tripping thereof to complete operation of the same into either of its limits at a predetermined rate, and manually operable means associated with said driving gears to provide for angular adjustment of one of the same relatively to the other, whereby to effect adjustment of the angular relationship between said projecting members and between said notches, to thereby vary the amount of rotation required of said gears in each direction to effect engagement of said members with said notches.

18. In a reversing mechanism, in combination, a rotatably driven part, a driving gear member associated with said driven part and arranged for rotation therewith, a driven gear member cooperating with said driving gear member, one

of said gear members differing from the other by at least one tooth, a pivoted, oscillatable arm, means including a part adapted to move said arm in each direction between given limits, means for actuating said last mentioned means including parts carried by said gear members, respectively, said last mentioned parts being adapted for interengagement upon completion by said gear members of a predetermined number of revolutions in one direction or the other, and means associated with said arm and adapted to control the movement thereof at a varying rate between said limits independently of said actuating means.

19. In a reversing mechanism, in combination, a rotatably driven part, a driving spur gear member associated with said driven part and arranged for rotation therewith, a driven spur gear member co-operating with said driving gear member, one of said gear members differing from the other by at least one tooth, an oscillatable arm, means for moving said arm in each direction between given limits including an oscillatable lever, means for tripping said lever including parts carried by said gear members, respectively, said parts being adapted for interengagement upon completion by said gear members of a predetermined number of revolutions in one direction or the other, means associated with said lever and operable upon tripping thereof to tend to effect movement thereby of said arm from either of its limits to the other with a snap action, and means including a dash-pot for retarding at least a portion of the movement of said arm in each direction.

20. In a reversing mechanism, in combination, a rotatably driven part, a driving spur gear member associated with said driven part and arranged for rotation therewith, a driven spur gear member cooperating with said driving gear member, one of said gear members differing from the other in respect of the number of teeth, a movable arm, means including a pivoted lever for effecting movement of said arm in opposite directions between given limits, means including parts carried by the respective gear members for tripping said lever, said parts being adapted for interengagement upon completion by said gear members of a predetermined number of revolutions in either direction, means associated with said lever and operable upon tripping of the latter to tend to effect movement of said arm from either of its limits to the other with a snap action, means including a dashpot for retarding a portion of the movement of said arm in each direction to provide a predetermined time delay in the complete operation thereof, a switch member associated with said movable arm for movement by the latter under normal conditions, and associated means providing for manual operation of said switch member in either direction at will independently of said arm.

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