

Oct. 20, 1953

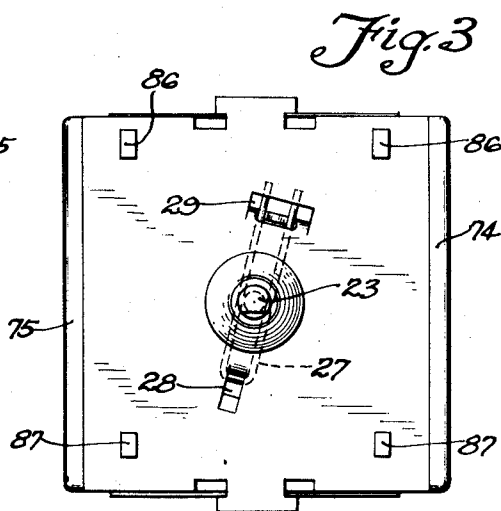
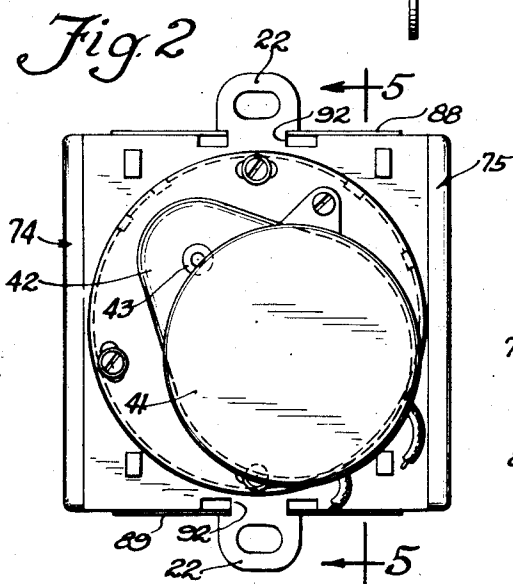
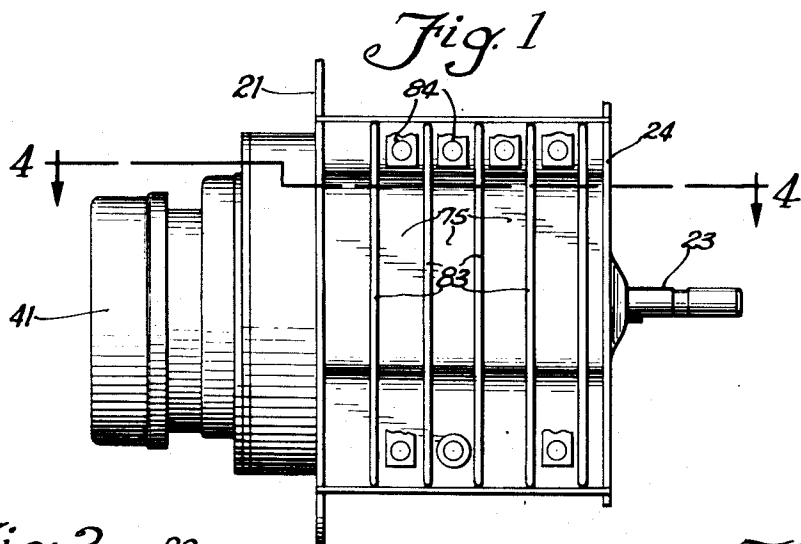
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2,656,424

AUTOMATIC TIMING APPARATUS FOR WASHING MACHINES

Filed Aug. 7, 1951

4 Sheets-Sheet 1



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AUTOMATIC TIMING APPARATUS FOR WASHING MACHINES

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4 Sheets-Sheet 2

Fig. 4

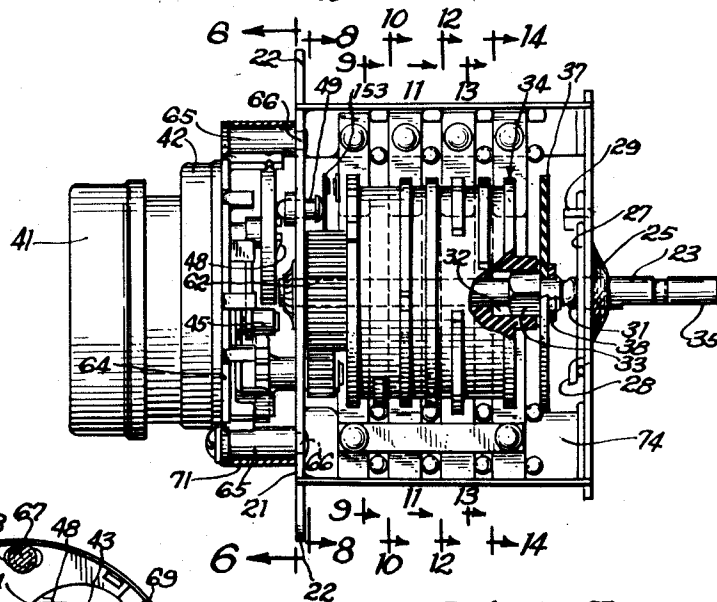
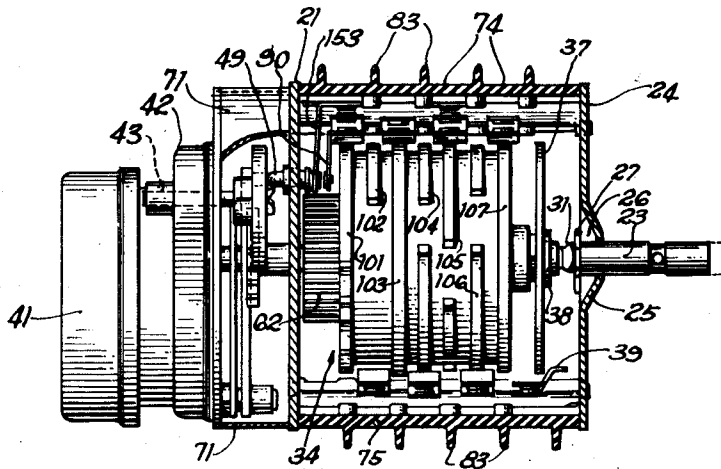


Fig. 6

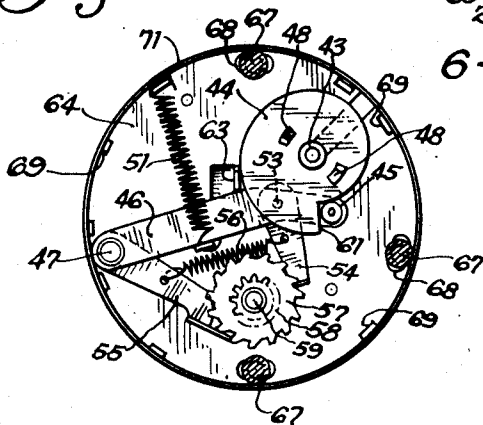


Fig. 5

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AUTOMATIC TIMING APPARATUS FOR WASHING MACHINES

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Fig. 7

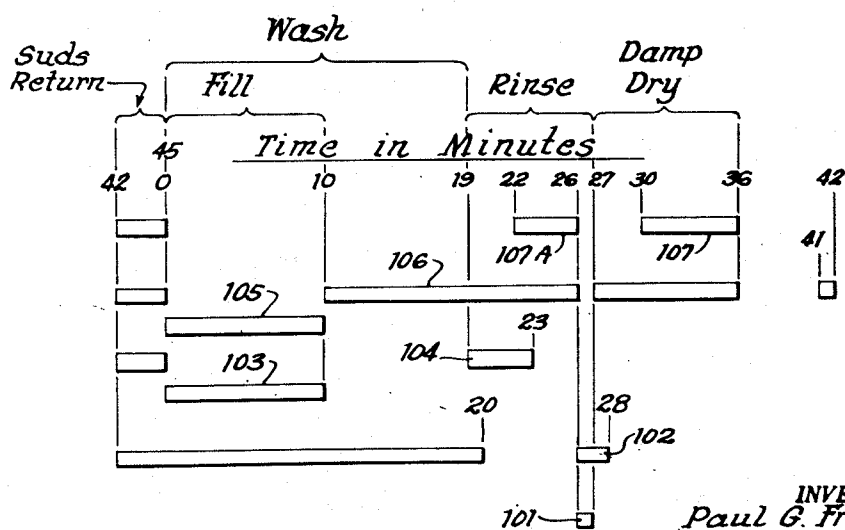
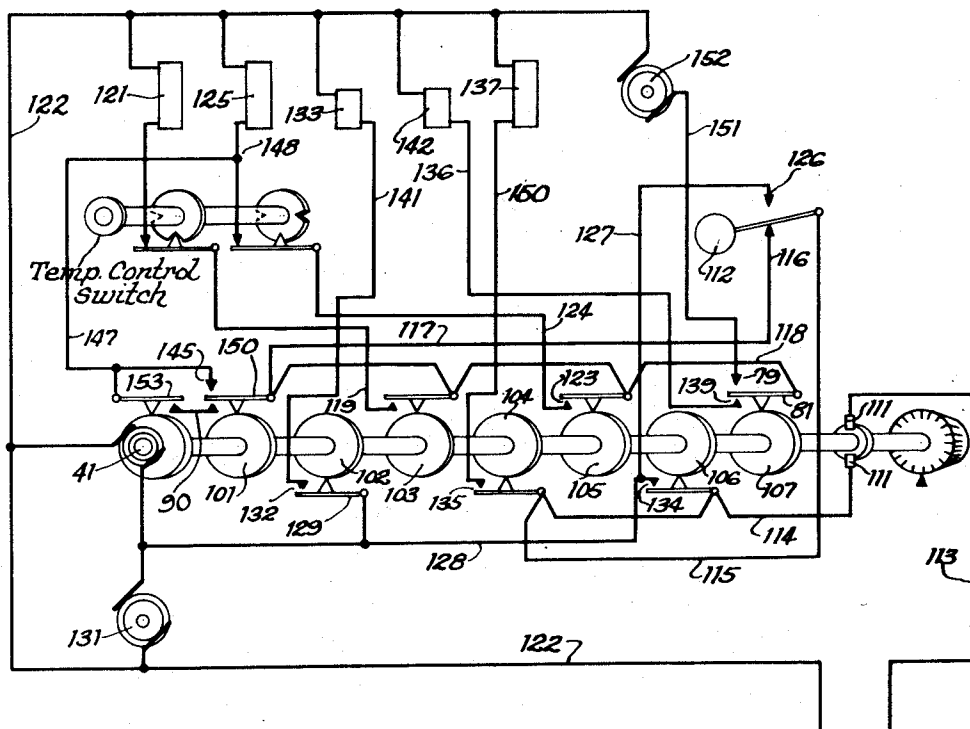


Fig. 15

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AUTOMATIC TIMING APPARATUS FOR WASHING MACHINES

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4 Sheets-Sheet 4

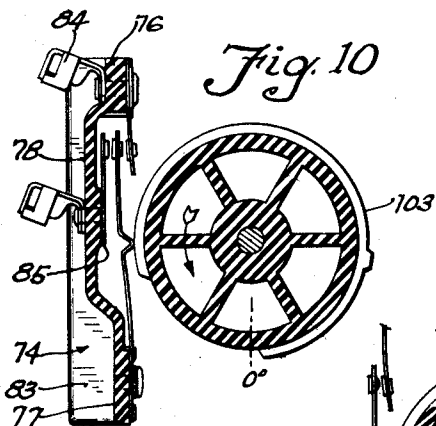
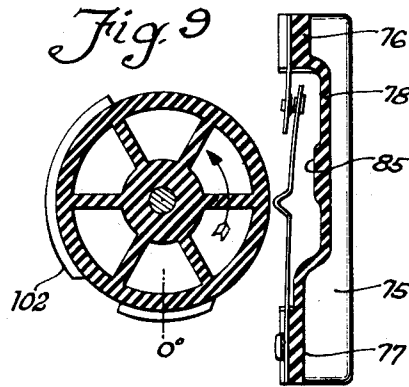
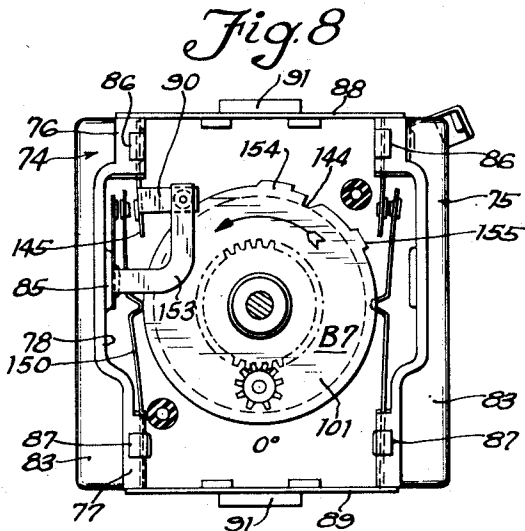
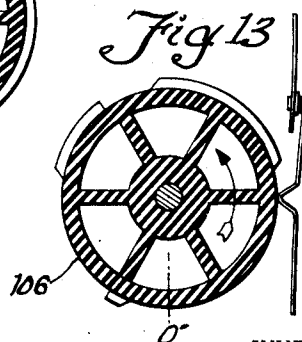
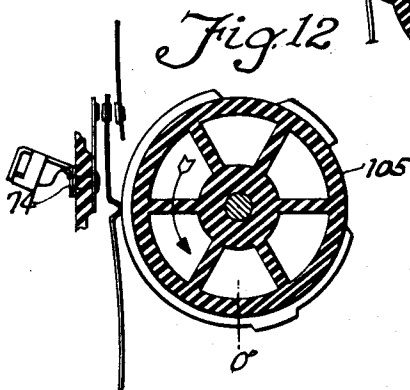
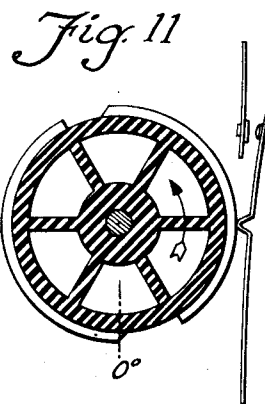
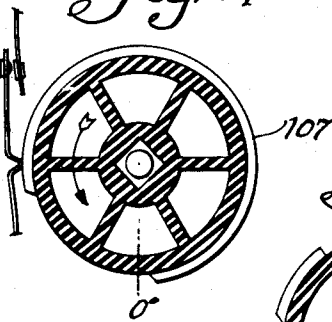


Fig. 14



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UNITED STATES PATENT OFFICE

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AUTOMATIC TIMING APPARATUS FOR
WASHING MACHINES

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Products, Inc., Schiller Park, Ill., a corporation
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Application August 7, 1951, Serial No. 240,672

4 Claims. (Cl. 200—35)

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The present invention relates to electrical circuit controlling apparatus for automatically cycling the various operations of a washing machine such as water supplying, agitation, rinsing, etc.

In its disclosed embodiment there is contemplated a centralized system of timing cams around which are clustered groups of primary and secondary control contacts, each brought into play at a predetermined interval of a washing cycle and rendered effective for a predetermined duration. Automatic supervision is made contingent upon prerequisite establishment of proper operating conditions and is susceptible of being arrested in the event of certain developments during a normal or proper performance cycle. Each washing machine function including for example agitation, rinsing, etc. is made to occur for a predetermined duration and in its proper sequence of the cycle. For the purpose of utilizing more efficiently prepared detergent liquids provision is made for drawing them off into a reservoir so that they can be re-used in successive washing operations or until they are fully spent.

Provisions have been made for suspending the continuation of the operative cycle in the event of certain contingencies such as a failure of water supply, etc. and in addition various stages of the performing cycle may be wholly or partially repeated for the sake of achieving accentuated action in respect to any of the detailed performances that constitute the full cycle.

In order to make the industrial production and assembly of automatic washing machines a more efficient and profitable undertaking from an industrial viewpoint the timing apparatus constituting the essence of the present invention has been designed in such a manner as to be especially compact while yet to be readily accessible and to dispose its various control contacts in a manner which will render them to be more easily accessible for wiring and installation purposes. Also, the timing apparatus is inherently of simple and efficient design so that it may be located in a position relatively remote with respect to the moving portions of the washing machine and to thus be more convenient for overseeing and regulation when required.

Further, the timing apparatus has been reduced in its complexity of parts in a manner such that the entire control is accomplished by a single rotary shaft on which are carried a distribution of timing cams having apices and recesses in homogeneous alignment and circumferential conformity.

In keeping with the foregoing objectives and purposes the single centralized timing cam has been so constructed that its manufacture is feasible to be accomplished in a single monoblock

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susceptible of being molded under high speed production methods and in accordance with certain efficiencies that are inherent in ejection molding methods of production.

A further and equally important characteristic of the compact design is its incorporation with a manually controllable selector which may instantly be invoked to supersede automatic operation without in any way disrupting the electrical or mechanical train of elements. By means of this device the total automatic supervision may be instantaneously arrested at any time during the successive intervals which comprise the entire cycle and in its stead the successive cyclic operations may be performed by hand giving to each interval any desired duration or continuity of operation until that step has been satisfactorily completed. Thereafter, automatic operation may be just as instantly reinstalled.

While automatic control or supervision as applied to washing machines and similar apparatuses is not generally speaking a new concept the teachings which comprise the instant invention are believed to advance the principles of timing apparatus design and manufacture to a degree whereat they may be produced under mass production methods with a greater reliance upon their accuracy and dependability of performance. A principal object of the present invention is to achieve a motor driven timing unit adaptable for the supervision of washing machines which may be mass produced at low manufacturing costs and under conditions of materially lessened labor and shipping expenses.

Another object of the present invention is to achieve an automatic timing mechanism which is particularly adapted to the supervision of clothes and dish washing machines which lends itself readily to installation within small and otherwise non-utilizable spaces.

Other and further objects of the present invention are such as will become more evident during the course of the following detailed description and explanation and upon referring to the hereinafter appended claims.

In the accompanying drawings

Fig. 1 is a side elevational view of a motor driven timer cam assembly having embodied therein various features of the present invention,

Fig. 2 is an end elevational view of the apparatus illustrated in Fig. 1 indicating the relative position of the case enclosed motor drive and gear train,

Fig. 3 is an end elevational view of the same apparatus looking in a direction opposite to that of Fig. 2,

Fig. 4 is a transverse sectional view taken approximately on line 4—4 of Fig. 1,

Fig. 5 is a transverse sectional view through

the contact assembly and distributor cam with portions broken away and is taken approximately on line 5—5 of Fig. 2,

Fig. 6 is a transverse sectional view taken approximately on line 6—6 of Fig. 5,

Fig. 7 is a schematic diagram illustrating conventionally the timing cam and its supervised contacts as well as the wiring diagram related thereto,

Fig. 8 is a transverse sectional view taken approximately on the line 3—3 of Fig. 5,

Fig. 9 is a transverse sectional view of a fragment of the apparatus and may be located from the designating line 9—9 of Fig. 5,

Fig. 10 is another transverse sectional view of a detail of the timing cam and one of its contact pair indicated by the line 10—10 on Fig. 5,

Figs. 11 through 14 are similarly transverse views taken approximately on their respective lines of Fig. 5, and

Fig. 15 is a diagrammatic timing chart indicating empirically the sequence relationship of the various cams and their periodicity and duration with respect to an operative cycle.

Attention is now directed to the accompanying drawings in which like reference numerals designate corresponding parts throughout and wherein the reference numeral 21 denotes a mounting flange which also forms one of the side plates that encases the timing cam assembly principal housing. Ear flanges 22 are apertured so as to receive mounting bolts whereby the timing cam assembly may be made fast to a surface wall or other flat area which may be conveniently provided in a washing machine supporting structure.

A suitable mode of mounting the unit may be chosen under which the control shaft 23 is so arranged as to protrude in a prominent and accessible position of the washing machine so as to make it suitable for manipulation for starting as well as for shifting the control to manual supervision. The face plate 24 which is opposite the already described plate 21 need not have the mounting gears but in all other respects may conform in outline as well as in perforation profile to the first mentioned plate. In addition this second plate is provided with a shaft aperture and surrounding embossment as at 25 by reason of which there is provided the interior space 26 for accommodating the hair pin retaining spring 27, see also Fig. 3.

Spring 27 is made of round wire stock and is shaped so that its parallel legs straddle the shaft 23 while the head of the pin 27 is lashed under an outwardly struck clip 28 of wall 24. Its free ends are confined with a hole in perpendicularly extending stock lug 29 to prevent the spreading of the free ends of spring 27 beyond a predetermined maximum. The legs of spring 27 will be observed to have a normal spacing so as to straddle the shaft 23 under some tension at a point wherein it has been turned down so as to afford a rounded intermediate collar section 31 flanked by annular seating grooves one on each side of said collar 31.

By means of the aforescribed arrangement shaft 31 may be shifted longitudinally throughout a limited distance which corresponds to the space or clearance that may be observed at point 32 in Fig. 5 where a square enlarged neck section 33 of the shaft 23 is confined within a similarly cross-sectioned recess in the apertured core of a molded integral cam assembly generally designed 34.

Inwardly of the squared neck portion 33 shaft 23 continues at its original diameter affording thereby an ample and steady journal to the interfitting relationship between this member and the cam assembly 34. The outer extremity of shaft 23, that is, that portion which protrudes to the outside of wall 24 is preferably flattened as at 35 after a well known practice so as to afford thereby a mode of adequately receiving the set screw extremity in tensioned juxtaposition when an operating handle (not shown), usually molded of non-conductive material is applied to the shaft in order to make its regulation by the attendant convenient both for the purposes of longitudinally shifting the shaft 23 as well as for rotating it manually to advance the cam assembly 34 successively from one control position to another as will become more evident by the description to follow.

An electrically non-conductive disc 37, Figs. 4 and 5, is splined to the shaft 23 on a reduced collar portion thereof next adjacent the square section 33. This disc may be held securely and rigidly in this confinement by means of a tightly fitted pressure washer 38 which may be pressed over the seating collar, the end of which is then swaged over or otherwise immobilized so as to give to the disc 37 a secure rigidity. In this way it may maintain itself against dislodgment under operating conditions when its periphery is utilized for camming and thereby operating a contact spring 39 between open and closed positions for a purpose which will become more evident later.

It is the relative longitudinal placement of disc 37 acting upon contact spring 39 which determines whether the timing apparatus is to function automatically under impetus of its motor and gear train or whether the drive is to be electrically disabled whereupon the advancement or rotation of the cam assembly 34 requires to be accomplished manually by rotation of the shaft 23 through its manipulation knob fitted over its outmost end.

The electric motor 41 which drives the timing apparatus is one of a conventional type synchronously driven and self starting entirely contained within a dust protective enclosure housing and carrying upon a short length of armature shaft a driving pinion which actuates a train of reduction gears contained within the gear housing 42 with the ultimate or emergent shaft 43 being driven at a reduced rate of speed, usually one R. P. M. Shaft 43 carries securely fast to its extremity a cam 44 the contour of which is best evident in Fig. 6.

A follower roller 45 sidewardly extending from the end of a lever 46 pivoted at 47 rides the periphery of cam 44 as the latter member describes its cyclic rotation at the aforescribed rate of operation and in addition the cam 44 will be observed to have two sidewardly extending cam projections 48, see also Fig. 5, which act against the innermost end of a contact operating plunger or pin 49, see also Fig. 4.

So long as electric current usually from a domestic supply source is fed into the windings of the synchronous motor 41, cam 44 will continue to undergo revolution at the rate of 1 cycle per minute and its involute periphery will continue to actuate lever 46 through the follower roller 45 opposing the return spring 51. Also, the sidewardly extending cam projections 48 will continue to actuate plunger 49 and as a consequence will cause to be closed the contact pair 93—153

twice during each cycle of rotation of shaft 43 and each contact closure period will approximate seven seconds. This contact pair functions to energize a water valve flow control for supplying spray water at certain intervals only, which, as will be explained later, follows the wash and rinse operations and causes a spray of water to be directed upon the load in order to cleanse off any detergent residues from a preceding treatment.

Lever 46 carries at an intermediate position of its length designated 53 a brief stud pivot on which swings the feed pawl or arm 54. A detent arm 55 also pivoted at 47 is connected by a spring 56 with the feed arm 54 so as to exert a mutually yieldable force urging both pawls 54 and 55 into engagement with the teeth of a feed sprocket 57. Sprocket 57 is an integral part of a bushing member which includes driving pinion 58 and this member journaled on a cantilever stud shaft 59.

The feed action of sprocket wheel 57 is in a counterclockwise direction as observed in Fig. 6 impelled by the yieldable force of spring 51 acting through lever 43. As each step-by-step advance is attained by sprocket 57 the latter is prevented from returning clockwise with the forward stroke of the feed pawl 54 by the positive blocking engagement of the end of detent pawl 55.

It is to be noted that each rising movement of feed pawl 54, stimulated by the long ascendancy of the involute curvature of cam 44, occupies nearly all of the one minute interval which is the revolving rate of shaft 43. Its movement in the opposite direction under influence of spring 51 is a relatively instantaneous response as the follower roller 45 falls off of the cam drop 61.

Pinion 58 meshes with the molded gear 62 that forms part of the cam assembly 34. The gear ratio between pinion 58 and gear wheel 62 has been selected at three to one. There being fifteen teeth to the sprocket wheel 57, it follows that cam shaft 23 together with its cam assembly 34 will undergo a full cycle of revolution once every forty-five minutes. This time has been chosen as adequate for performing the various supervisions and operations necessary to accomplish the different functions which are necessary for a clothes washing machine to perform during domestic use. It will be understood, of course, that the matter of driving ratios and distributions of function regulating cams are arbitrary arrangements and that where other machines of a similar nature are to be correspondingly supervised and regulated the period of the timing cycle and the distribution of the cams and may be revised within the contemplation of these teachings.

Attention will now be directed to the performance of the pawls 54 and 55 when it is desired to override automatic operation by manual intervention. Because gear 62 which is an integral part of the cam assembly 34 is positively meshed with pinion 58 and the latter forms an integral part with sprocket 57 it follows that shaft 23 may be rotated in one direction only and that this direction is clockwise as this shaft would be observed if it were shown in Fig. 6. The pinion 58, with which gear 62 meshes, can only rotate counterclockwise because the shoulder extremity of pawl 55 positively engages the teeth of sprocket 57 when it is attempted to rotate shaft 23 in a counterclockwise direction.

During the permissive rotation of shaft 23, namely clockwise, with sprocket wheel 57 caused thereby to be rotated counterclockwise, pawls 54 and 55 overpowering their mutual spring 56 will

click idly as the teeth of sprocket 57 pass under them. The tension of spring 56 requires to be but very mild in order to accomplish the purposes of detent pawl 55 in positively engaging the teeth of sprocket 57 for the purpose of preventing reverse or clockwise rotation thereof, and for the purpose of urging feed pawl 54 into engagement as it rides from one tooth to the next during successive actuations of lever 46. Movement of lever 46 in a counterclockwise direction about its pivot 47 is prevented from carrying beyond the position shown in Fig. 6 when the back of said lever encounters the stop lug 63, a protrusion which is formed by striking out a perpendicular ear from an area of metal mounting plate 64.

Plate 64 which, as had been said, is a mounting plate for the gear train and motor cases 42 and 41, is itself supported upon three mount posts 65, shown to be riveted or otherwise secured to the principal mount plate 21 as at 66. The ends of the three posts 65 are drilled and threaded to receive the securement screws 67 which pass through elongated apertures 68 thereat provided to afford a short but significant angular adjustment which has been found to liberalize manufacturing tolerance requirements.

At various points about the periphery of mounting plate 64 there are provided minute spacer projections 69 which are also struck and formed of the stock which comprises plate 64 just as in the case of stop lug 63, but these projections 69 are for the purpose of confining an encircling band 71 which may be made of relatively thin sheet metal stock and which thereby is afforded adequate rigidity as well as stability to accomplish its purpose of protecting the mechanism located between mounting plates 64 and 21 against invasion by dust and foreign matter.

Attention will now be directed to the cam assembly 34 the design and arrangement of which is not only noteworthy for its simplicity and compactness as to space and economy of fabrication material, but because it has been so laid out as to be constructible as a monoblock, that is to say, so as to be molded out of a single unit of plastic consistent with the vagaries of extrusion molding. The cam assembly comprises essentially a cylindrical cored-out member whose periphery carries a plurality (in the present instance seven) circumferential cam tracks. Each cam track or cam disc which forms a part of the cam assembly 34 comprises an arcuate projection radially of shallow amplitude having but slight difference between its apex and nadir contact actuating surfaces.

On opposite sides of the cam assembly 34 and forming part of the respective wall surfaces which enclose the cam are a pair of similarly profiled molded wall elements designated 74 and 75. It is to be observed that although these two members are identical throughout so as to lend themselves to be made by the same set of molding dies, they have been designed with certain features of placement adaptability so as to be placed on opposite sides of the cam assembly 34 and when so placed to dispose their respective alignments of contact pairs in a staggered relationship with respect to the contact pairs of the other wall. This arrangement is best illustrated in Fig. 4 where it will be observed that each wall 74 and 75 is provided with four recesses within which the four contact pairs are placed and that each recess aligns itself with one of the cam tracks or cam discs of the cam assembly 34.

Moreover, each wall element 74 and 75 consists

of an upper 76 and lower 77 relatively solid beam element with an intermediate portion that is recessed or set back as at 78 whereby there is afforded sufficient rearward clearance for the mounting of back contact springs 79 where required and for the movement of contactor springs 81 under double throw action even when stimulated by a shallow impulsing at their points of contact with the peripheries of the cam tracks of assembly 34.

The molded wall elements 74 and 75 are longitudinally reinforced against likelihood of distortion by being provided with a series of vertical reinforcing ribs 83 which also serve the purpose of partitioning the plug receptacle terminals 84, Fig. 1, from each other whereby they may be placed relatively closer to one another without incurring the hazard of accidental electric shorting.

The recessed wall formation 75 is preferably shaped to afford a slight plateau formation as at 85 so that back contact springs 79 when required, may be mounted thereon in a manner which will afford sufficient clearance to permit said springs to be flexed slightly for promoting wiping engagement between their contact points and those of their engaging contractor springs 81. At each end of the wall sections 74 and 85 they are provided with a pair of protruding lugs 86 and 87 adapted to be received within identically shaped apertures in the end walls 21 and 24 whereby the walls 74 and 75 are accurately and infallibly located in respect to the enclosure assembly. As will be noted from Fig. 8 these projecting lugs 86 and 87 are of slightly different size each pair from the other and by reason of this arrangement there is prevented improper placement of the molded end walls in respect to the mounting plates 21 and 24 thereby preventing improper assembly of these members and permitting this operation to be carried on by a relatively lesser skilled standard of factory talent.

Complete enclosure of the cam space or housing between the wall elements 74 and 75 on the one hand and the mounting plates 21 and 24 on the other is accomplished by placement of thin plastic or fibre rectangular sheets 88 and 89 over the remaining opposite sides. These plates may be economically stamped or cut from thin stock of insulation material and by being provided with accurately profiled shallow notches at their ends, made to secure themselves by projecting on both sides of the T-formations 91 at the top and bottom plate 24 as well as by the similar provisions 92 of the necked-down shanks of the ears 22 which are integral with the mounting plate 21.

It is to be noted that the entire timing apparatus is thus constituted a unitary and compact mechanism adaptable to mounting in any convenient apertured location by means of but two mounting ears 22 on plate 21 and when so placed is able to withstand the rigors of constant and continuous use. Attention will now be directed to electrical phases of this mechanism and for this purpose the description will concern itself more closely with the illustrations of Figs. 7 and 9 through 15. The cam barrel assembly 34 is provided with seven peripheral cam discs designated 101 through 107. The shape of each one of these sections or cam peripheries may be discerned from the seven sectional views including Figs. 8 through 14 as well as from the empirical timing chart although the latter will be recognized to portray timing rather than merely cam profiles developed.

At the time of starting, cam shaft 23 is withdrawn into the position at which it is shown in dotted outline in Fig. 4 and an indicator which may be a part of its operating handle is pointed toward that portion of a circular index scale which designates a selective ten minutes from among a total of twenty minutes allocated to the washing interval. The operator by means of this selection may choose or predetermine the washing interval to last any amount of time beyond ten and up to twenty minutes according to the estimated requirements of her particular washing load.

The laundry is presumed to have been placed into the washing and agitating chamber of the tub and hot and cold water sources connected to the two way valve and ready to be supplied when called upon by the automatic supervisory system. At this time the operator depresses the manual shaft 23 placing it into the condition in which it is shown in full lines in Fig. 4.

As a consequence of this performance, switch operating disc 37 rides off the high point of its contact blade 39 where it had been holding open the main line supply contacts 111, Fig. 7, and completing an operating circuit to the timer motor 41.

If the washing machine tub is empty or still not filled with sufficient water to actuate the level responsive toggle switch 112, Fig. 7, the power line circuit just established by the operation of contact pair 111 is traceable from main line 113 through the contact pair 111, bus 114, line 115, toggle switch contactor 112, its lower terminal 116, line 117, to the supply bus 118. By referring to the timing chart, Fig. 15, it will be observed that at this time cams 103 and 105 are in effective or contact closing position, whereupon the afore-described circuit is further traceable over line 119 to the hot water control valve 121 and return line 122 so that hot water will be permitted to flow into the tub during this interval and while the cam assembly remains motionless. On the other hand this circuit is further traceable through the contact 123 which is also at this time closed due to effectiveness of cam 105, over line 124, the energizing winding of mixing valve 125, and return line 122, causing the mixing valve to be operated for the purpose of tempering the hot water with cold in order to fill the tub with the water at the desired temperature.

Eventually the tub becomes filled and the toggle switch 112 is caused to rise and make contact with its upper contact point 126, Fig. 7. As a consequence, the afore-established current is cut off at bus line 118 and is transferred instead to line 128 which connects with the contactor 129, as well as with the terminals of the washing machine motor 131 and the sequence timer motor 41. The return terminals of both of these motors are connected to the return power line 122 and as a consequence both of these motors will start into operation, the sequence timer beginning to toll off its forty-five minute cycle.

The mechanical performance of the sequence switch operating motor has already been described above and consists essentially in the rotation of power cam 44 and in the resultant step-by-step movement of sprocket 57 which is geared, by means of pinion 58 and driving gear 62, to the cam assembly 34. By referring to the timing chart, Fig. 15, it will be observed that the agitation cycle which is under the control of cam 102 continues slightly beyond the washing cycle so that the washing machine motor 131 will be ef-

fective so long as contact pair 132 of cam 102 continues to energize the agitator clutch winding 133.

Near the middle of the washing cycle, cam 106 becomes effective and closes its contact pair 134. This supplies an alternative path for maintaining power line 113 in communication with supply line 128 for continuing the operation of motors 41 and 131 when the toggle action switch 112 drops in response to the subsequent emptying of the washing machine tub detergent water.

Shortly before the end of the washing cycle, cam 104 becomes effective and closes its contact pair 135. As a consequence an energizing current is established traceable from terminal line 113, contact pair 111 and bus wire 114, through the contact pair 135, thence out over line 150 to the energizing winding of a two-way valve 137, thence out over return line 122 to the opposite side of potential source. Thus the closure of contact pair 135 for the interval which is designated in Fig. 15 on cam profile 104 the washing water is drained off into a storage receptacle and may be re-used at a later time.

As the sequence switch continues to toll off its cycle, cam 107 becomes effective and since its contactor follower is a double throw element as best illustrated in Fig. 8, its first performance, represented by segment 107, is to engage with front contact 139, Fig. 7, completing a circuit which has been prepared by the recession of float toggle switch 112 and traceable from power line source 113, through the contact pair 111, line 114, thence over line 115, through the toggle contactor 112 and its lower contact point 116, line 117 to the bus wire 118, contactor 31 and its lower contact point 139, line 136, through the winding of the extractor operating device 142 to the return power line 122. As a consequence of this operation there is removed from the tub by the extractor apparatus all residual traces of rinse water or washing water that failed to run out as a result of the action of the drainage valve 137. Also this extraction removes such added water as is the consequence of the operation of the two seven second sprays which will be more particularly described later.

The aforescribed extractor action prevails until the end of the 107 cam interval which coincides with the twenty-sixth minute of the total operating cycle. Coincident with this termination cam 106 rides out from under its contact pair 134 and the aforescribed holding circuit for maintaining power to the sequence timer and principal machine motors 41 and 131 becomes broken, reestablishing the dependency for current by these motors onto the prevalence of an adequate water supply in the tub to float the toggle switch 112.

Since water has been drained out by the last described extractor and valve operations the motors 41 and 131 will be at once arrested. As this occurs, however, cam 101 reaching the interval which corresponds to the twenty-sixth minute of the overall cycle, presents its nadir 144, Fig. 8, to the follower projection of its contactor spring 150, permitting the latter to fall back into engagement with its back contact point 145, which thereby extends power from line 113 through the contact pair 111, bus 114 and line wire 115, through the depressed toggle switch 112 now in engagement with its lowermost contact 116, over line 117 contactor 31 now in engagement with its back contact point 145, line 147 which joins with line 124 at junction 148, thence through the winding of mixer valve 125 and out over return line 122. As

a consequence the mixer valve is opened, permitting rinse water to enter into and fill the tub. At this time the timer switch is arrested awaiting the filling of the tub and as soon as that happens the toggle 112 snaps to its opposite or uppermost position engaging the top contact point 126, breaking the circuit to the mixer valve 125 just described and in its stead reestablishing the power circuit to line 128 which feeds the motors 41 and 131.

The clothes will now be agitated in fresh rinse water and the timing switch proceeds from its point of arrestment at the twenty-sixth minute position of the timing chart and enters upon the twenty-seventh minute interval. Agitation continues for two minutes and cam 106 reestablishes the holding circuit for nine minutes taking away the control over the motor circuit from float toggle switch 112 during this interim.

At the thirtieth minute cam 107 again closes its contact 31 and contactor 39 extending operating power out over line 136 to operate the extractor device 142 which discharges the rinse water and again empties the tub. At the end of the thirty-sixth minute cam 107 rides out from under its contactor 31 and the aforescribed holding circuit for maintaining the motors in operation is broken, whereupon when the tub is fully emptied the two motors are again brought to rest.

At this time the active portion of the operating cycle is terminated and the clothes are ready to be removed or to be rewashed if that is thought to be necessary. In any event, if another washing is to follow the timer dial is rotated until its indicator points to the area marked "Suds return." This is a manual regulation since it is tantamount to a recycling and should be performed only under discretionary supervision. As a consequence of the rotation of shaft 23 carrying with it the cam assembly 34, a condition is established effecting closure of contact at cams 102, 104, 106 and 107.

As a consequence of the closure of contact pair 132 by cam 102, a circuit is reestablished for operating the agitator device 133 for the purpose of reviving suds in the returning detergent water so that it will at once be in readiness for action upon a new batch of laundry or upon the old batch if it is to be rewashed. As a consequence of the operation of cam 106 upon its contact pair 134, the holding circuit for reactivating motors 41 and 131 is again closed, causing these members to resume rotation. As a consequence of the operation of cam 104 closing its contact pair 135 an energizing circuit is established over line 150 reopening the valve 137 to establish communication between the tub and the reserve storage tank whereinto the suds have been discharged. Finally, as a result of the operation of cam 107, in this instance elevating its follower 31 so that it engages its forward contact point 79, a circuit is established extending power over interim bus line 118 through the contact pair 31 and 79, out over line 151, to the winding of a motor which operates pump 152, thence over return line 122. As a consequence the pump operates until all of the reserve water from the storage tank has been brought back into the tub and until the float valve 112 is again suspended to open the circuit through its lower contact 116 in which case the motor of pump 152 will be arrested.

If the reserve storage tank supplies an inadequate amount of water to float valve 112 supplemental water will be added at the start of the subsequent operating cycle when cams 103 and

105 take over, as in the first described cycle, to operate mixing valve 125 and hot water control valve 121.

Attention is now directed again to the performance of cam 101, and in connection therewith to the operation of the seven second spray control under the supervision of the two side projections 48 of cam 44. It will be observed from Figs. 4, 5, and 8 that actuating plunger 49 functions to press contactor 153 into engagement with the back contact point of contactor 90 twice during each one-minute cycle of cam 44. Contactor 153 is an electrically conductive extension of back contact 145 which is capable of establishing electrical connection with contactor 150 only during the brief intervals represented by cam projections 154 and 155 of cam 101, see Fig. 7. It will be understood therefore that although the seven second rinse operations are mechanically stimulated twice during each rotation of cam 44, yet the only times during which the sprays are actually operated and effective are for such intervals when they occur in coincidence with cam apices 154 and 155, Fig. 8, which begin during the twenty-second and thirtieth minutes of the general cycle.

While the present invention has been explained and described with particular reference to a specific embodiment and design, it will be understood nevertheless that it is susceptible to various modifications and rearrangements within the spirit and scope of the herein disclosed teachings. Accordingly, it is not intended to be limited for an understanding of this invention to the particulars of the foregoing detailed description nor to the illustrations shown on the accompanying drawings except as indicated in the hereunto appended claims.

The invention claimed is:

1. A timing mechanism for automatic washing machines comprising, a frame structure made up of a pair of end plates in parallel alignment and having therethrough aligned circular bores to serve as a journal for a principal rotary cam barrel assembly, a cylindrical cam barrel molded as a monoblock and having on its periphery a plurality of axially spaced circular cam discs and at one end an integrally molded gear wheel, the axial center of said cam barrel being bored to receive therethrough an operating shaft having a polygonally cross-sectioned neck adapted to fit into a similarly cross-section aperture at one end of said axial bore, means for confining said cam barrel against axial movement whilst permitting said operating shaft to be so moved reciprocally throughout a distance less than the length of said interfitted polygonal cross-sectioned neck and aperture, a power driven train for rotating said cam barrel assembly cyclically through said gear wheel, and means for detenting said shaft at each end of its said axial movement comprising an annularly turned ring formation on said shaft flanked by spaced annular depressions one on each side of ring formation, and a straddle spring fixedly mounted in said frame structure exerting a tension so as to retain said shaft and so as to exert an over-centering movement when passing said shaft ring formation, said shaft carrying an actuator for opening and closing said control switch according to its axial detented position.

2. A rotary switch mechanism comprising, a pair of end plates having therethrough circular bores to serve as a journal, a cylindrical cam barrel molded as a monoblock and having on its

periphery a plurality of spaced circumferential cam discs, the axial center of said cam barrel being bored to receive therethrough a manual operating shaft splined to said cam barrel so as to be rotatable therewith, but susceptible to limited axial movement with respect thereto, an electrically driven power train for rotating said cam barrel, switch means under control of said manual operating shaft for supervising said train, and means for detenting said shaft at each end of its said axial movement whereby to establish said switch means in either its power train energizing or deenergizing conditions.

3. A rotary power driven timing mechanism for automatic washing machine operation comprising, a single cam barrel distributor molded as a monoblock and having integral axially spaced cams for supervising all of the functions of an automatic washing machine, a pair of side wall elements each provided with spaced contact spring assemblies, the spring assemblies of one said elements being displaced or off-set from symmetrical alignment with the spring assemblies of the other of said elements whereby when one of said side wall elements is aligned opposite the other one on both sides of said cam barrel distributor, the off-set displacement establishes an alternate and opposite staggered relation of said recesses contact spring assemblies, each adjacent one of said cams, an electrically driven power train including a system of gear reduction for imparting rotation at a predetermined rate of revolution to said cam barrel distributor, and a manual switch for controlling the introduction of operating current to the motor of said train comprising a shaft contained within the center of said cam barrel distributor and axially shiftable therein, a disc of electrically non-conductive material and a contact pair in circuit with the supply line to the motor of said train displaceable in closed and opened position in accordance with the movement of said disc as said shaft is shifted axially.

4. An automatic cycling control timer for clothes washing machines comprising, a cylindrical cam barrel molded as a monoblock having a plurality of axially spaced cam means for journaling said barrel for rotation on its axial center a synchronously driven electric motor and system of reduction gears, a tolling cam carried upon the output shaft of said system of reductions gears, said tolling cam having a peripheral involute surface and a sidewardly extending wedge cam surface, a step-by-step ratchet drive actuated by said involute surface to impart rotation to said cam barrel, a pair of contacts effective to prepare a spray control valve operating circuit for a duration corresponding in time to the extent of said wedge cam and effective at a recurrent frequency corresponding with the cyclic rotation of said tolling cam, and a further pair of contacts under the control of said cam barrel for completing said circuit thereby determining which of said tolling cam cyclic rotations shall be effective.

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