

Feb. 19, 1963

D. W. LAVIANA ET AL

3,077,784

TIMER MECHANISM

Filed Feb. 19, 1960

3 Sheets-Sheet 1

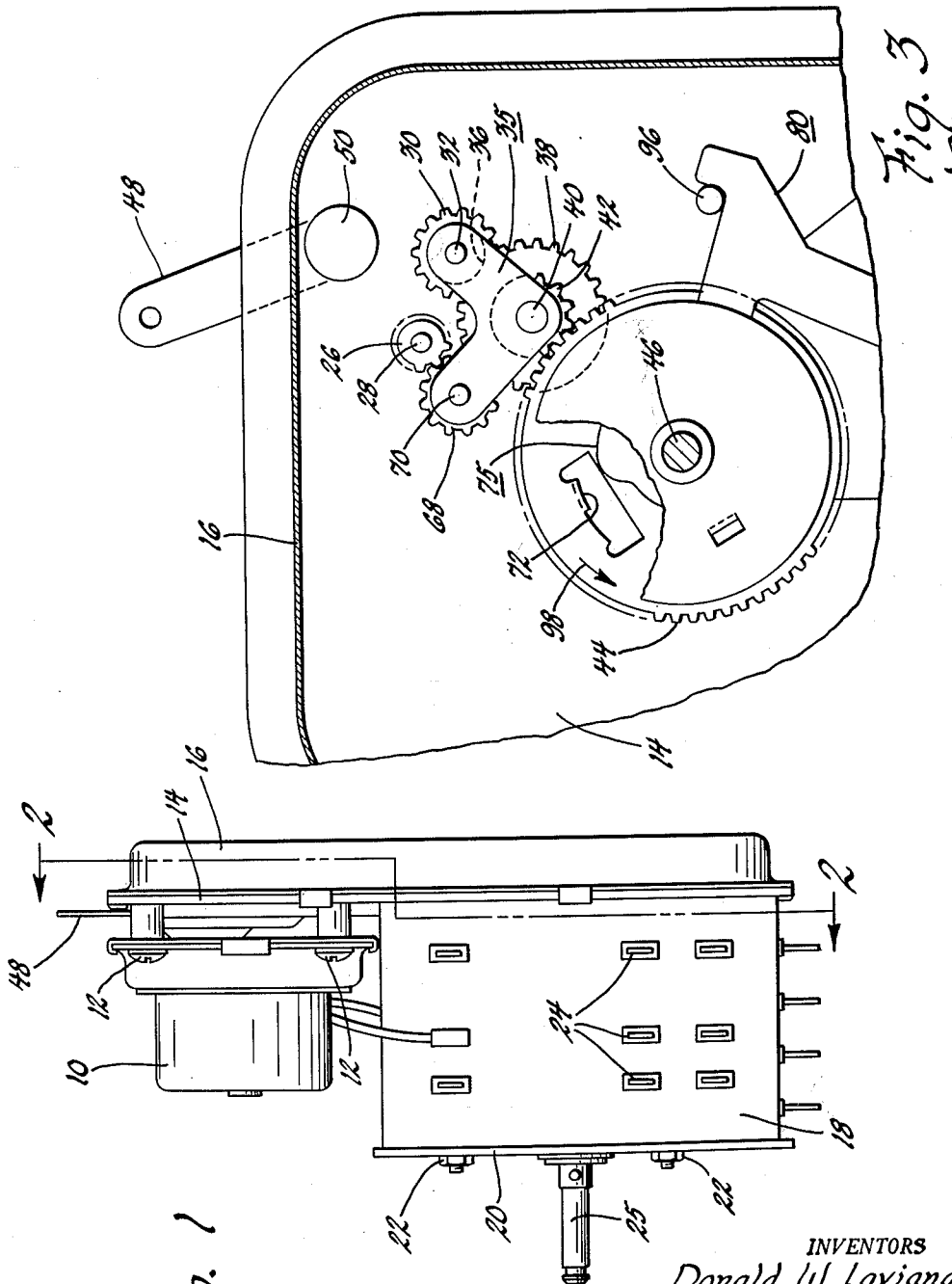


Fig. 1

Fig. 3

INVENTORS
Donald W. Laviana
BY Ralph D. Unterborn

W.E. Finken
THEIR ATTORNEY

Feb. 19, 1963

D. W. LAVIANA ETAL

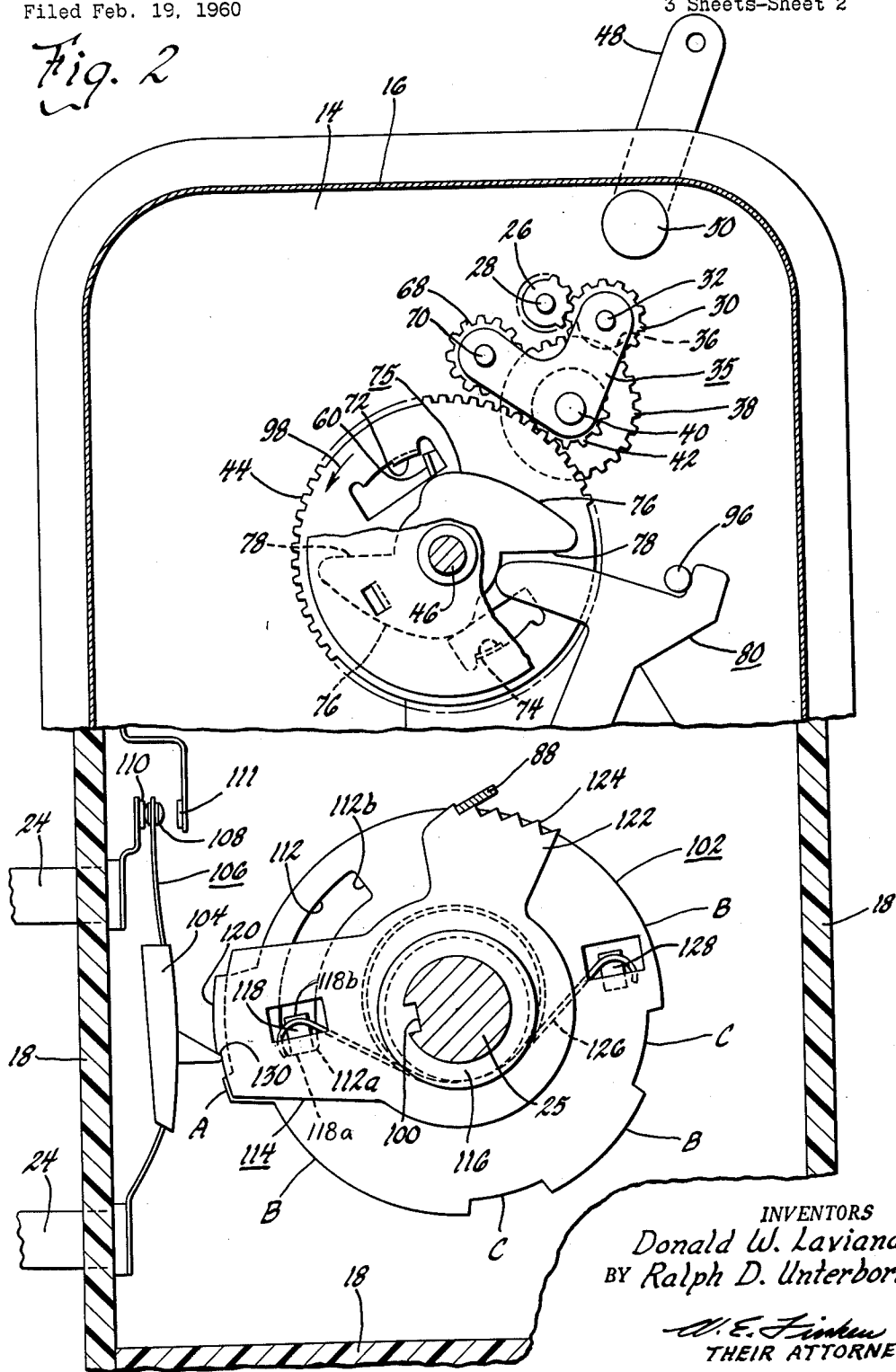
3,077,784

TIMER MECHANISM

Filed Feb. 19, 1960

3 Sheets-Sheet 2

Fig. 2



Feb. 19, 1963

D. W. LAVIANA ETAL

3,077,784

TIMER MECHANISM

Filed Feb. 19, 1960

3 Sheets-Sheet 3

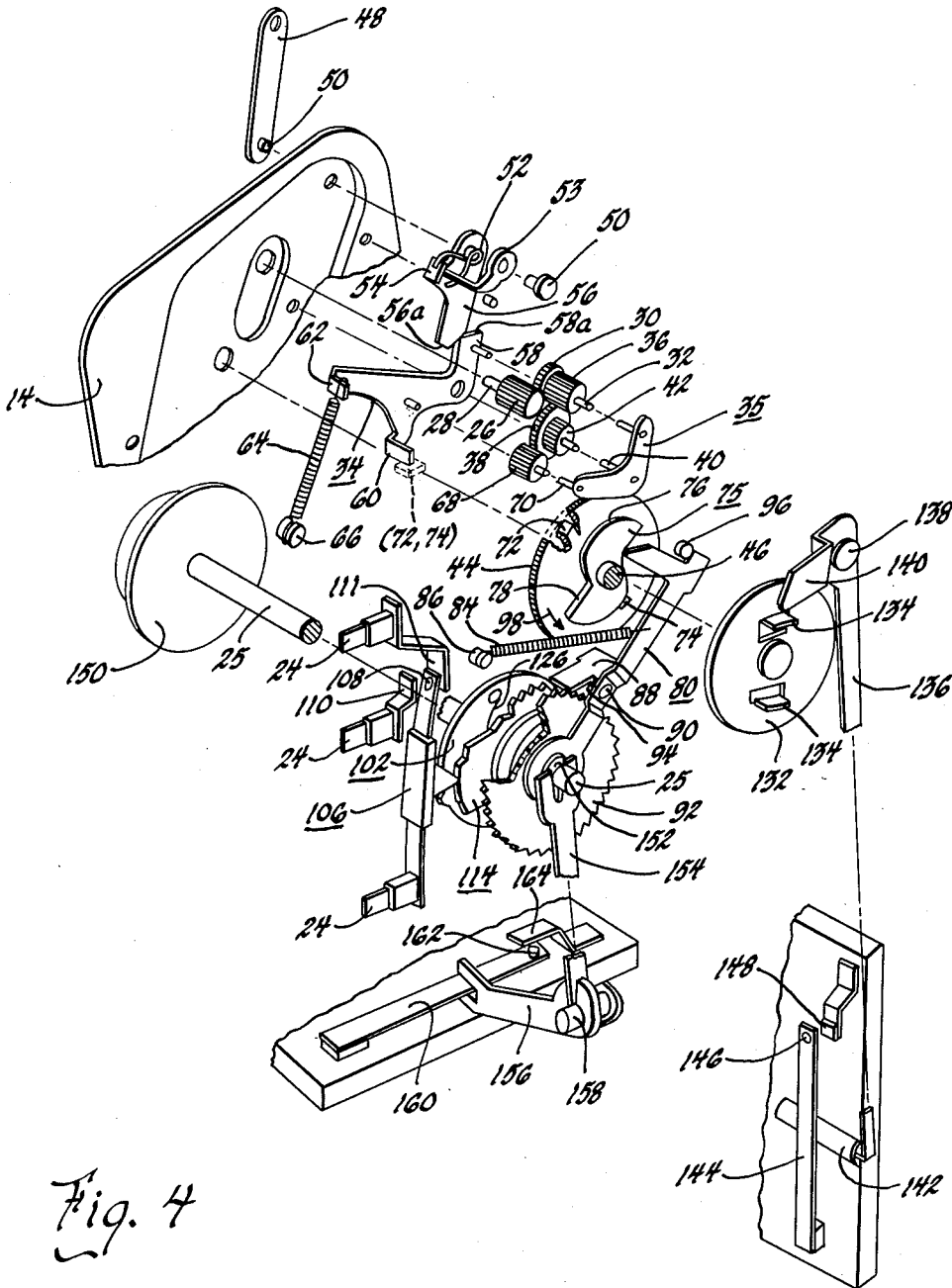


Fig. 4

INVENTORS
Donald W. Laviana
BY Ralph D. Unterborn

W. E. Finken
THEIR ATTORNEY

1

3,077,784

TIMER MECHANISM

Donald W. Laviana, Pittsford, and Ralph D. Unterborn, Rochester, N.Y., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware
Filed Feb. 19, 1960, Ser. No. 9,837
7 Claims. (Cl. 74-3.52)

This invention pertains to timing devices for initiating and controlling a predetermined sequence of operations, and particularly to an improved timing mechanism designed for washing machines.

At the present time automatic washing machines are designed to launder clothing composed of both natural and synthetic fabrics. Moreover, clothing manufacturers recommended that synthetic fabrics should not be subjected to the same laundering operations as natural fabrics, and for this reason washing machines are designed to have both normal and fast cycles of operation. The present invention relates to an improved impulse timer of the two-speed type having a constant fill period. Accordingly, among our objects are the provision of a two-speed impulse timer having a variable ratio drive train; the further provision of a two-speed impulse timer having a variable ratio gear drive train including interlocking means precluding speed changes under some conditions; the further provision of a two-speed impulse timer having a constant fill period; and the still further provision of an impulse timer having a pair of coaxial fill cams and a pair of spaced coaxial ratchet members.

The aforementioned and other objects are accomplished in the present invention by utilizing a two-speed gear drive between the motor and the drive pawl mechanism, and driving the two ratchet members through a double width pawl. Specifically, the disclosed timer is constructed with terminal block assemblies in accordance with copending application Serial No. 786,986 filed January 15, 1959, in the name of Donald W. Laviana including switches of the type disclosed in copending application Serial No. 786,953 filed January 15, 1959, in the name of Donald W. Laviana. Thus, the switches are supported on terminal blocks, at least two of which are located in planes normal to each other, the terminal blocks being held in assembled relation with the front and back plates by a plurality of tie bolts. A plurality of rotatable cams is attached to a shaft journaled in the front and back plates for sequentially actuating the several switches.

The timer is driven by a synchronous motor having a drive pinion which can be meshed with either of two driven gears supported on a bellcrank. When one of the gears engages the drive pinion, the timer operates on a sixty minute cycle, and when the other gear engages the drive pinion, the timer operates on a forty minute cycle. The gear train rotates a cam for actuating the drive pawl mechanism, and in order to prevent shifting of the gears when the follower is on the steep, or drop side of the cam, an interlock is provided.

The drive cam actuates a pawl engageable with a ratchet wheel for rotating the cams in a step by step movement. A second segment ratchet is coaxially mounted on the motor cam for rotation relative thereto, the ratchet segment having a constant fill cam portion. The ratchet segment has a lost motion connection with the motor cam and is normally spring biased for movement therewith. The arrangement of the constant fill portion cam and the motor cam is such that a constant fill period will be assured at all times irrespective of the washing in-

2

terval. The interval is four minutes on low speed and two and two-thirds minutes on high speed.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

FIGURE 1 is a plan view of a washing machine timer constructed according to the present invention.

FIGURE 2 is an enlarged fragmentary view, partly in elevation and partly in section, taken along lines 2-2 of FIGURE 1 showing the gear train in one drive position.

FIGURE 3 is an enlarged fragmentary view, partly in section and partly in elevation similar to FIGURE 2 showing the gear train in the other drive position.

FIGURE 4 is an exploded isometric view of the improved timer assembly.

With particular reference to FIGURE 1, the timer is driven by a synchronous motor indicated by numeral 10, the housing of which is attached by screws 12 to a backplate 14. The back plate has a dished cover 16 attached thereto which forms a chamber with the back plate 14 for enclosing the gear train and drive pawl mechanism, to be described. A plurality of terminal blocks 18, at least two of which are arranged in planes normal to each other, are held in assembled relation with the back plate 14 and a front plate 20 by tie bolts 22. The terminal blocks 18 support terminals as indicated by numeral 24, and a shaft 25 capable of both rotation and limited axial movement is journaled in the front and rear plates 14 and 20.

With reference to FIGURES 2 and 4, the synchronous motor 10, when energized, drives a pinion gear 26 attached to a motor output shaft 28 supported for rotation in the back plate 14. The drive pinion 26 has twelve teeth. In the position shown FIGURE 2, the drive pinion 26 meshes with an eighteen tooth gear 30 rotatably supported on a stub shaft 32 carried by a bellcrank, or keeper plate, 35. The keeper plate also carries a fifteen tooth gear 68 journaled on shaft 70. The gear 30 is integral with a twelve tooth gear 36, which, in FIGURES 2, 3 and 4, meshes with a thirty-two tooth gear 38 rotatably supported on a pivot stud 40 journaled in the back plate 14. Plate 35 is rigidly connected with shift plate 34 allowing plates 34 and 35 to pivot about stud 40. The thirty-two tooth gear 38 is integral with a fifteen tooth gear 42 that meshes with a seventy-five tooth gear 44 attached to a shaft 46. The shaft 46 is journaled in the rear plate 14. With this drive train, the gear 44 will rotate one revolution for every twenty revolutions of the pinion 26, since the gear 44 will rotate thirty revolutions per hour for a sixty minute wash cycle, the pinion gear 26 is driven by the motor at ten revolutions per minute.

With reference to FIGURES 3 and 4, when the shift plate 34 is moved in the clockwise direction, the drive pinion 26 engages the fifteen tooth gear 68. The gear 68 drives the gear 38 which rotates the gear 42 having engagement with the gear 44. Since the drive pinion 26 rotates at ten revolutions per minute, the gear 44 will be driven at forty-five revolutions per hour so that the sixty toothed ratchet wheel 92 will make one complete revolution in forty minutes. In this manner, the speed of cam 75 can be changed by movement of the shift plate 34 and thereby change the frequency of advance of the cam barrel assembly driven by the ratchet wheel 92. However, the shift plate 34 must be locked in engagement since the reaction forces from the gear engagement, under some

circumstances, tend to drive the shift plate 34 and the gears carried thereby out of engagement with the drive pinion 26.

In order to maintain the shift plate 34 and the keeper plate 35 in the selected position, a mechanical interlock is embodied in the instant timer. The position of the shift plate 34 and the keeper plate 35 is controlled by a lever 48 which is attached to a shaft 50 journaled in the back plate 14. A torsion spring 52 has one end engaging an actuator 53 attached to the shaft 50 and the other end engages an abutment 54 on a latch arm 56 which is journaled on the shaft 50. The latch arm 56 engages an arm 58 formed on the shift plate 34. The shift plate 34 is also formed with a projection 60 and a second arm 62. One end of a tension spring 64 is attached to the arm 62, the other end of the spring 64 being attached to a pin 66 secured to the back plate 14. The abutment 60 is selectively engageable with diametrically opposed arcuate abutments 72 and 74 integral with the gear 44.

The arcuate abutments 72 and 74 coact with the abutment 60 on the shift plate 34 to form an interlock for preventing pivotal movement of the shift plate 34 during advance of the ratchet wheel 92 thereby preventing disengagement between the drive pinion 26 and either gear 30 or gear 68. As seen in FIGURE 4, the gear 44 drives a two-lobe cam 75 having gradually sloped rise surfaces 76 and abrupt drop surfaces 78. The cam 75 is engaged by a follower 80 which is pivoted on a bushing attached to the back plate 14. The cam follower has one end of a tension spring 84 attached thereto for maintaining the follower in engagement with the cam 75. The other end of the tension spring 84 is attached to a pin 86 carried by the back plate 14. In addition, the cam follower 80 has a drive pawl 88 connected thereto by a pin 90 and maintained in engagement with the sixty toothed ratchet wheel 92 by a torsion spring 94. The pawl 88 drives the ratchet wheel 92, the ratchet being keyed, or otherwise suitably connected to the shaft 25. A stop pin 96 supported by the back plate 14 is employed to limit movement of the follower 80 in the counterclockwise direction during movement of the cam follower 80 under the urge of spring 84 as seen in FIGURE 4.

The cam 75, the cam follower 80 and the pawl 88 constitute a drive mechanism for imparting step by step movement to the ratchet wheel 92 and the shaft 25 during rotation of the gear 44. The gear 44 is rotated in the direction of arrow 98, and as the follower 80 engages the rise 76 of cam 75, the follower 80 is pivoted in the clockwise direction about the bushing supporting the same whereby the torsion spring 94 will move the pawl 88 into engagement with a ratchet tooth. During continued rotation of the cam 75, the follower will move down the sharp drop 78 of the cam 75 under the urge of spring 84 and thus impart a one tooth movement to the ratchet wheel 92.

With the shift plate 34 in the position shown in FIGURES 2 and 4, projection 60 on the shift plate 34 is beneath either arcuate projection 72 or arcuate projection 74 thereby preventing clockwise movement of the shift plate 34 when the follower 80 starts down the sharp drop 78 of the cam 75. In this manner, the coaction between projection 60 and lugs 72 or 74 prevents disengagement between the drive pinion 26 and the pinion 30 when the cam follower 80 attempts to drive the gear 44 faster than the pinion 26. On the other hand, when the shift plate 34 is in the position depicted in FIGURE 3 wherein the pinion 26 engages the pinion 68, the projection 60 is located above the arcuate abutments 72 and 74 so that when the follower 80 begins its movement down the sharp drop 78 of the cam 75, the projection 60 co-operates with the projection 72 or the projection 74 to prevent counterclockwise movement of the shift plate, thereby preventing disengagement between drive pinion 26 and pinion 68.

When lever 48 is rotated in the counterclockwise direction, as viewed in FIGURES 2 and 4, the actuator 53 rotates with the shaft 50 thereby loading torsion spring 52 so as to apply a counterclockwise torque to the latch arm 56. The latch arm thereby applies clockwise torque to the shift plate 34. If the teeth of pinion 68 do not mesh with the teeth of drive pinion 26 when the shift is attempted, the spring 52 is extended thereby providing torque on the latch arm 56 and the shift plate 34 to rotate the shift plate 34 in the clockwise direction until the teeth of the pinion 26 mesh with the teeth on pinion 68. When the shift is completed, the latch arm 56 will move counterclockwise into engagement with a stop pin 85 carried by the back plate 14. In this position the end surface 56a of the latch arm 56 rides on the surface 58a of the shift plate arm 58 to form a mechanical lock for the shift plate 34. If a speed change is attempted when the cam follower 80 is approaching the sharp drop 78 on the cam 75, the coaction between the projection 60 on the shift plate 34 and the end lug 72 or 74 will prevent shifting of the plate 34 until the advance of the ratchet wheel 92 is completed.

When the pinion 68 engages the drive pinion 26, the timer is driven at high speed. In order to drive the timer at low speed, the lever 40 is moved to the clockwise direction from the position of FIGURE 3 to the position of FIGURES 2 and 4. As the lever 48 is rotated in the clockwise direction, the actuator 53 imparts clockwise movement to the latch arm 56 thereby releasing the shift plate 34 and permitting spring 64 to rotate the shift plate 34 in the counterclockwise direction so as to engage pinion 30 with the drive pinion 26. This shift likewise cannot be made when the cam follower is approaching the sharp drop 78 on the cam 74 due to the interlocking action between the projection 60 and either arcuate projection 72 or 74. When the drive pinion 26 engages the pinion 30, the timer is driven at low speed.

As seen particularly in FIGURE 2, the shaft 25 is formed with a keyway 100 for receiving a key to drivingly connect a cam barrel assembly including a cam 102 for rotation with the shaft 25. The cam 102 constitutes a main motor cam having suitably programed rises and dwells on the periphery thereof including surface A, surface B and surface C for actuating a switch 106 comprising a movable contact 108, a stationary contact 110 and 111 and a cam follower 104. The cam 102 is formed with an arcuate slot 112 subtending an angle of approximately 75°. A constant fill cam 114 is journaled on a hub portion 116 of the cam 102. The constant fill cam 114 has a projection 118 extending through an arcuate slot 112 and a radially extending cam portion 120 for actuating the switch 106. The cam 114 has a second radially extending arm portion 122 formed with ratchet teeth 124 on the same radius as the teeth of ratchet wheel 92. The drive pawl 88 is of sufficient width to engage both ratchet wheel 92 and the ratchet teeth 124. The constant fill cam 114 is normally biased so that end 118a of the projection 118 engages end 112a of the arcuate slot 112 by means of a torsion spring 126. One end of the torsion spring 126 engages the projection 118 and the other end engages an abutment 128 integral with the cam 102. The cam surface 120 on the constant fill cam 114 is formed with an abrupt shoulder 130 which is engaged by the cam follower 104, as seen in FIGURE 2, so as to prevent movement of the cam 114 when the cam 102 is manually turned counterclockwise. Under these conditions, the ratchet wheel 92 and the cam 102 will rotate in the counterclockwise direction, as viewed in FIGURE 2, relative to the constant fill cam 114 until end 118b of the abutment 118 is engaged by end 112b of slot 112 so as to disengage the cam follower 104 from the shoulder 130, thereby cancelling the four minute fill time and the wash time.

The variable wash period is obtained through the displacement of the tab 118 with respect to surfaces 112a

5

and 112b of slot 112. The first tooth of the ratchet segment integral with the fill cam engages the drive pawl 88 as switch follower 104 is against abutment 130. As cam 102 is turned counterclockwise by shaft 25, it will displace the tab 118 from slot end 112a reducing the wash period. When the desired wash time has been selected the shaft 25 is axially pushed in starting the timer motor which in turn will actuate the lever 80 moving pawl 88 to the next tooth of the ratchet segment. This will continue until four minutes of fill time has elapsed at which time the segmented gear will no longer have any tooth engagement with the pawl and the switch follower 104 will fall to the surface B on cam 102 starting the agitating cycle, also allowing cam 114 to reset itself so that tab 118 is again against end 112a of the slot 112.

With reference to FIGURE 4, a disc 132 is attached to the gear 44, the disc having a pair of diametrically opposed axially extending projections 134. The projections 134 coast with a lever 136 pivoted at 138 to the back plate 14 and having a leg 140 adapted to be engaged by the projections 134. The other end of the lever 136 carries a roller 142 of insulating material adapted to engage a leaf spring 144 carrying a movable switch contact 146. The contact 146 is engageable with a fixed contact 148. The switch comprising contacts 146 and 148 is periodically opened twice during each revolution of the gear 44. The inherent resiliency of the leaf spring 144 maintains the leg 140 in the path of movement of the projections 134 so that at all times when the leg 140 does not engage a projection 134, the switch contacts 146 and 148 are maintained in the closed position.

As alluded to hereinbefore, the shaft 25 is both rotatable and axially movable. A knob 150 may be conveniently attached to the shaft 25 for manually imparting axial movement and rotation to the shaft. The shaft 25 is formed with an annular groove 152 which receives a bifurcated end of a lever 154. The other end of the lever 154 is received in a notch of an insulating switch actuator 156 supported for pivotal movement by a pin 158. The pin 158 is attached to the back plate 14. The actuator 156 engages a leaf spring 160 carrying a movable contact 162 engageable with a fixed contact 164. The leaf spring 160 is inherently biased so that the movable contact 162 engages the fixed contact 164. When the shaft 25 is moved axially to the left, as viewed in FIGURE 4, the lever 154 imparts counterclockwise pivotal movement to the actuator 156 so as to disengage the contacts 162 and 164. The switch contacts 162 and 164 may conveniently be used as the control switch for the synchronous motor 10 such that the synchronous motor 10 is energized only when the knob 150 and the shaft 25 are moved axially to the right, as viewed in FIGURE 4.

Operation of the two-speed timer is as follows: When the lever 43 is in the position of either FIGURES 2 or 4, the timer operates on a slow, or sixty minute cycle. On the other hand, when the lever 43 is in the position of FIGURE 3 the timer operates on a forty minute, or fast cycle. The lever 43 can be moved between its limit positions at any time during the cycle. However, when cam follower 30 starts down the sharp drop surface 78 of the cam 75, a shift cannot occur due to the interaction of tab 60 and either tab 72 or tab 74. The switch comprising contacts 146 and 148 is alternately opened and closed twice during each revolution of the gear 44. Accordingly, on a sixty minute cycle wherein the gear 44 rotates thirty revolutions per hour, the switch contacts 146 and 148 are opened every minute. On the other hand, when the timer is operating on a fast cycle wherein the gear 44 rotates at 45 r.p.h., the switch contacts 146 and 148 are opened every forty seconds.

When the timer is operating on the sixty minute cycle, the ratchet wheel 92 and the cam barrel assembly driven thereby rotates a distance of one tooth every sixty seconds. When the timer is operating on the fast cycle of forty minutes, the ratchet wheel 92 and the cam barrel assembly

6

driven thereby is rotated throughout a distance of one tooth every forty seconds. The constant fill cam 114 coacts with the main motor cam 102 so as to assure a four minute fill period during the sixty minute cycle and a two and two-thirds minute period during the forty minute cycle irrespective of the washing period selected by the operator. It is to be understood that the shaft 25 can be manually rotated to advance the timer at any time to enable the operator to select the desired washing interval. If a full ten minute washing interval on the sixty minute cycle is selected, the constant fill cam 114 is driven throughout a distance of four teeth by the pawl 88 through the ratchet tooth section 124 with the main motor cam 102. If a washing interval of less than ten minutes is selected by the operator, the cam follower 104 engages the shoulder 130 on the constant fill cam 114 during manual rotation of the cam barrel assembly so as to assure a four minute fill period on the sixty minute cycle. When the synchronous motor 10 is energized, the drive pawl 88 will drive both the ratchet wheel 92 and the ratchet segment 124 to drive the constant fill cam 114 and the main cam 102. When the four minute fill period has elapsed the ratchet segment 124 will be disengaged from the pawl 88 thereby permitting the torsion spring 126 to rotate the constant fill cam 114 so that the abutment 118 engages the end 112a of the slot 112, and in so doing the fill period is terminated. During the fast cycle of forty minutes, the constant fill period is reduced to a time interval of two and two-thirds minutes irrespective of the selected washing interval.

While the embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. An impulse timer including, a drive pinion, a driven gear operatively engageable with said drive pinion, a ratchet wheel, a drive pawl mechanism actuated by said driven gear for imparting step by step movement to said ratchet wheel, a cam barrel assembly driven by said ratchet wheel including a main motor cam, a constant fill cam journaled on said main motor cam and having a lost motion driving connection therewith, and means for driving said constant fill cam from said drive pawl mechanism to obtain a constant fill period.
2. A two-speed impulse timer including, a drive pinion, a driven gear, a drive pawl mechanism actuated by said driven gear, a manually selectable two-speed transmission between said drive pinion and said driven gear, and interlock means preventing disengagement between the drive pinion and the transmission during advancing movement of the drive pawl mechanism.
3. A two-speed impulse timer including, a drive pinion, a driven gear, a drive pawl mechanism actuated by said driven gear, a manually selectable two-speed gear transmission between said drive pinion and said driven gear, a pivotally movable shift plate carrying said two-speed gear transmission, and coacting lug means on said shift plate and said driven gear for precluding disengagement of said two-speed gear transmission and said drive pinion during advancing movement of said drive pawl mechanism.
4. A two-speed impulse timer including, a drive pinion, a driven gear, a shift plate carrying a two-speed gear assembly for establishing a driving connection between said drive pinion and said driven gear, a drive pawl mechanism actuated by said driven gear including a cam having gradual rises and abrupt drops, and coacting lug means on said shift plate and said gear for precluding disengagement of said gear drive assembly and said drive pinion during advancing movement of the drive pawl mechanism.
5. The two-speed timer set forth in claim 4 wherein said cam is formed with two rises and two abrupt drops, and wherein said gear is formed with a pair of diametrically opposed lugs coacting with a single lug on said shift plate.
6. An impulse timer including, a drive pinion, a driven

gear operatively engageable with said drive pinion, a drive pawl mechanism actuated by said driven gear, a ratchet wheel driven by said escapement mechanism, a cam barrel assembly driven by said ratchet wheel including a main motor cam, a constant fill cam journaled on said main motor cam and having a lost motion driving connection therewith, said constant fill cam having a ratchet tooth segment drivable by said drive pawl and an abutment, and cam follower means engageable with said abutment whereby said constant fill cam is driven by said drive pawl mechanism for assuring a constant fill period.

7. The impulse timer set forth in claim 6 wherein said main motor cam includes an arcuate slot, said constant fill cam having a lug disposed within said slot, and torsion spring means biasing said constant fill cam for normally maintaining the lug in engagement with one end of said slot.

References Cited in the file of this patent

UNITED STATES PATENTS

829,068	Fox	Aug. 21, 1906
2,046,412	Reynolds	July 7, 1936
2,585,018	Kreitchman et al.	Feb. 12, 1952
2,657,748	Snoddy	Nov. 3, 1953
2,864,443	Niemand	Dec. 16, 1958
2,870,834	Sisson	Jan. 27, 1959
2,938,970	Constantine	May 31, 1960
2,984,716	Timon et al.	May 16, 1961
2,985,029	Schneider	May 23, 1961

FOREIGN PATENTS

859,553	Germany	Dec. 15, 1952
---------	---------	---------------