

July 17, 1951

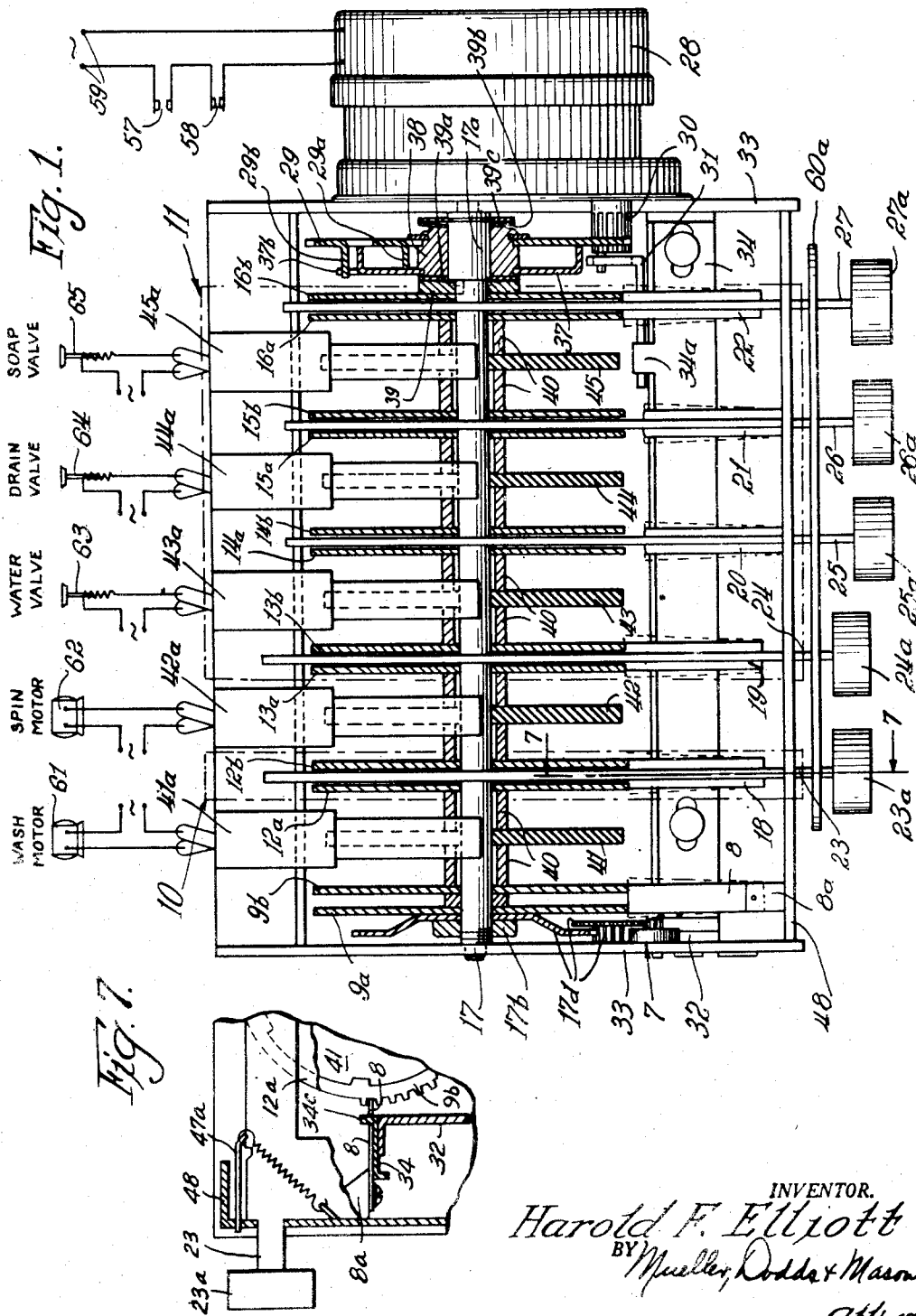
H. F. ELLIOTT

2,561,187

PROGRAM TIMING MECHANISM

Filed April 25, 1945

5 Sheets-Sheet 1



July 17, 1951

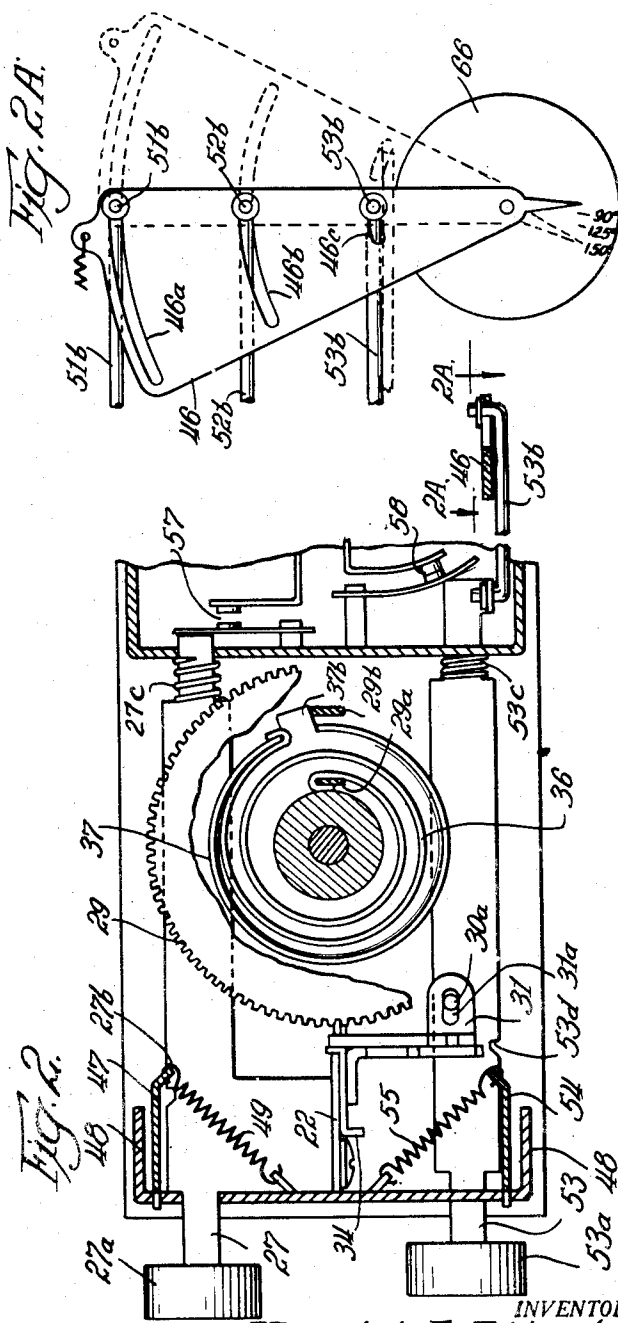
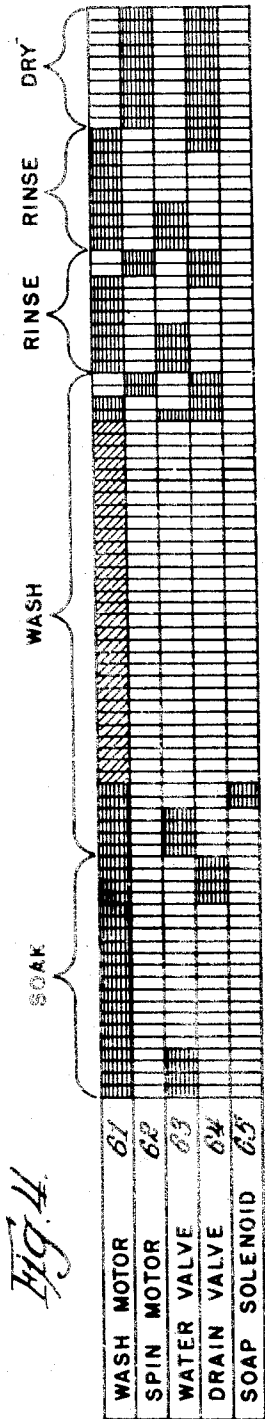
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PROGRAM TIMING MECHANISM

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5 Sheets-Sheet 2



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PROGRAM TIMING MECHANISM

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Fig. 5A

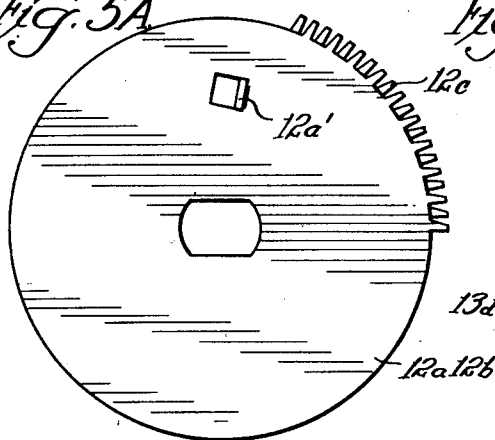


Fig. 5B

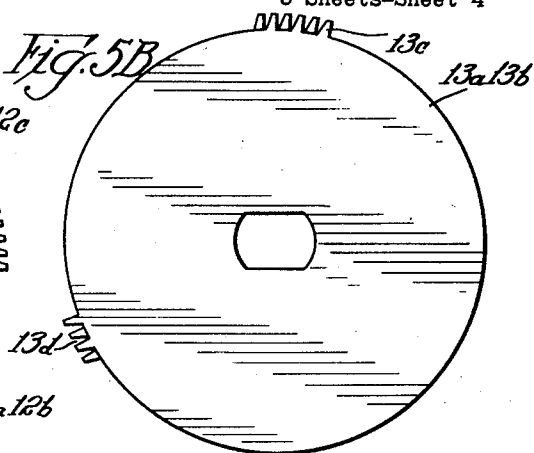


Fig. 5C

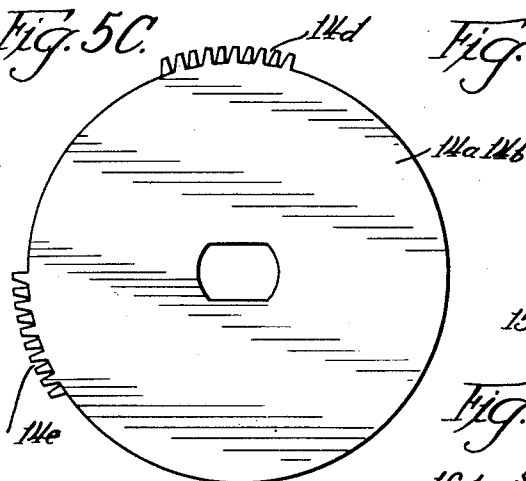


Fig. 5D

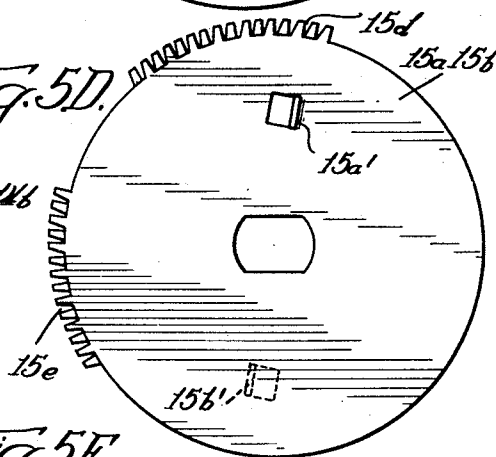


Fig. 5E

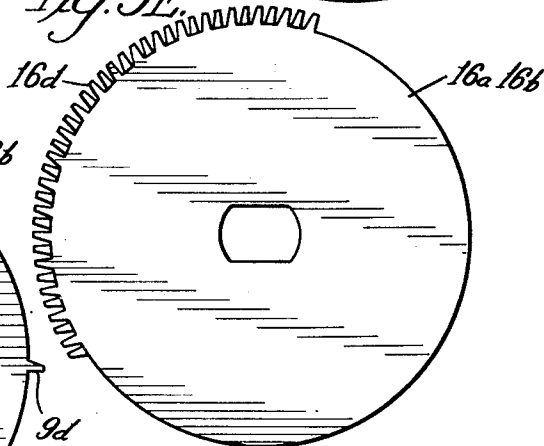
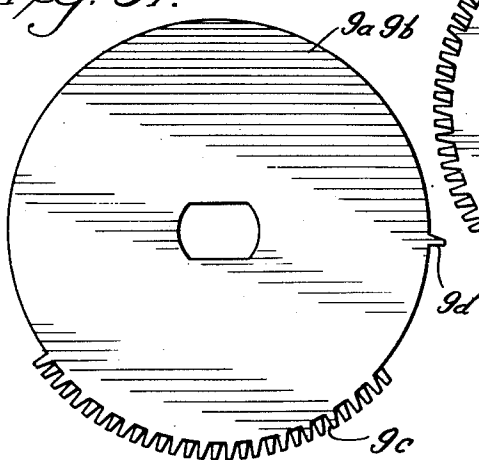


Fig. 5F



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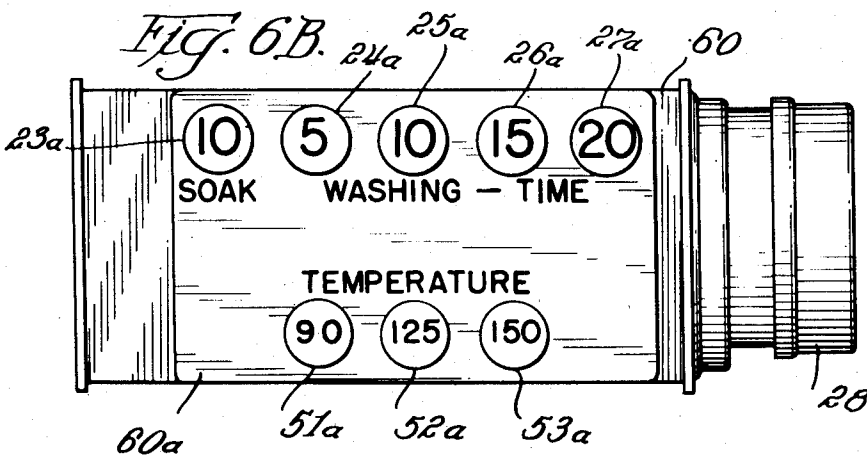
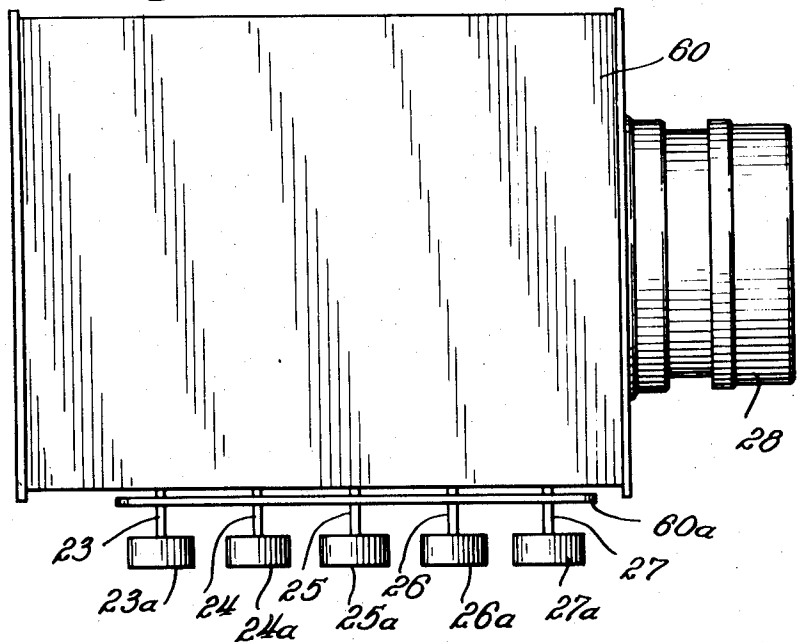
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Fig. 6A.



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UNITED STATES PATENT OFFICE

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PROGRAM-TIMING MECHANISM

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Application April 25, 1945, Serial No. 590,294

15 Claims. (Cl. 68—12)

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This invention relates to program-timing mechanisms and, while it is of general application, it is particularly suitable for timing the several operations involved in an automatic washing machine and it is illustrated and described herein as embodied in such an application.

In an automatic washing machine, there are a number of successive operations involved in a complete washing cycle which may comprise soaking, rinsing, washing, one or more additional rinsings, and spinning, that is centrifugal drying. In order to accommodate a machine to the various types of articles being washed and to their particular condition, it is desirable to be able to select one or more of the different operations, to be able to select different time cycles for one or more of the operations, and also to select a desirable temperature of the washing water. It is also desirable to be able to set up a complete program or washing cycle by setting up in advance a number of selectors, such as push-buttons, effective to cause the selected operations automatically to follow one another in a desired sequence.

While heretofore there have been proposed a number of timing mechanisms intended for automatically controlling a washing machine, such mechanisms have lacked the desirable flexibility described above or have involved complicated and expensive constructions, or have been subject to both of these limitations.

It is an object of the invention, therefore, to provide a new and improved program-timing mechanism which is of general application and which is particularly suitable for timing the several operations of an automatic washing machine.

It is another object of the invention to provide a new and improved program-timing mechanism which overcomes one or more of the above-mentioned disadvantages and limitations of the prior art timing mechanisms.

It is another object of the invention to provide a new and improved program-timing mechanism by means of which there can be set up in advance a complete program or washing cycle, including one or more successive operations of soaking, rinsing, washing, rinsing, drying, etc.

It is a further object of the invention to provide a new and improved program-timing mechanism for setting up in advance a program of the type described and in which the time cycle of one or more of the operations may be varied in accordance with the requirements of the articles being washed.

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In accordance with the invention, a program-timing mechanism comprises a plurality of timing elements for individually controlling a plurality of successive operations of the program and means for selectively initiating operation of each of the timing elements. The mechanism also includes interlocking means between the timing elements effective upon operation of any one of such timing elements to delay the operation of the next successive selected timing element until completion of the operating cycle of the selected one of the timing elements.

Further in accordance with the invention, a timing mechanism comprises an intermittently operable timing element, driving means for the element continuously operable at a speed higher than the average speed of the timing element, and a driving connection between the element and the driving means including an energy-storage element and a slip clutch.

Further in accordance with the invention, in a timing mechanism of the type described there is provided an intermittently operable timing element comprising a pair of toothed wheels, means for driving the wheels synchronously and an oscillatable finger disposed alternately to engage the teeth on the wheels of the pair.

Further in accordance with the invention, a program-timing mechanism for an automatic washing machine including a plurality of means for individually establishing a plurality of operating conditions comprises a plurality of manually and concurrently presettable means for selectively and individually controlling the condition-establishing means of the machine, at least one of the manually presettable means including means for selectively predetermining the time of operation of its controlled means at any of a number of different values.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings while its scope will be pointed out in the appended claims.

Referring now to the drawings, Fig. 1 is a top plan view, partly in section, of a program-timing mechanism embodying the invention; Fig. 2 is an end view of one of the timing elements of the mechanism of Fig. 1; Fig. 2A is a view taken on line 2A—2A of Fig. 2; Fig. 3 is a fragmentary perspective view of one of the timing elements of the mechanism of Fig. 1 together with the driving mechanism; Fig. 4 is a chart illustrating a typical program or washing cycle which may be

set up by means of the mechanism of the invention; Figs. 5A-5F, inclusive, are detailed views of escapement wheels utilized in one embodiment of the timing mechanism of the invention; Figs. 6A and 6B are top and front views, respectively, of a complete program-timing mechanism of the invention enclosed in a suitable housing; and Fig. 7 is a fragmentary sectional view of the mechanism along the lines 7-7 of Fig. 1, with portions thereof broken away.

Referring now to Figs. 1, 2 and 3 of the drawings, there is represented a program-timing mechanism suitable for automatically controlling a washing machine. This mechanism comprises a plurality of intermittently operable timing elements, such as the units 10 and 11, for individually controlling a plurality of successive washing operations of such program. As indicated, the timing elements 10 and 11 are preferably combined into a single unitary timing structure. Each of the timing elements 10 and 11 comprises one or more pairs of toothed step-by-step escapement timing wheels, such as the wheels 12a, 12b of timing element 10 and the pairs of wheels 13a, 13b, 14a, 14b, 15a, 15b and 16a, 16b of the timing element 11. The mechanism also includes means for driving the several timing wheels synchronously, for example a shaft 17 on which all of the wheels are mounted. Also mounted on shaft 17 are a pair of timing wheels 9a, 9b which are not included within the timing elements 10 and 11. There are provided a plurality of oscillatable fingers 8 and 18-22, inclusive, individually associated with the pairs of escapement wheels 9a, 9b and 12a, 12b-16a, 16b, respectively. The fingers 18-22, inclusive, are pivotally supported from the bottom faces of push rods 23-27, respectively, and each is disposed so that, when pushed in and oscillated as described hereinafter, it alternately engages the teeth of the two wheels of its respective pair of escapement wheels 12a, 12b-16a, 16b, inclusive. Finger 8 is pivotally supported from the bottom face of a bracket 8a mounted on supporting frame 48 for the assembly so that it is always in engagement with one of the escapement wheels 9a, 9b and, when oscillated, it alternately engages the teeth thereof. The alternate engagement of the escapement wheels of each pair by their associated oscillating finger is effected by relatively offsetting the finger and the teeth of the two wheels in the direction of motion, either by offsetting the two sides of the oscillating finger or, as illustrated, by staggering the teeth on the wheels of each pair relative to each other.

The timing mechanism also includes a common driving means for the shaft 17 and the pairs of timing wheels 9a, 9b and, 12a, 12b-16a, 16b, inclusive, and for the oscillatable fingers 8 and 18-22, inclusive. This common driving means is most clearly shown in Fig. 3, which is a perspective view of the fourth pair of timing wheels 15a, 15b, the other timing wheels being omitted for the sake of clarity. This common driving means may be a common driving motor 28 which drives the shaft 17 through a reduction gearing comprising a spur gear 29 and a pinion 30 on the motor shaft. The pinion 30 is also provided with an eccentric pin 30a which engages a slot 31a in a bell crank 31 pivoted to a transverse frame member 32 which extends between end plates 33, forming therewith a portion of the framework of the timing mechanism. The bell crank 31 is connected to actuate a reciprocable gate 34 provided with a lug 34a engaging a notch

31b in the upper end of the vertical arm of the bell crank 31. The reciprocable member or gate 34 is provided with longitudinal slots 34b engaging pins 35 mounted in the frame piece 32 and effective to guide the member or gate 34 in its reciprocating motion. The gate 34 is provided with an upstanding flange 34c having formed therein a plurality of notches 34d for engaging and oscillating the pivoted fingers 8 and 18-22, inclusive.

The common driving motor 28 is preferably a constant-speed motor operating continuously during the normal cycle of the timing mechanism, while the timing escapement wheels 9a, 9b and 12a, 12b-16a, 16b, have an intermittent motion inherent in escapement devices and in addition, as explained hereinafter, during portions of their operating cycle jump through a considerable portion of one revolution in a short interval of time. In order to accommodate these disparities in motion, the motor 28 is designed to operate the gear 29 at a speed higher than the average speed of the intermittently operating timing wheels. To this end, the driving connection between the timing wheels and the motor 28 includes an energy-storage element, such as a spiral spring 36, anchored at its inner end on a flange or lug 29a upset from the side of gear 29 and at its outer end hooked over an edge of an opening 37a in the periphery of a drum 37. This opening may be formed by punching-out a portion of the periphery of the drum 37 into an upstanding lug 37b which is adapted to abut against an arm or flange 29b formed out of or secured to the gear 29. The cooperating lugs 29b and 37b serve to limit the amount of advance which the driving motor and its gear 29 may develop relative to the driven drum 37.

The gear 29 is freely rotatable on a hub 38 which, in turn, is freely rotatable on the shaft 17, while the drum 37 is staked or otherwise secured to the hub 38. Also mounted on the shaft 17 and keyed or splined thereto is a hub 39, while a friction disk 39a is interposed between the hubs 38 and 39 and forms therewith a slip clutch. A spring washer 39b is disposed between the hub 38 and a washer 39c retained in a slot near the end of the shaft 17. It will also be understood that the several escapement timing wheels 9a, 9b and 12a, 12b-16a, 16b are secured to the shaft 17 by keying, splining or, as shown, by clamping them to the hub 39, which rests on a shoulder 17a of the shaft 17, by means of a nut 17b, spacing sleeves 40 providing the desired spacings therebetween. In order to limit the speed of rotation of the timing assembly when it jumps through a portion of a revolution due to the absence of teeth on the active escapement wheels and to limit the shock on the following escapement wheel teeth, there is provided a centrifugal governor 7, which may be of any suitable type, driven from shaft 17 through speed increasing gearing 17d.

There are also secured to the shaft 17 any desired number of timing cams 41-45, inclusive, together with their associated cam-operated switches 41a-45a, respectively, which may be of any conventional construction and which may have a configuration to provide any desired timing in a manner well understood in the art and as explained in further detail hereinafter. The switches 41a-45a, inclusive, are connected to control the operation of the several elements of the washing machine, such as wash motor 61, a spin

motor 62, a water valve 63, a drain valve 64, and a soap valve 65, respectively.

The timing mechanism also includes preset means for selectively initiating operation of either of the timing elements 10 or 11 for selecting operation of either or both thereof. Specifically, these preset means comprise the push rod 23 for the unit 10, operated by a push-button 23a, and the push rods 24-27, inclusive, for the timing element 11, operated by push-buttons 24a-27a, respectively. Each of these push rods 23-27, inclusive, constitutes means for selectively engaging its associated one of the oscillatable fingers 18-22, inclusive, and its corresponding pair of timing escapement wheels 12a, 12b-16a, 16b, respectively; that is, for selectively engaging the oscillatable finger 18 of the timing element 10 with its associated timing wheels 12a, 12b and any one of the oscillatable fingers 19-22, inclusive, of the timing element 11 with its respective pair of timing wheels to procure any of a plurality of predetermined timing cycles, as explained further hereinafter.

The several push rods 24-27, inclusive, of timing element 11 are provided with notches 24b-27b, inclusive, in their upper edges and a common latching member 47 pivoted in a frame member 48 and urged into engagement with the notches 24b-27b, inclusive, by means of a biasing spring 49. The latch bar 47 also serves as a mechanical interlock for the push rods 24-27, inclusive, to release any push rod upon operation of any other push rod and thus to prevent simultaneous operation of more than one rod. Upon any one of the push rods 23 to 27 being pushed in, it compresses a helical biasing spring, such as that shown at 27c and 53c in Fig. 2 of the drawings, which tends to drive the push rod back to its original position, but is prevented from doing so, by the latch bar. A separate but similar latch 47a, best shown in Fig. 7, similarly pivoted in frame member 48 is provided for push rod 23 of timing element 10. There is also provided a trip arm 50 (see Fig. 3) attached to the latch 47 and bevelled at its free end, as at 50b, and disposed in the path of a lug or bracket 15a' secured to or struck up from the timing wheel 15a. If desired a striker arm 50a may be attached to the trip arm 50 and disposed to strike a bell 50c to indicate the end of a timing cycle.

At least one of the timing elements of the timing mechanism, for example the element 11, includes provisions for predetermining its timing cycle at any of a plurality of different values; specifically, a plurality of devices such as the pairs of escapement wheels 13a, 13b-16a, 16b of different timing characteristics for imparting to the timing element timing cycles of different values. The wheels of each of such pairs have uniformly spaced teeth but the spacings between the teeth groups are different for different pairs of wheels to provide the different timing characteristics. By way of explanation, reference is made to Fig. 4 which is a chart representing one typical cycle of operation of an automatic washing machine, the chart being drawn with time units of one-half minute each and showing the successive intervals during which the several devices 16-65, inclusive, controlled by the cams 41-45, inclusive, are operative.

For example, when the machine is started, the water valve 63 is initially opened for an interval of two minutes allowing water of a selected temperature to enter the washing chamber. The washing motor 61 is operated for a period of ten

minutes, including this interval, to circulate and agitate the clothes during soaking. During the last two minutes of this interval, the drain valve 64 is opened to discharge the soaking water.

Immediately thereafter the washing cycle commences and the water valve 63 is again opened for an interval of two minutes to introduce washing water of a selected temperature. The soap valve 65 is opened for an interval of one minute to introduce soap into the washing chamber and the wash motor 61 is operated for any of four desired intervals of five, ten, fifteen or twenty minutes. At about two minutes before the end of the washing cycle the drain valve 64 is opened, the water valve 63 is opened for one-half minute to introduce rinsing water and, during the last minute the spinning motor 62 is operated to discharge the bulk of the washing water from the clothes. During the next operation, or rinsing, the water valve 63 is again opened for an interval of two minutes, the wash motor 61 is operated for an interval of four minutes, while the drain valve is open during the last minute and a half and the spinning motor is operated during the last minute, rapidly to discharge the rinsing water from the washing chamber.

During the second rinsing operation, the water valve 63 is again opened for an interval of two minutes, the wash motor 61 is operated for an interval of four and one-half minutes, during the last minute of which the drain valve 64 is opened. The final operation is the spin drying which may be an interval of five minutes, during which the spinning motor 62 is operated while the drain valve 64 remains open.

It will be understood that the operation of the devices 61-65, inclusive, during the intervals suggested in the chart described above may readily be obtained by the appropriate configuration of their associated cams 41-45, inclusive, in a manner well understood in the art. It is seen that duration of the soaking cycle for ten minutes is fixed. This is determined by the pair of timing wheels 12a, 12b of timing element 10, represented collectively in Fig. 5A, the staggered teeth of the two wheels being shown superimposed. It is assumed that the complete program or washing cycle of operation is forty-five minutes and that each tooth represents an interval of one-half minute. Therefore, to provide the initial soaking period of ten minutes, the wheels 12a, 12b are provided with a group 12c of twenty teeth, as represented in Fig. 5A. If only the push-button 23a associated with the wheels 12a, 12b were operated, the timing mechanism would go through the ten-minute soaking operation and then jump substantially instantaneously through the remaining portion of its operating cycle, corresponding to the washing operation, to the finishing cycle, described hereinafter.

However, by simultaneously pushing the button 23a and, for example, the button 24a as shown in Fig. 1, the oscillating fingers 18 and 19 are brought into engagement with their respective timing wheels 12a, 12b and 13a, 13b, respectively. The timing wheels 13a, 13b may, as represented in Fig. 5B, be designed to provide only a five-minute washing cycle. As indicated in Fig. 5B, the interval corresponding to the portion of the wheels 12a, 12b occupied by teeth 12c has no teeth. There then follows a group 13c consisting of six teeth representing three minutes of operation, followed by a blank space, then a group 13d of four teeth. The groups 13c and 13d, comprising a total of ten teeth, represents a five-min-

ute timing operation. After the finger 18 has traversed the groups of teeth 13c, 13d, the finger 8 engages the group of teeth 9c of the escapement wheels 9a, 9b, Fig. 5F. The group of teeth 9c comprise a total of thirty teeth, representing the fifteen-minute finishing cycle including the two rinsing periods and the final drying period described above. This group is followed by a blank space to the starting-stopping tooth 9d which is provided to enable the spring 36 to impart to the rotatable shaft 17 and its associated wheels and cams sufficient momentum for the lug 15a' to strike the release arm 50 and release the push rod 24 through 27, thereby restoring the timing mechanism to its initial condition. Similarly a lug 12a' on escapement wheel 12a (Fig. 5A) is effective to release the latch bar 47a associated with push rod 23 of timing element 10. The tooth 9d ensures that the timing mechanism will always stop at the desired point even though the wound-up spring 36 tends to produce further rotation.

The timing wheels 14a, 14b and 15a, 15b and 16a, 16b, represented by Figs. 5C, 5D and 5E, respectively, are similar to the timing wheels 13a, 13b, described above, except that the blank spaces between the groups of teeth 14d, 14e and 15d, 15e are progressively narrower by increments corresponding to five-minute intervals, while the wheels 16a, 16b have a continuous series of teeth 16d representing the full twenty-minute interval for the washing operation.

It will, of course, be readily understood that the number of timing wheels in the element 11 may be varied as desired in accordance with the number of operations in the timing cycle desired. It will further be apparent that the groupings and spacings of the teeth on the several timing wheels may be varied in accordance with the operational requirements of any particular installation. It will also be apparent that, while the invention is illustrated and described in a timing mechanism in which only one of the timing elements 11 is provided with means for predetermining its timing cycle at any of a plurality of values, the other timing element 10 or additional timing elements included within the mechanism may be constructed to incorporate the features of the timing element 11 to procure any desired overall flexibility in the timing cycle.

The timing mechanism also includes means for selectively predetermining any of a plurality of desired water temperatures. This means comprises a series of pushbuttons, such as the buttons 51a, 52a and 53a (Fig. 6B) connected to push rods 51, 52 and 53, respectively, (Figs. 2, 2A and 3) these push rods being provided with extensions 51b, 52b and 53b, respectively, engaging arcuate slots 46a, 46b, and 46c, respectively of an operating sector 46 of a hot and cold water mixing valve 66 which is calibrated to supply water of desired temperatures, for example 90° F., 125° F. and 150° F. The arcuate slots 46c, 46b and 46a are of progressively increasing lengths so that when the operating sector is moved to its extreme position by the push rod 53, as shown in dotted-line position, sufficient lost motion is provided in the connections to the push rods 51 and 52 to avoid actuating them from their normal positions. The push rods 51, 52 and 53 are also provided with a latch 54 pivoted in the frame 48 and biased by a spring 55 into engagement in the notches in push rods 51, 52 and 53, such as the notch 53d indicated in Fig. 2. The latch 54 is also provided with a pivoted tripping arm 56 (Fig. 3) secured there-

to and having a bevelled end and adapted to be engaged by a lug or bracket 15b' attached to the timing wheel 15b.

The timing mechanism also includes circuit-controlling means interlocked with the selective means for determining the timing cycle and the selective means for determining the water temperature in order to prevent operation of the timing mechanism until operation of both of these selective means. This interlocking means may take the form of two normally-open circuit-controlling means or switches 57 and 58 (Fig. 2) adapted to be operated by any of the groups of push rods 23 to 27, inclusive, and 51 to 53, inclusive, respectively. As indicated in Fig. 1, the contacts of these switches are included in series circuit with the driving motor 28 and a pair of supply terminals 59, which may be connected to an ordinary commercial 60-cycle supply circuit.

In Figs. 6A and 6B are illustrated the timing mechanism of the invention enclosed within a housing 60 and provided with an indicating panel 60a carrying suitable legends registering with the several push-buttons 23a-27a, inclusive, and 51a-53a, inclusive.

It is believed that the operation of the timing mechanism of the invention will be clear from the foregoing detailed description. However, in brief, assuming that it is desired to select a soaking period of ten minutes followed by a washing period of ten minutes with a water temperature of 125° F., the push-buttons 23a, 25a and 52a are operated compressing their respective biasing springs in the manner shown at 53c in Fig. 2 of the drawings, the latch associated with push rod 23 and the latches 47 and 54 retaining their associated push rods 25 and 52 in their respective operated positions. The program is then carried out completely automatically by the mechanism; for example, initially the oscillating finger 8 engaging the start-stop tooth 9d of wheel 9 restrains the mechanism for approximately one-half minute until it is released. Thereafter, oscillating finger 18 is brought into engagement with the pair of timing wheels 12a, 12b and assumes control of the timing mechanism. The gear ratio between the pinion 30, reciprocating the gate 34 and the several escapement fingers, and the shaft 17 is 45 to 1 due to the fact that there are an aggregate of ninety teeth on the escapement wheels 12a, 12b, 16a, 16b, 9a and 9b and two teeth are released for each cycle of operation of gate 34 and each revolution of pinion 30. It may be assumed that the gear ratio between the pinion 30 and the gear 29 is a fraction of this value so that the gear 29 and the drum 37 operate at a speed higher than the average speed of the shaft 17. The several timing wheels have a total tooth coverage corresponding to ninety teeth or forty-five minutes of operation plus the final gap between the end of the tooth groups and the starting-stopping tooth 9d.

Thus, when the buttons 23a, 25a and 52a are depressed, the switches 57 and 58 are operated to close the circuit of the motor 28 which then rotates and keeps the spring 36 in a wound-up condition, due to the higher speed of the gear 29 than the shaft 17. Simultaneously the gate 34 is reciprocated to oscillate the fingers 8, 18 and 20 which are in engagement with the pairs of timing wheels 9a, 9b and 12a, 12b and 14a, 14b, respectively. The timing wheels 12a, 12b, being alternately engaged by the oscillating finger 18, advance one tooth every one-half minute for a total of twenty teeth or ten minutes. This correspond-

ing period on the remaining timing wheels is blank so that they do not come into operation. At the conclusion of the ten-minute soaking period described, the oscillating finger 20 engages the group of teeth 14d of the escapement wheels 14a, 14b and cause a continued advance of the wheels and the shaft 17 in one-half minute steps for a duration of ten teeth or five minutes, followed by a quick jump over the blank spaces between the groups of teeth 14d and 14e, corresponding to a normal time interval of ten minutes, and then a further step-by-step advance for the duration of the group of teeth 14e, representing an additional five minutes.

The pair of timing wheels 9a, 9b and the oscillating finger 8 assume control over the shaft 17 during the final or finishing portion of the cycle represented by the rinse periods and the dry period of Fig. 4, these periods being covered by the group of thirty teeth 9c, corresponding to a fifteen-minute interval. This corresponding period on the remaining timing wheels is blank so that they do not come into operation. At the conclusion of this interval, the shaft, under the influence of the spring 36, jumps to the starting-stopping tooth 9d. Simultaneously the bracket 15a' strikes the trip arm 50, the bracket 15b' strikes the trip arm 56, and the bracket 12a' strikes the trip arm of the latch 47a associated with the push rod 23, simultaneously to release the latches which, in turn, simultaneously release the push-buttons 23a, 25a, and 52a to restore the mechanism to its initial setting. At the same time, the switches 57 and 58 in the circuit of motor 28 are returned to their normally open positions and are effective to stop the motor. Thus the arrangement of the timing wheels of the timing elements 10 and 11 on a common shaft and the complementary arrangement of the teeth on the timing wheels of the two timing elements constitute interlocking means between the timing elements effective upon selection of the first timing element to delay operation of the second timing element until completion of the operating cycle of the first timing element.

It will be apparent that, if any other washing interval is desired, any one of the push-buttons 24a, 26a and 27a may be operated to bring the timing mechanism under the control of their respective timing wheels 13a, 13b or 15a, 15b or 16a, 16b, respectively, the operation being the same except that the extent of the blank spaces between the groups of teeth 13d, 13e, or 15d, 15e, or 16d, 16e is progressively decreased while in the wheels 16a, 16b these groups of teeth are continuous.

It will be understood that the control of the temperature mixing valve 66 by the push rods 51, 52 and 53 under control of the push-buttons 51a, 52a, 53a, respectively, may be entirely conventional in form and that the timing of the several control devices 61-65, inclusive, by the several cams 41-45, inclusive, and their respective switches 41a-45a, inclusive, may also be effected in any desired conventional manner by giving suitable configurations to the several cams 41-45, inclusive.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

I claim:

1. A program timing mechanism comprising, a

first timing element for controlling a first operation of said program, a second timing element for controlling a second operation of said program, each of said timing elements including a timing escapement wheel and a finger engageable therewith, selectively operable means for engaging said finger and wheel of either or both of said timing elements, and interlocking means between said timing elements effective upon selection of said first timing element to delay the operation of said second timing element until completion of the operating cycle of said first timing element.

2. A program timing mechanism comprising, a first timing element for controlling a first operation of said program, a second timing element for controlling a second operation of said program, at least one of said timing elements including a plurality of selectively operable timing units for imparting to said element timing cycles of different values, means for selectively initiating operation of either of said timing elements, and interlocking means between said timing elements effective upon selection of said first timing element to delay the operation of said second timing element until completion of the operating cycle of said first timing element.

3. A program timing mechanism comprising, a first timing element for controlling a first operation of said program, a second timing element for controlling a second operation of said program, each of said timing elements including one or more timing escapement wheels and fingers individually engageable therewith, selectively operable means for moving the finger into engagement with the corresponding wheel of either or both of said timing elements, and interlocking means between said timing elements effective upon selection of said first timing element to delay the operation of said second timing element until completion of the operating cycle of said first timing element.

4. A program timing mechanism comprising, a first timing element for controlling a first operation of said program, a second timing element for controlling a second operation of said program, at least one of said timing elements including a plurality of timing escapement wheels of different timing characteristics and a plurality of fingers individually engageable therewith, selectively operable means for initiating operation of either of said timing elements including means for selectively moving the finger into engagement with the corresponding wheel of said one of said timing elements, and interlocking means between said timing elements effective upon selection of said first timing element to delay the operation of said second timing element until completion of the operating cycle of said first timing element.

5. In a timing mechanism, an intermittently operable timing element comprising, a pair of toothed wheels, means for driving said wheels synchronously, the teeth on said wheels being staggered with respect to each other, and an oscillatable finger disposed alternately to engage the teeth on the wheels of said pair, said means for driving said wheels synchronously being connected to positively and directly drive said oscillatable finger independently of driving said wheels.

6. In a timing mechanism, an intermittently operable timing element comprising, a pair of toothed wheels, an oscillatable finger disposed alternately to engage the teeth on the wheels

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of said pair, and a common driving means including separate means connected to said wheels and said finger for driving the same.

7. In a timing mechanism, an intermittently operable timing element comprising, a drive shaft, a pair of toothed wheels mounted on said shaft, an oscillatable finger disposed alternately to engage the teeth on the wheels of said pair, a driving motor for said shaft, and an eccentric driven by said motor and connected to oscillate said finger.

8. In a timing mechanism, an intermittently operable timing element comprising, a pair of toothed wheels, means for driving said wheels synchronously, an oscillatable finger disposed alternately to engage the teeth on the wheels of said pair, and a latchable element for selectively engaging said wheels and said finger.

9. In a timing mechanism, an intermittently operable timing element comprising, a plurality of pairs of toothed wheels of different timing characteristics, means for driving said wheels synchronously, and a plurality of oscillatable fingers each disposed alternately to engage the teeth on the wheels of one of said pairs.

10. In a timing mechanism, an intermittently operable timing element comprising, a plurality of pairs of toothed wheels of different timing characteristics, a plurality of oscillatable fingers each disposed alternately to engage the teeth on the wheels of one of said pairs, and a common driving motor for said wheels and said fingers.

11. In a timing mechanism, a shaft, an intermittently operable timing element comprising, a plurality of pairs of toothed wheels of different timing characteristics mounted on said shaft, a plurality of oscillatable fingers each disposed alternately to engage the teeth on the wheels of one of said pairs, a driving motor for said shaft, a reciprocable member for oscillating said fingers, and an eccentric driven by said motor and connected to reciprocate said reciprocable member.

12. In a timing mechanism, an intermittently operable timing element comprising, a plurality of pairs of toothed wheels, the wheels of each of said pairs having groups of uniformly spaced teeth but the spacings between teeth groups being different for different pairs to provide different timing characteristics, means for driving said wheels synchronously, and a plurality of oscillatable fingers each disposed alternately to engage the teeth on the wheels of one of said pairs.

13. In a timing mechanism, an intermittently operable timing element comprising, a plurality of pairs of toothed wheels of different timing characteristics, means for driving said wheels synchronously, and a plurality of oscillatable fingers each disposed alternately to engage the

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teeth on the wheels of one of said pairs, and means for selectively engaging said fingers and their associated wheels to procure any of a plurality of predetermined timing cycles.

14. A program timing mechanism for an automatic washing machine comprising, a plurality of timing elements for individually controlling a plurality of successive washing operations of said program, means for selectively initiating operation of some of said timing elements, interlocking means between said timing elements effective upon operation of any one thereof to delay the operation of the next successive timing element until completion of the operating cycle of said one of said timing elements, means for selectively predetermining any of a plurality of desired wash-water temperatures, and means interlocked with both of said selective means for preventing operation of the timing mechanism prior to operation of both of said selective means.

15. A program timing mechanism for an automatic washing machine comprising, a plurality of timing elements for individually controlling a plurality of successive washing operations of said program, means for selectively initiating operation of some of said timing elements, a common driving motor for said timing elements, interlocking means between said timing elements effective upon operation of any one thereof to delay the operation of the next successive timing element until completion of the operating cycle of said one of said timing elements, means for selectively predetermining any of a plurality of desired wash-water temperatures, and two normally-open circuit-controlling means in series with said motor, each connected to be operated by one of said selective means.

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