

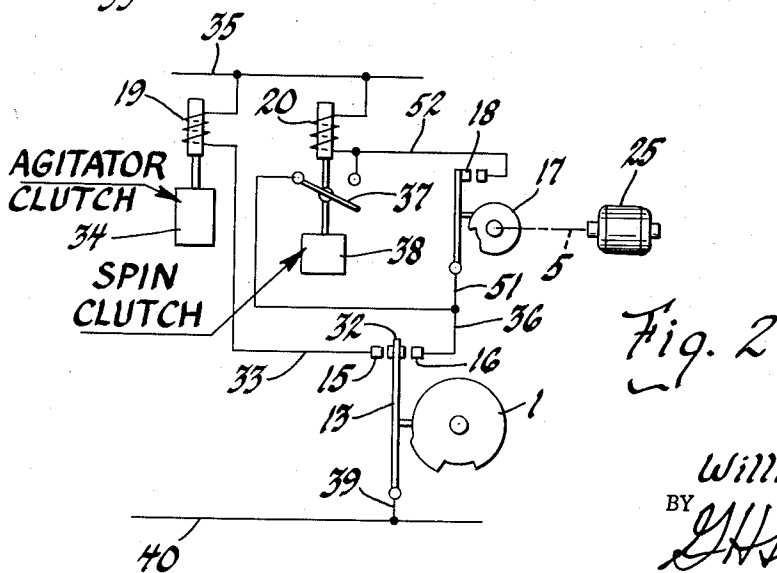
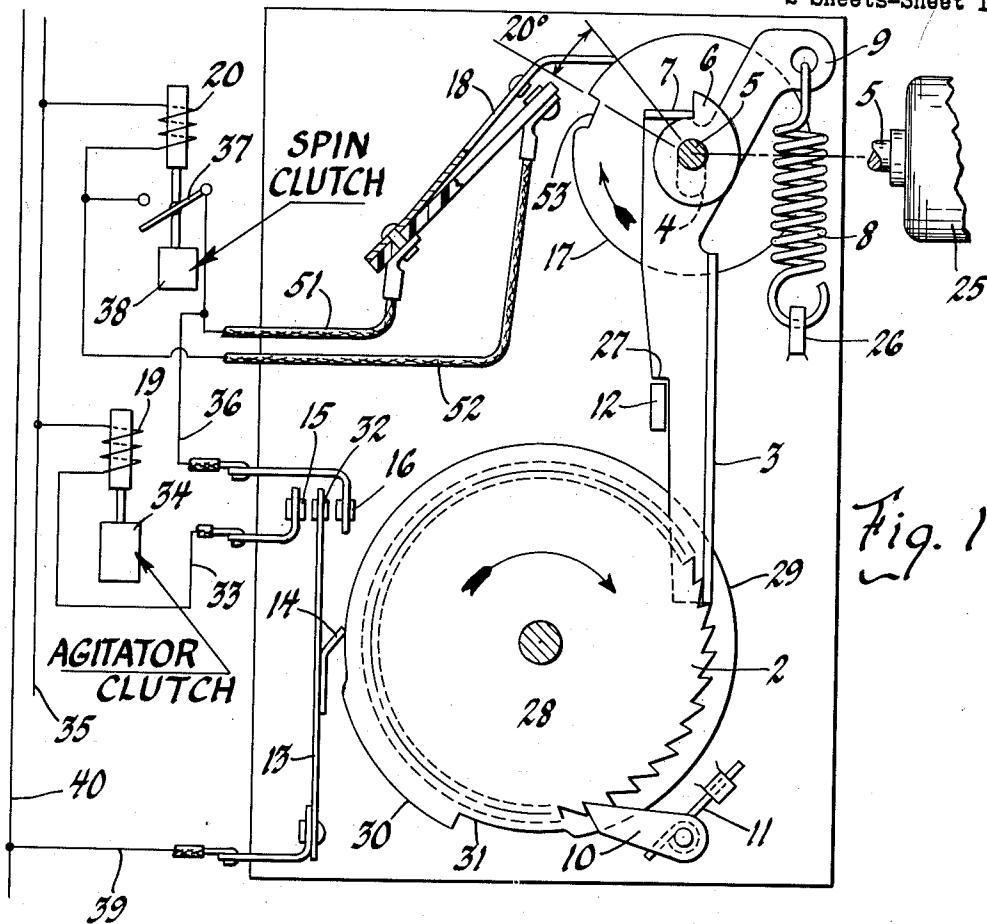
Dec. 20, 1960

W. E. FRITZ
PROGRAM TIMER

2,964,933

Filed July 14, 1958

2 Sheets-Sheet 1



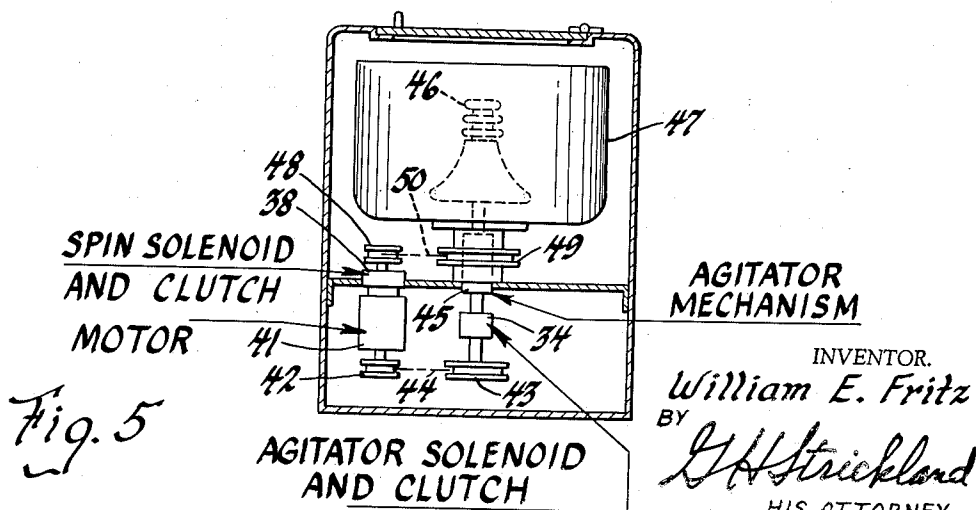
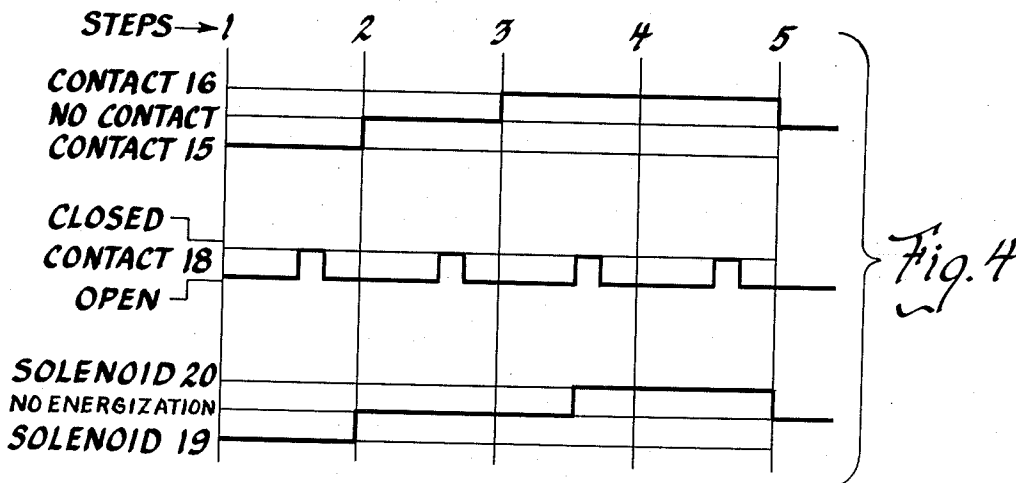
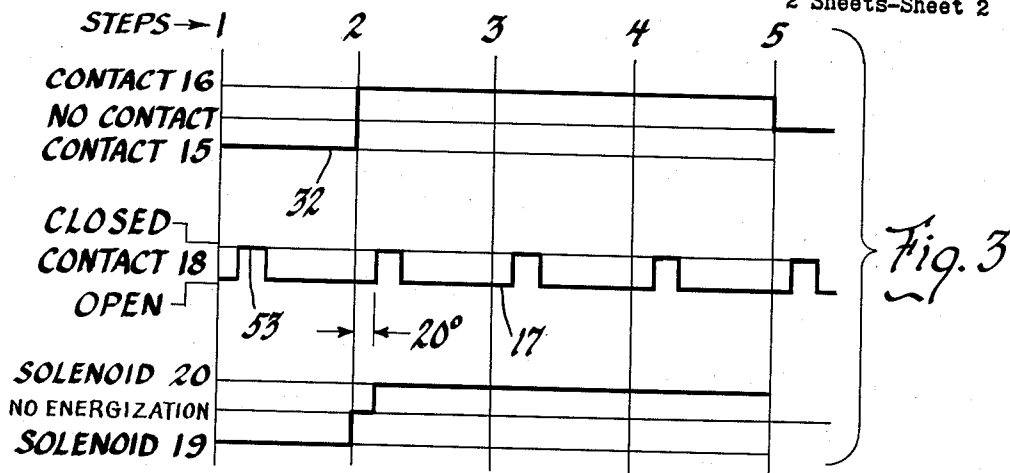
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2,964,933

PROGRAM TIMER

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This invention pertains to program timers and especially to program timers for the sequential operation of automatic washers and other devices.

In automatic washers, at the conclusion of the agitation period, the program timer is called upon to effect a change to the extraction period. In most washers, it is desirable that there be some delay between these periods to allow the agitation mechanism to be stopped before the extraction mechanism is rendered effective. However, in program timers, to assure instantaneous closing and opening of contacts, the actuating cams are advanced in quick steps separated by intervals of 40 to 120 seconds during which the cams are not moving. This provides an arrangement whereby the switches can be only either substantially simultaneously opened or closed during a single step or during successive steps at intervals of 40 to 120 seconds.

It is an object of this invention to provide a more flexible program timer with a simple arrangement wherein the difference between the effective control operations of a circuit or circuits can be fractions of the intervals between the steps, for example, 3 seconds or 135 seconds.

It is another object of this invention to provide a washing machine with a short minimum uniform delay between the agitation and spinning periods which is no more than sufficient to allow the mechanism to stop in between the two periods.

It is still another object of this invention to provide a program timer arrangement whereby a step-by-step actuator is provided with a circuit time delay device inherently coordinated mechanically with the step-by-step actuation.

These and other objects are attained in the form shown in the drawings in which a geared synchronous motor continuously operates at a slow speed a shaft provided with two cams. One of the cams, through a pawl and ratchet wheel, step by step slowly rotates a cam shaft. The cam shaft is provided with one or more cams operating single or double-throw switches. These switches may be used to control one or more electrical circuits to control one or more electrical devices. The switches may be operated during any of the steps according to the contour of the cam or cams.

To provide a different period of delay in one or more of the circuits than is possible by step-by-step operation, the second cam on the first-mentioned shaft controls a switch in series with one or more of the circuits. The angular relationship between the cam and its follower operating the pawl and ratchet mechanism and the second cam and its follower operating the last-mentioned switch determines the interval that can be obtained between the actuation of the switch or switches by the step-by-step actuated cam and the second cam on the continuously operated slow speed shaft.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein

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a preferred embodiment of the present invention is clearly shown.

In the drawings:

Figure 1 is a diagrammatic view and wiring diagram of a program timer and electrical circuit embodying one form of my invention;

Figure 2 is a simplified wiring diagram for the electrical circuit and timer shown in Figure 1;

Figure 3 is a time-movement graph of the two contact cams and the resulting circuit energization for the program timer illustrated in Figure 1;

Figure 4 is a similar time-movement graph in which the time delay period is longer than one revolution of the continuously operated shaft; and

Figure 5 is a diagrammatic view of an automatic washer to which this program timer and circuit may be applied.

Referring now to the drawings and more particularly to Fig. 1, there is illustrated a synchronous electric motor 25 provided with suitable gearing (not shown) to constantly rotate the cam shaft 5. This cam shaft 5 has fixed thereon a spiral cam which is in the form of an Archimedes spiral, and a second cam 17. Also on the shaft 5 is a pawl 3 having a vertical slot 4 which receives the shaft 5 which thereby supports the pawl. The pawl 3 has a lever extension arm 9 extending diagonally upwardly from the shaft 5 to which is connected a tension spring 8 connected at its lower end to an anchorage 26. The tension spring 8 urges the pawl 3 downwardly and also in a clockwise direction about the shaft 5 due to its offset relationship. The pawl 3 is provided with a shoulder 27 which as a result of the applied clockwise component as well as the downward component of force engages a stop 12 to limit the clockwise and downward movement of the pawl 3. The pawl 3 is provided with a right-angled follower projection 7 held on the periphery of the spiral cam 6, by the downward component of the spring 8, as shown in Fig. 1. The right edge of the projection 7 is substantially over the axis of the shaft 5.

The spring 8, by applying a clockwise component, also holds the lower end of the pawl 3 in engagement with the teeth of the ratchet wheel 2 fixed to the intermittently operable cam shaft 28. To prevent the ratchet wheel 2 from being pulled backward by the pawl 3 when it is raised by the cam 6, there is provided a pivoted keeper pawl 10 having a spring 11 to keep it in engagement with the teeth of the ratchet wheel 2.

Also fixed to the cam shaft 28 is a peripheral cam 1 having a long section 29 of intermediate radius, a short section 30 of a slightly longer radius and a third section 31 of shorter radius than the section 29. A conventional spring mounted contact reed 13 has a projection 14 continuously held in engagement with the periphery of the cam 1. The contact reed 13 is anchored at one end and at the opposite end carries a double contact 32 held by the peripheral section 29 at an intermediate point between the contacts 15 and 16. The contact reed 13 is moved by the peripheral section 30 to cause engagement of the contacts 32 and 15 at the junction between the sections 29 and 30. When the junction between the sections 30 and 31 reaches the projection 14, the reed 13 and the contacts 32 will move suddenly out of contact with the contact 15 directly into contact with the contact 16. This is illustrated in the upper line 32 of Fig. 3 in which there is shown the engagement of the contact 32 with the contact 15 in step 1, which is the last portion of the section 30, and the sudden movement of the contact 32 during step 2 from the contact 15 to the contact 16 when the junction of the sections 30 and 31 is reached. The contact 32 remains in contact with the contact 16 through steps 3, 4 and 5.

Contact 15 is connected by the conductor 33 to a solenoid 19 connected to operate the agitation clutch 34 of

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the automatic washer shown in Fig. 5. The solenoid 19 is connected to the supply conductor 35. The contact 16 is connected by a conductor 36 to a holding switch 37, in turn connected to a solenoid 20 which controls the spin clutch 38. The solenoid 20 is also connected to the supply conductor 35. The reed 13 is connected by conductor 39 to the supply conductor 40.

As shown in Fig. 5, an electric motor 41, through the pulleys 42 and 43, a belt 44, and the agitator solenoid and clutch 34 drive an agitating mechanism 45 connected to an agitator 46 in the washing and extraction container 47. The motor 41 also connects through the spin clutch 38, the pulleys 48, 49 and the belt 50 with the washing and extraction container 47 to spin the container 47 for extraction of water from the clothes in the container 47. To prevent strain and damage to the clothes and the mechanism of the washer, it is desirable that the agitator 46 and the agitating mechanism 45 be at rest when the motor 41 starts the spinning or extraction operation. Therefore, the immediate change of the contact 32 from engagement with the contact 15 to the contact 16, would be undesirable.

In Fig. 4 is shown an alternative arrangement in which there is shown on the first line a development of the surface of a cam corresponding to the cam 1 which is provided with an intermediate step of the same radius as the periphery 29 between the sections 30 and 31 providing a period between the steps 2 and 3 in which the contact corresponding to the contact 32 is held at the intermediate point illustrated in Fig. 1 to provide time for the agitation mechanism to stop before the extraction operation is begun. However, this time delay is limited to the time between successive movements of the pawl 3, which is governed by the speed of rotation of the shaft 5. This speed of rotation of the shaft 5 varies, in different timers, from 40 to 120 seconds. Usually, the interval is about 60 seconds. This interval of 60 seconds is much longer than is required for the agitation mechanism to come to a complete stop. Therefore, this increases the time necessary for a complete washing cycle.

According to this invention, to provide a time delay between the agitation and extraction periods which is independent of the speed of the shaft 5 and the cam 1, I connect in shunt with the switch 37 through the conductors 51 and 52 a spring contact switch 18 having an extension normally in engagement with the periphery of the cam 17. The periphery of the cam 17 has its major portion of such a radius as to hold the switch 18 in the open position. The cam 6 operates to raise the pawl 3 from the lowest portion of its periphery to the highest portion of its periphery during each revolution against the tension of the spring 8. When the highest portion of the periphery of the cam 6 reaches the edge of the projection 7, the pawl 3 is suddenly pulled downwardly by the spring 8 to advance the ratchet wheel 2 through an angle equal to the peripheral distance of one tooth.

The amount of movement of the cam 17 after this sudden movement of the pawl 3 until the switch 18 is closed, determines the time delay in the circuit of the spin solenoid 20 by which the energization of the solenoid 20 is delayed. In Fig. 1 the cam 17 is provided with a notch 53 of limited depth. The beginning of this notch is located approximately 20° in a counter-clockwise direction from the contacting projection of the spring switch 18 when the vertical peripheral portion of the cam 6 is in the position shown in Fig. 1. This, therefore, will provide a delay or open circuit of about 3 seconds when the shaft 5 is rotating at 1 r.p.m. As shown in the second line of Fig. 3, the notch 53 provides brief closed period between each of the steps at regular intervals.

In the bottom line of Fig. 3 the effect of this arrangement is shown. The energization of solenoid 19 is shown as continuing from step 1 to step 2. At step 2 solenoid 19 is deenergized by the movement of the contact 32 away from the contact 15 into engagement with the con-

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tact 16, as illustrated in line 1. This does not result in the energization of solenoid 20 immediately since switches 37 and 18 are both open. When the notch 53 presents itself to the projection of the switch 18, the circuit is then completed through the electromagnet 20 to operate the spin or extraction clutch 38 to start the spinning or extracting operation of the container 47. The energization of the solenoid 20 also causes the closing of a holding switch 37 which will continue the energization of the solenoid 20 throughout the extraction period even though the switch 18 will reopen after several seconds. This extraction period will continue until the junction of the sections 31 and 29 of the cam 1 reaches the projecting follower 14 to return the contact 32 to its intermediate position.

If the cam 1 were provided with an intermediate step of a length substantially equal to one of the teeth of the ratchet wheel 2, providing a holding of the contact 32 at an intermediate point between steps 2 and 3, as indicated by line 1 of Fig. 4, the cam 17 could be provided with a notch similar to the notch 53 at another point in its periphery, perhaps diametrically opposite to the position shown in Fig. 1, to provide operation of the contact 18 at the times indicated on the middle line of Fig. 4. The arrangement thus illustrated in Fig. 4 shows an arrangement by which the time delay between the energization of the solenoids 19 and 20 is increased to about 1.6 the time interval between one step. The modification shown in Fig. 4 thus illustrates the flexibility of this timer arrangement.

While the embodiment of the present 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. A washing machine including an enclosure, agitating means, extracting means, an intermittently advancing timer having electrical control switch means and a circuit for changing the operation from said agitating means to said extracting means during one of its periods of operation for changing from an agitating to an extracting period, said timer including a time delay switch device connected in electrical series circuit with said control switch means and said circuit, said time delay switch device being coordinated with and rendered effective during said one period of operation of said timer for briefly opening said circuit for interposing a short limited uniform delay in the change from the agitating to the extracting period.

2. A washing machine including an enclosure, agitating means and agitating circuit means, extracting means and extracting circuit means, a timer having electrical control switch means associated with said agitating and extracting circuit means for sequentially rendering effective said agitating means and said extracting means to provide agitation and extracting periods, said timer including an additional switch means in electrical series circuit with said electrical switch means and said extracting circuit means and means coordinated with the change from the agitating period to the extracting period for delaying the closing of said additional switch means for a limited uniform period of time to provide a minimum but sufficient delay between the agitating and extracting periods.

3. A washing machine including an enclosure, agitating means, extracting means, electrical control switch means for operating said agitating means and said extracting means to provide agitating and extracting periods, an additional switch means in electrical series circuit with said extracting means and said electrical switch means, and means coordinated with the change from the agitating period to the extracting period for delaying the closing of said additional switch means for a limited uniform period of time to provide a minimum but sufficient delay between the agitating and extracting periods.

4. A washing machine including an enclosure, agitat-

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ing means, extracting means, an intermittently advancing timer having first switch means for changing the operation from said agitating means to said extracting means during one of its periods of operation for changing from an agitating to an extracting period, said timer also including a time delay switch means connected in electrical series circuit with said first switch means and said extracting means coordinated with and rendered effective during said one period of operation of said timer for interposing a short uniform delay in the change from the agitating to the extracting period.

5. A washing machine including an enclosure, agitating means, extracting means, an intermittently advancing timer having first switch means for energizing the agitating means and second switch means for energizing the extracting means and means for opening the first switch means and closing the second switch means for changing from the agitating period to the extracting period, said timer also including a time delay switch means connected in electrical series circuit with said second switch means and said extracting means coordinated with and rendered effective during the closing of the second switch means for interposing a short uniform delay in the change from the agitating to the extracting period.

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6. A program timer including a double throw switch means having two energized positions, slowly operating cam means for moving said switch means rapidly from the first energized position to the second energized position, a first normally open switch and an electrical means in series with the second energized position of said double throw switch means, a second rapidly rotating cam means having means coordinated with said slowly operating cam means for momentarily closing and then reopening said normally open switch means, a shunt circuit provided with a second normally open switch means for shunting said first normally open switch means, and means responsive to the energization of said electrical means for closing said second normally open switch means and responsive to the deenergization of said electrical means for opening said second normally open switch means.

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