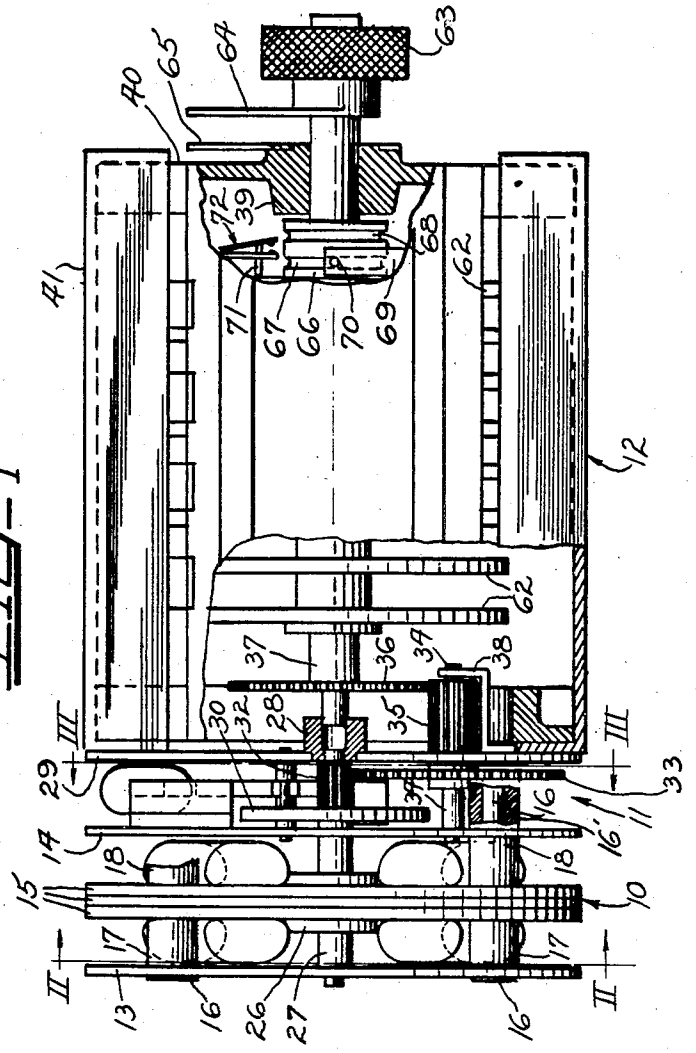
July 13, 1948. L. RINGER 2,444,955

TIME SWITCH

Filed Oct. 14, 1944 2 Sheets-Sheet 1

Fig-1



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TIME SWITCH

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Fig-3

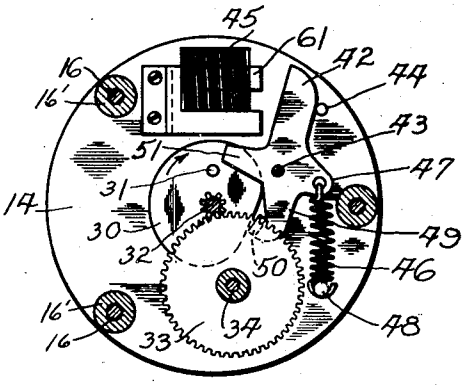


Fig-2

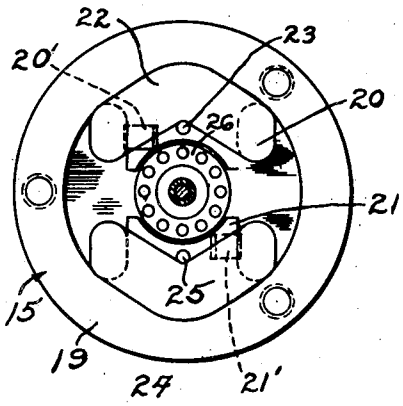


Fig-4

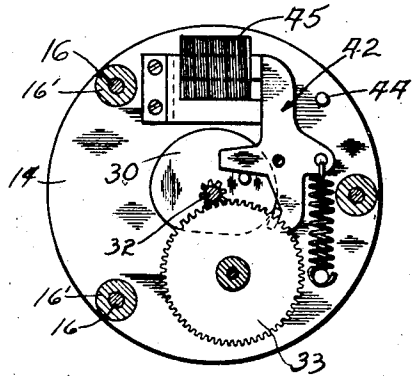


Fig-6

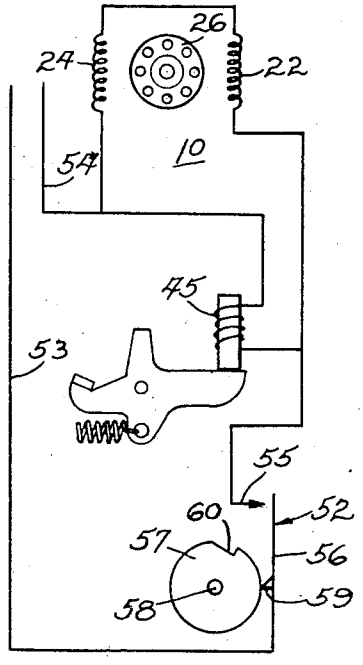
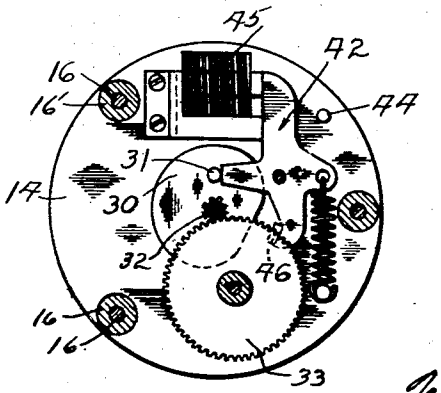


Fig-5



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Patented July 13, 1948 2,444,955

UNITED STATES PATENT OFFICE

2,444,955

TIME SWITCH

Luther Ringer, Berrien Springs, Mich., assignor to Nineteen Hundred Corporation, St. Joseph, Mich., a corporation of New York

Application October 14, 1944, Serial No. 558,711

8 Claims. (Cl. 74—84)

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This invention relates to a time switch, and more particularly to a time switch of the intermittent drive type.

Considerable work has been done in the past in connection with time switches and other similar mechanisms wherein a plurality of electric circuits are sequentially opened and closed in accordance with some predetermined program of action. These time switches may be broadly classified into two groups; namely, those in which the cams for opening and closing the switch elements have a continuous rotary movement derived from a continuously rotating driving member, and those in which the cams have an intermittent rotary motion derived from an intermittently or a continuously rotating driving member. The first class of time switches is not particularly suited for controlling circuits carrying any substantial amount of current in view of the fact that the slow opening and closing of the contact elements usually causes considerable arcing. It is in connection with the second class of time switches with which the present invention is concerned.

Considerable work has been done in the past in connection with time switches in which the cams are intermittently driven from the energy stored in a spring and in which energy is intermittently released to cause a rapid advancement of the cams through a predetermined arc of movement. One of the principal features and objects of the present invention is to provide a time switch of the intermittently driven type which does away with the need for loading a spring to intermittently drive the cams.

More particularly, it is a feature and object of the present invention to provide a time switch in which a small electric motor is employed to drive the cams and which small motor is intermittently energized.

A further object of the present invention is to provide a novel time switch and control circuit therefor.

Another and further object of the present invention is to provide novel mechanism for delivering intermittent rotary movement.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to its organization, manner of construction and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings, in which:

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Figure 1 is an elevational view of a time switch embodying the novel features of the present invention with a portion of the casing removed;

Fig. 2 is an end view of the electric motor forming a part of the structure of Figure 1, with one of the field coils thereof removed, as taken along the line II—II of Figure 1;

Figure 3 is a sectional view through the time switch as taken along the line III—III of Figure 1; and shows the time and latch switch when the time switch and its associated control circuit is in a de-energized condition;

Figure 4 is a view similar to Figure 3 showing an initial stage in the operation of the cam;

Figure 5 is a view similar to Figure 3 showing the cam after it has made one complete revolution and showing the latch mechanism in its position for interrupting the movement of the cam; and

Figure 6 is a diagrammatic illustration of the control circuit which is associated with the time switch of Figure 1.

Referring to the various figures of the drawings, the time switch shown therein includes a shaded pole squirrel-cage induction motor 10, an intermittent coupling mechanism 11 and a cam and switch unit 12. These structures 10, 11 and 12 are mounted together in a single integral unit as is clearly shown in Figure 1 of the drawings.

The shaded pole squirrel-cage induction motor 10 includes two end plates 13 and 14 between which are mounted the stator laminations 15 by means of suitable stator pins 16 and spacers 17 and 18. The stator laminations 15 are in the form of an annular ring portion 19 with two salient pole portions 20 and 21, having shading coils 20' and 21' respectively. A field coil 22 is mounted on the salient pole portion 20 and is held in place by means of a pin 23 which extends through the pole portion 20 and projects outwardly therefrom on either side. A coil or field winding 24 similar to the winding 22 is mounted on the pole portion 21 and is held in place by a pin 25.

The motor 10 is provided with a rotor 26 of conventional squirrel-cage design, and this rotor 26 is rigidly mounted on a rotor shaft 27 which is journalled in the end plates 13 and 29.

The rotor shaft 27 extends through the end plate 14 and is supported and journalled in one end of the bearing 28. A mounting plate 29 is supported in spaced parallel relation from the end plate 14 by the pins 16 and the spacers 16'.

The intermittent drive coupling mechanism 11 may be seen best from an inspection of Figures 1 and 3 to 5 of the drawings. As shown the

rotor shaft 27 has a cam 30 rigidly mounted thereon which carries a pin 31 on one face thereof. Also formed on the rotor shaft 27 is a pinion 32 which meshes with a large gear 33 rigidly mounted on a shaft 34. The shaft 34 is journalled in the end plates 14 and 29 and extends through the latter, as is clearly shown in Figure 1. The portion of the shaft 34 which extends through the end plate 29 is provided with a pinion 35 which meshes with a large driven gear 36 which is carried on the cam shaft 37. The right hand end of the shaft 34, as viewed in Figure 1, is supported and journalled in a bracket 38 carried on the end plate 29. The cam shaft 37 is journalled at one end in the bearing 28 and at its opposite end in the enlarged portion 39 of the end wall 40 of the time switch and cam housing 41.

Mounted between the end plates 14 and 29 is a latch finger 42 which is pivotally mounted on a pin 43 carried by the plates 14 and 29. This latch finger 42 is arranged for limited angular movement between a stop pin 44 and the magnetic field member 45, it being normally biased against the pin 44 by a biasing spring 46 which extends between an ear 47 on the latch finger 42 and a pin 48 on the end plate 14. The latch finger 42 is provided with a tail portion 49 which terminates in a transversely bent lip 50. The lip 50 is positioned opposite a peripheral edge of the cam 30. The latch finger 42 is also provided with a cam pin engaging finger 51. When the latch 42 is in its position as shown in Figures 4 and 5 of the drawings, the cam pin engaging finger 51 lies in the path of movement of the cam pin 31.

As shown in Figure 6 of the drawings, the electromagnet or magnetic latch 45 is connected in parallel with the field windings 22 and 24 of the electric motor 10. This electromagnetic latch 45 and the field windings 22 and 24 are arranged to be intermittently energized through a cam operated switch 52 connected in the power supply line 53. The other power supply line 54 is connected as shown in Figure 6 to the field winding 24 and the electromagnet 45. The cam operated switch 52 includes a stationary contact member 55, a movable contact member 56 and a cam 57 which is rigidly mounted on a continuously rotating shaft 58. The movable contact arm 56 is provided with a cam follower 59 which rides on the outer peripheral surface of the cam 57 and is arranged to drop into the notched out portion 60 of the cam 57 to close the movable contact arm 56 against the stationary contact 55. The cam 57 may be driven in any suitable manner and when the switch is employed in connection with an automatic washing machine it may be conveniently driven from the main motor of the washing machine, this combination being described in further detail in an application to Geldhof and Ringer filed concurrently herewith and in which is claimed the time switch control system in which my intermittent drive for the time switch may be employed.

The manner in which the cam shaft 37 of the switch unit 12 is intermittently driven may best be understood by a consideration of Figures 3 to 6 of the drawings. With the switch 52 of the control circuit open and the cam 57 rotating in a clockwise direction, as indicated by the arrow, the intermittent coupling mechanism is in the position as shown in Figure 3 of the drawings. As the cam 57 continues to rotate the notched out portion 60 in the peripheral surface of the cam 57, it passes under the cam 59 and the movable contact arm 56 (which is normally biased to its closed position) snaps into engagement with the stationary contact 55. This energizes the squirrel-cage induction motor 10 as well as the electromagnet 45. Due to the fact that the latch finger 42 is a considerable distance away from the core member 61 of the electromagnet 45, as well as being biased by the spring 46 in a direction away from this core member 61, energization of the electromagnet 45 will not rock the latch finger in a counter-clockwise direction. The motor, however, being energized, effects movement of the rotor 26 which in turn rotates the cam 30 in a clockwise direction, as indicated by the small arrow in Figure 3 of the drawings. Since the small pinion 32 is also rigidly secured on the rotor shaft 27 along with the cam 30, the large gear 33 is rotated, which in turn drives the large gear 36 through the pinion 34. Rotational movement of the large gear 36 turns the cam shaft 37 of the switch unit 12. It will be observed that there is a very substantial gear reduction between the gear 32 and the gear 36 and it will therefore be understood that one complete revolution of the gear 32 will only cause a very small angular movement of the cam shaft 37. This movement of the cam shaft 37, however, will take place very rapidly due to the high speed of rotation of the motor 10.

Returning now to Figures 3 to 6 of the drawings, the rotational movement of the cam 30 in a clockwise direction causes the cam 30 to bear against the lip 50 of the tail portion 49 on the latch finger 42. This causes the latch finger to be rocked in a counter-clockwise direction about its pivot pin 43. This rocking movement moves the upper end of the latch finger 42 into engagement with the core 61 of the electromagnet 45 where it is retained thereby. The position of the respective elements of the intermittent drive mechanism 11 as the cam 30 moves the latch finger 42 into engagement with the core 61 of the electromagnet 45 is shown in Figure 4 of the drawings. Continued rotation of the cam 30 carries the pin 31 around until it strikes the cam pin engaging finger 51 of the latch finger 42. This interrupts the rotational movement of the rotor 26 and hence also interrupts the rotational movement of the cam shaft 37 of the switch unit 12. If for any reason the rotating mass, including the cam 30 and the rotor 26, should bounce back slightly when the pin 31 strikes the finger portion 51, the pin will be returned to its position against the finger portion 51 due to the fact that the motor 10 is still energized.

During this very rapid rotational movement of the cam 30 of the intermittent drive mechanism 11, the cam 57 of the switch 52 is also continuing to rotate. The notch 60 is so cut that very shortly after the cam 30 has made one complete revolution the movable contact arm 56 is opened and the motor 10 as well as the electromagnet 45 are de-energized. De-energization of the electromagnet 45 releases its hold on the latch finger 42 and the biasing spring 46 accordingly shifts the latch finger 42 back into its position against the stop pin 44. The intermittent drive mechanism is now in the position as shown in Figure 3 of the drawings, and the elements are thus again in a position awaiting re-energization of the motor 10 and the electromagnet 45 after the cam 57 has made another complete revolution.

From the above description it will be apparent that the cam shaft 37 of the switch unit 12 is

intermittently advanced at periodically spaced intervals by a rapid movement. This rapid step by step advancement of the cam shaft 37 substantially reduces arcing during the making and breaking of the various switch elements contained within the switch unit 12 which are opened and closed by the cam 62 mounted on the cam shaft 37. The extent of each angular advancement of the cam shaft 37 of course depends upon the extent of the gear reduction through the gears 32, 33, 35 and 36. The duration of the interval between the angular advancements of the cam shaft 37 will of course depend upon the speed of rotation of the shaft 58 as well as the numbered notches 60 in the cam 57 of the switch 52, for more than one notch may be employed if desired.

The details of construction of the switch unit 12 form no part of the present invention other than their general relationship to the combination. For that reason the switch unit 12 has not been illstrated in detail. For the purpose of understanding the present invention it is sufficient to know that the cam shaft 37 is mounted in such a manner as to have limited longitudinal movement within its bearings 28 and 39. This cam shaft 37 carries a knob 63 on the outer end which is rigidly secured thereto. The knob 63 is provided with a pointer 64 which lies opposite a dial 65 carried on the end wall 40 of the housing 41. A hub member 66 having two annular grooves 67 and 68 therein is carried on the cam shaft 37 and secured thereto. A spring finger 69 mounted on the housing has a pin 70 carried on the free end thereof which is arranged to normally set within either the groove 67 or the groove 68. This finger 69 is for the purpose of normally holding the cam shaft 37 in either one of two longitudinal positions.

In the position as shown the pin 70 on the finger 69 is in engagement with the groove 67 since the cam shaft has been pulled to the right, as viewed in Figure 1 of the drawings. It is moved to this position for the purpose of manually advancing the position of the cam shaft 37 by the knob 63. The end cam 62 carried on the cam shaft 67 engages a pin 71 of a switch 72 when the cam shaft 37 is moved to the right to completely open the circuit (not shown) of the switches which are opened and closed by the various cam disks 62. When the cam shaft 67 is moved to the left so that the pin 70 of the finger 69 drops into the groove 68, the switch 72 is closed.

The gear 36 remains in mesh with the pinion 35 irrespective of the longitudinal position of the cam shaft 37.

While I have shown a particular embodiment of my invention, it will, of course, be understood that I do not wish to be limited thereto, since many modifications may be made, and I, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim as my invention:

1. An intermittent drive mechanism comprising a rotatable member, an electric motor in driving engagement with said member, means for intermittently energizing said motor at uniform spaced intervals, means rendered operative upon partial rotation of said member for stopping the rotational movement of said member upon a predetermined further rotational movement thereof, and means for rendering said stop means inoperative when said motor is deenergized.

2. An intermittent drive mechanism comprising a rotatable member, an electric motor in driving engagement with said member, means for intermittently energizing said motor at uniform spaced intervals, means rendered operative upon partial rotation of said member for stopping the rotational movement of said member after one complete revolution thereof, and means for rendering said stop means inoperative when said motor is deenergized.

3. An intermittent drive mechanism comprising a rotatable member, an electric motor in driving engagement with said member, means for intermittently energizing said motor at uniform spaced intervals, means movable into engagement with said member for interrupting the rotational movement thereof, said last means being normally biased out of engagement with said member, means responsive to a partial rotational movement of said member for moving said interrupting means to an operative position, and means effective each time said motor is deenergized, for releasing said interrupting means, whereby said interrupting means is returned to its normally biased inoperative position.

4. An intermittent drive mechanism comprising an electric motor having a rotor, a driven shaft, gear reduction mechanism connecting said rotor to said driven shaft, means for intermittently energizing said motor at spaced intervals, each period of energization being greater than the time it takes said rotor to advance from one predetermined angular position to another, means rendered operative upon an advancement of said rotor a fractional portion of its step by step advancement for stopping the rotational movement of said rotor after it has reached its said another predetermined angular position, and means for rendering said stop means inoperative when said motor is de-energized.

5. An intermittent drive mechanism comprising an electric motor having a rotor, a driven shaft, gear reduction mechanism connecting said rotor to said driven shaft, means for intermittently energizing said motor at spaced intervals, each period of energization being greater than the time it takes said rotor to make one revolution, means for stopping the rotational movement of said rotor after one complete revolution, means rendered operative upon partial rotational movement of said rotor for moving said stop means to an operative position, and means for returning said stop means to an inoperative position when said motor is deenergized.

6. An intermittent drive mechanism comprising an electric motor having a rotor, a driven shaft, means connecting said rotor to said driven shaft to drive the same, means for intermittently energizing said motor at spaced intervals, each period of energization being greater than the time it takes said rotor to make one revolution, a cam rotated by said rotor, said cam having a stop member thereon in an eccentric position with respect to its axis of rotation, a latch normally biased to a position out of engagement with said stop member, said cam being arranged to move said latch to a stop member engaging latching position upon partial rotation of said rotor, where it will interrupt the rotational movement of said rotor after said rotor has made one revolution, and means for returning said latch to its original position when said motor is de-energized.

7. An intermittent drive mechanism comprising an electric motor having a rotor and a rotor shaft, a driven shaft, means connecting said rotor shaft

to said driven shaft to drive the latter, means for intermittently energizing said motor at spaced intervals, each period of energization being greater than the time it takes said rotor to make one revolution, a cam secured on said rotor shaft having a non-concentric cam surface, said cam having a stop projection thereon spaced from the axis of rotation of said cam, said stop member being out of the path of movement of said stop projection on said cam when said stop member is in its first position, and being in the path of movement of said projection when said stop member is in its second position, biasing means normally holding said stop member in its first position, said cam surface being shaped and positioned to move said stop member to said second position upon a fractional revolution of said cam, means rendered operative upon energization of said motor for holding said stop member in its second position when moved there by said cam surface, whereby the rotational movement of said rotor is stopped after said projection strikes said stop member, and means for releasing said holding means when said motor is de-energized.

8. An intermittent drive mechanism comprising an electric motor having a rotor and a rotor shaft, a driven shaft, means connecting said rotor to said driven shaft to drive the latter, means for intermittently energizing said motor at spaced intervals, each period of energization being greater than the time it takes said rotor to make one revolution, a cam secured on said rotor shaft having a non-concentric cam surface, said cam having a stop member engaging portion thereon spaced from the axis of rotation of said cam, a stop member of magnetizable material mounted

for movement between a first position and a second position, said stop member being out of the path of movement of said stop portion on said cam when said stop member is in its first position, and being in the path of movement of said stop portion when said stop member is in its second position, whereby the rotational movement of said rotor is stopped when said stop portion strikes said stop member, biasing means normally holding said stop member in its first position, said cam surface being shaped to move said stop member to its second position upon a partial revolution of said cam, and an electromagnet having a field when energized sufficiently strong to hold said stop member in its second position when moved there by said cam but of insufficient strength to effect movement of said stop member from its first position to its second position, said electromagnet being energized and de-energized as said motor is energized and de-energized.

LUTHER RINGER.

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