May 14, 1963 P. H. WILLIAMS 3,089,994

TIMER APPARATUS WITH RAPID ADVANCE

Filed Oct. 9, 1959 3 Sheets-Sheet 1

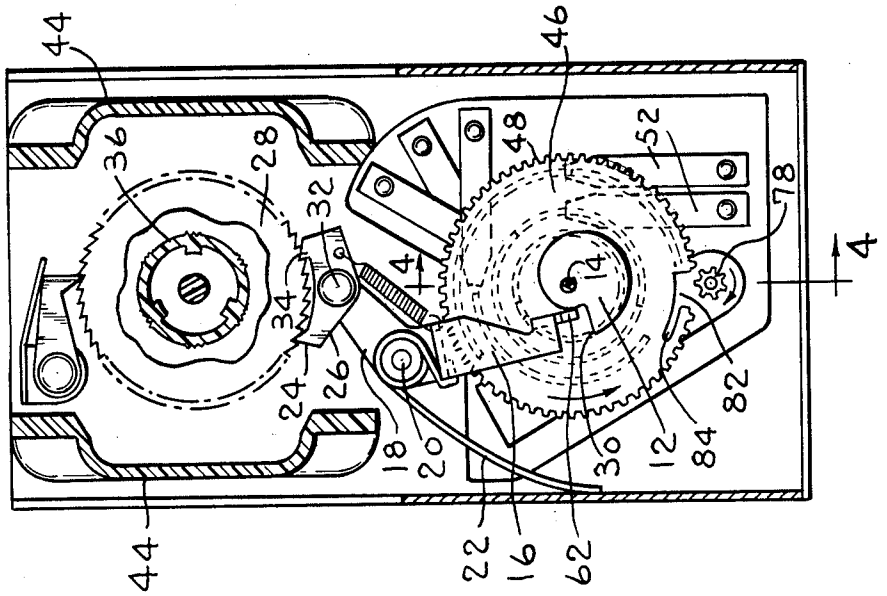

FIG. 2

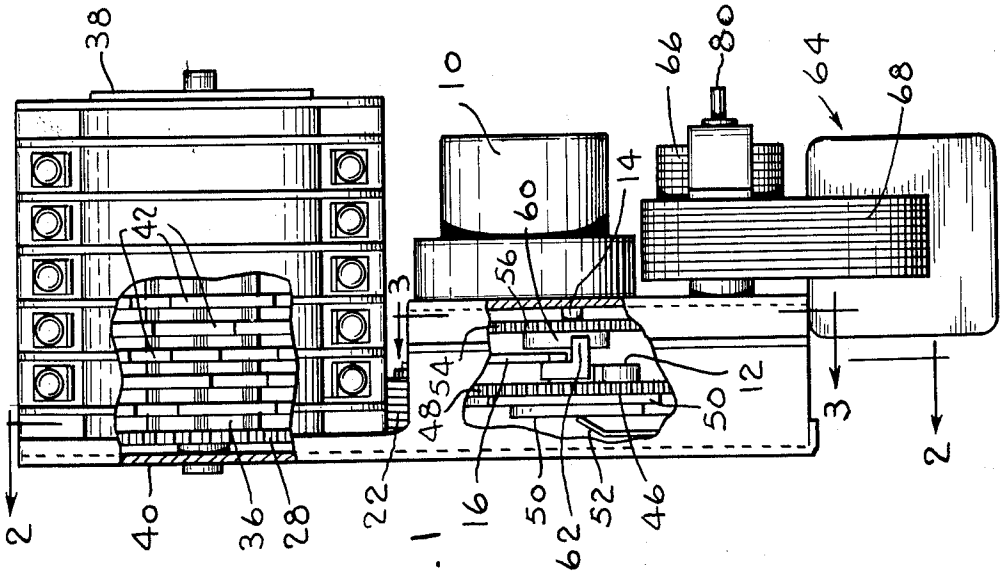

FIG. 1

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Filed Oct. 9, 1959 3 Sheets-Sheet 2

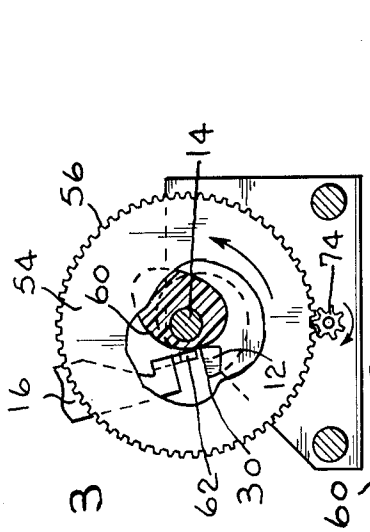

FIG. 3

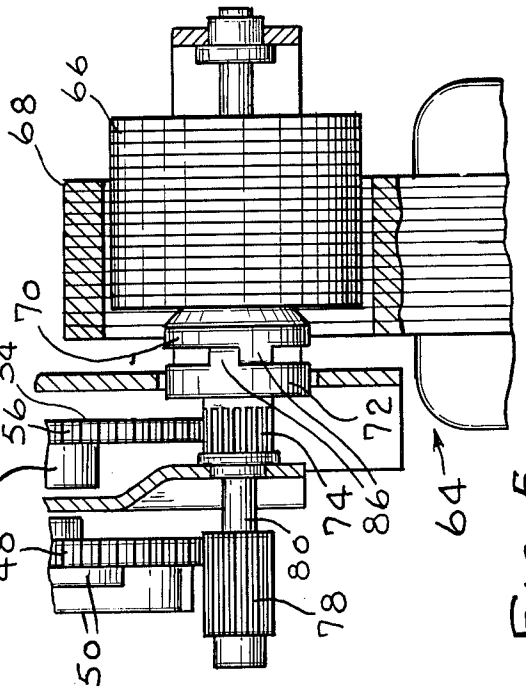

FIG. 5

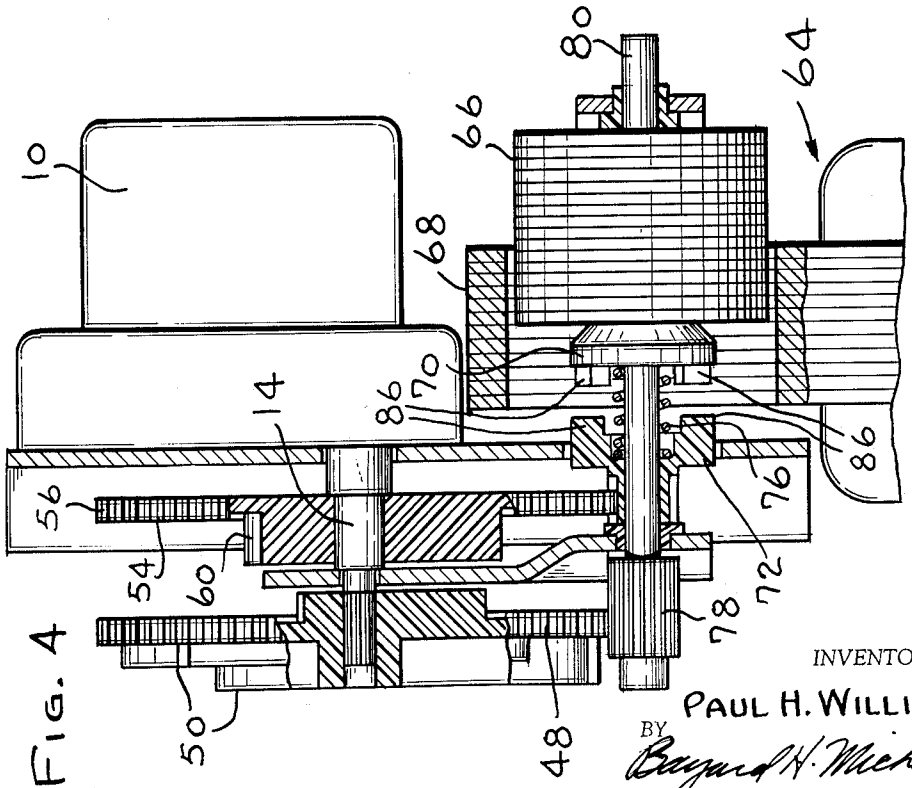

FIG. 4

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TIMER APPARATUS WITH RAPID ADVANCE

Filed Oct. 9, 1959 3 Sheets-Sheet 3

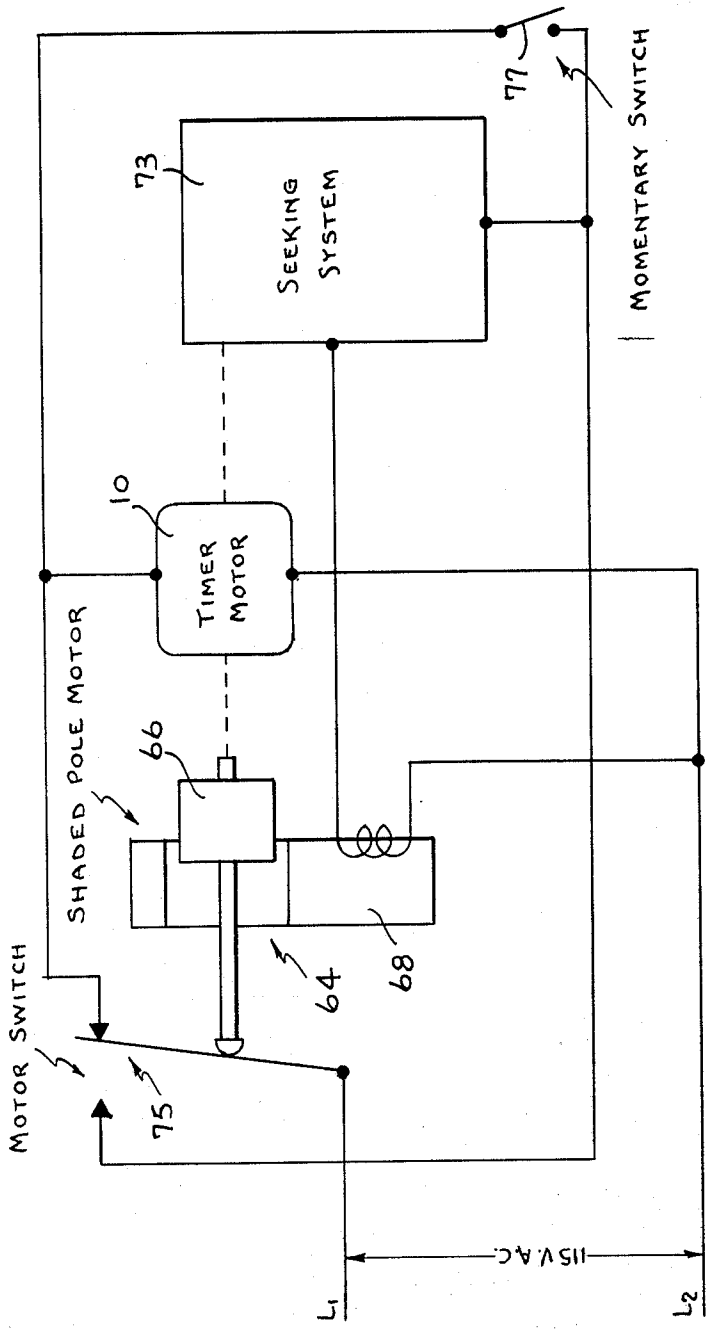

FIG. 6

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TIMER APPARATUS WITH RAPID ADVANCE

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Filed Oct. 9, 1959, Ser. No. 845,551
13 Claims. (Cl. 318—443)

This invention relates to timers of the type having high speed advancing means to rotate the timer rapidly to a starting point. A timer of this type is shown in copending Strathearn et al. application, Serial Number 799,780, filed March 16, 1959, now Patent No. 2,995,143 issued August 8, 1961.

In Strathearn et al. the functions available on the timer were increased by adding sub-interval switches to the timer drum drive system which switches are actuated during each step of movement (or interval) of the timer drum. When the drum is advanced at high spee dto the starting point, the fast rotation of the drive system causes considerable noise due to the continuous actuation of the sub-interval switches. The noise level is raised further by the snapping of the follower of the step drive mechanism against the drive cam.

An object of the present invention is to reduce the noise level of the timer as much as possible during high speed advance. This has been accomplished by providing means to drop out the slow speed drive cam on which the sub-interval switch cams are mounted during high speed advance which gives rise to a further problem of picking up the slow speed cam at the proper starting point. Means are therefore provided for properly orienting the slow speed drive cam during the high speed operation.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the single embodiment shown in the drawings in which:

FIG. 1 is a front elevation, partly in section.

FIG. 2 is taken on line 2—2 of FIG. 1 showing the drive mechanism.

FIG. 3 is taken on line 3—3 of FIG. 1 showing the high speed cam drive.

FIG. 4 is taken on line 4—4 of FIG. 2 with the high speed motor disengaged.

FIG. 5 is similar to FIG. 4 with the high speed motor engaged.

FIG. 6 is a schematic wiring diagram of the present invention.

In the drawings, the timer is of the basic interval type wherein slow speed drive motor 10 drives cam 12 (FIG. 2), fixed on shaft 14, in a counterclockwise direction to act on follower 16 to rock link 18 in a clockwise direction about pivot 20 and against the bias of spring 22. During the clockwise rocking of the link, the toe 24 of verge 26 will ride up the sloping portion of the next rearward ratchet tooth on ratchet wheel 28 and shortly before the impulse is given to its lever, the toe will drop into the next notch on the ratchet wheel. When the follower reaches the drop portion 30 of the cam, the energy of spring 22 is released and the link rapidly rocks in a counterclockwise direction, driving the toe against the ratchet. Simultaneously with this action the verge will rock about pivot 32 in a counterclockwise direction to force heel 34 into a corresponding ratchet tooth, thus preventing overstepping. The ratchet wheel is secured to arbor 36 which is mounted to rotate between end plates 38, 40 and carries cams 42 which sequentially actuate function switches mounted on terminal boards 44.

Sub-interval switches 52 are actuated by face cams 50 which are integral with drive cam 12. In the Strathearn et al. patent, the drive cam is rotated one complete revolution for each step of the timer drum and sequences the sub-interval switches through a complete cycle. When the Strathearn cam is rotated at high speed to advance the timer drum rapidly to a starting point, the sub-interval switches are also actuated rapidly, causing noise. The noise level is increased still further by the follower dropping off the high point of the cam after each revolution of the cam and snapping against the low point of the cam.

In the present invention, a high speed disc 54 having gear teeth 56 on its outer periphery is mounted to rotate freely on a timer motor shaft 14 and is provided with elliptical cam 60 that acts on finger 62 on follower 16. When shaded pole motor 64 is energized, as shown in FIG. 5, rotor 66 will be pulled between shaded poles 68 by solenoid action and rotor clutch half 70 will engage pinion clutch half 72 and rotate pinion gear 74 which engages teeth 56. This will rotate cam 60 and impulses will be delivered to the ratchet wheel on the arbor at a faster rate (generally in the neighborhood of six per second). The finger of the follower will ride on the slow drop portion of the cam thereby preventing any noise from the follower snapping thereagainst. When the shaded pole motor is de-energized, clutch spring 76 will immediately move the rotor back to the position shown in FIG. 4, disengaging the clutch halves. Thus the inertia of the rotor is immediately removed from the high speed disc when the shaded pole motor is de-energized and, hence, the inertia of the rotor will not tend to overdrive the timer past the desired point. It will be noted that when the high speed motor is energized by closing momentary switch 77, the timing motor is de-energized by switch 75 so that no motion is imparted to the low speed cam and the high speed cam will idle on shaft 14. This effects a smooth delivery of high speed drive without actuating the sub-interval switches or allowing the follower to hit the low speed cam. The high speed motor will continue to drive cam 60 until the cam bank reaches the selected starting point and the high speed motor is deenergized by seeking system 73 as described in the Strathearn et al. patent. The timer motor will then be energized to drive the cam bank at timing speed.

Referring now to other details of the device it can be seen that at the completion of a given time cycle the low speed cam disc will be stopped at any point in the sub-interval switch sequence. In the present invention pinion gear 78 engages gear teeth 48 on the periphery of the disc so that on energization of the high speed motor the low speed cam disc will be rotated until the pinion gear engages broken out section 82 which stops rotation of the low speed cam because the pinion gear no longer engages gear teeth 48. This arrangement prevents the continued rotation of the low speed disc during high speed advance and assures that the sub-interval cam disc is at the same starting point for the sub-interval switch sequence each time the timer drum is started. Orienting of the low speed disc by the pinion gear also aligns the low point of cam 12 with the follower so as not to interfere with the follower during operation of the high speed cam. Since the low speed cam will be rotated momentarily by shaded pole motor 64 after the timer motor has been de-energized, an over-running clutch is provided in the gear train which is similar to the arrangement described in Strathearn et al. By aligning the low speed disc at a starting point, a full sub-interval switch sequence will be available at the first interval. Without such an arrangement, the first interval may be lost in aligning the low speed cam disc at the start of a sub-interval sequence. When the timer motor is energized to start the program selected, the sub-interval disc will be rotated into engagement with pinion gear 78. To prevent the possibility of the gear teeth on the disc jamming with

the pinion gear due to misalignment, undercut 84 is provided behind the first few teeth on the disc to allow a small amount of flexure to occur at the point of contact of the teeth so that the gear teeth can align themselves.

Another improvement which was found necessary in using a separate elliptical cam to drive the follower was in the dogs 86 of the clutch. In the Strathearn et al. application, the dogs were cut in a saw tooth fashion so that the clutch dogs would assist in dis-engaging the clutch halves if the spring did not separate them immediately. In the present invention, it was found that when finger 62 is coasting on the elliptical cam due to the force of spring 22 acting on the link 18 the finger would actually push the cam and cause clutch half 72 to rotate faster than the rotor. If saw tooth dogs were used on the clutch, the rotor of the shaded pole motor would be cammed outward each time clutch half 72 caught up with clutch half 70. To prevent this oscillation of the armature, the shape of the trailing edge of the dogs 86 was changed to a square configuration, so that the rotor would be driven momentarily by clutch half 72 rather than being cammed outward.

In operation when a particular program cycle is selected on an appliance, shaded pole motor 64 will be energized and due to the solenoid action of poles 68, the armature will be moved against the bias of spring 76 causing clutch half 70 to engage clutch half 72 and drive elliptical cam 60 to cause the rapid rotation of the timer cam drum until the starting point for the selected program is located. Simultaneously with the energization of the shaded pole motor, pinion gear 78 on armature shaft 80 will rotate the sub-interval cam disc until broken out section 82 is opposite the pinion gear. Since the pinion gear no longer engages the gear teeth on the disc it will not rotate and the sub-interval switches will not be actuated. The timer will be advanced rapidly through the rotation of elliptical cam disc 60 by the shaded pole motor to position the timer at the selected starting point. When the cam drum on the timer has reached the starting point, the shaded pole motor will be de-energized and the clutch halves disengaged due to the bias of the clutch spring. The sub-interval cam disc will always be stopped at the same point due to the broken out section on the disc so that when the timer motor 10 is energized, it will start the disc at the beginning of an interval and drive the cam drum at timer speed through the selected cycle. The elliptical cam disc 60 will idle on the timer motor shaft during timing operation and will not rotate with the sub-interval cam disc. If there is any tendency for the high speed disc to rotate with the shaft 14, the elliptical cam is so designed so that the high point of the elliptical cam is higher than the high point of cam 12. When cam 12 is driving the follower the elliptical cam cannot rotate under the follower and the force of the follower on the advancing stroke will push the elliptical cam out of the way.

Although but one embodiment of the present invention has been illustrated and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. A timer of the type having a switch operating cam bank comprising, means for advancing the timer cam bank, slow speed cam means having a slow rise-fast drop contour for driving the advancing means at timing speed, high speed cam means having a slow rise-slow drop contour for driving the advancing means driven by the slow speed cam means at a rate faster than timing speed, and means for driving the high speed cam means independently of the low speed cam means.

2. A timer of the type having a switch operating cam bank, means for advancing the cam bank in a step-by-step manner, slow speed cam means operably engaging the advancing means, timing motor means rotating the slow speed cam means to actuate the advancing means once for each revolution of the slow speed cam means, high speed cam means operably engaging the advancing means driven by the slow speed cam means, and high speed motor means driving the high speed cam means to actuate the advancing means at a speed faster than timing speed.

3. A timer according to claim 2 wherein said high speed motor means operatively engages the slow speed cam means for less than 360 degrees of rotation of the slow speed cam means.

4. A timer of the type having a switch operating cam bank, a stepping drive mechanism for indexing the cam bank at intervals, first cam means for actuating the drive mechanism at spaced intervals, a plurality of sub-interval switches operated by the first cam means, timing motor means rotating the first cam means at timing speed, second cam means for actuating the drive mechanism independently of the first cam means, high speed motor means for driving the second cam means at high speed, clutch means for disengaging the rapid motor means from the second cam means when deenergized, said rapid motor means operatively engaging the first cam means to rapidly rotate the first cam means when the second cam means is being driven by the rapid motor means, means to disengage the first cam means from the rapid motor means when the first cam means has been rotated to the start of a sequence for the sub-interval switches.

5. A timer having a switch operating cam bank, a stepping drive mechanism to advance the cam bank at intervals, a first cam for actuating the drive mechanism during timing operation, a second cam for actuating the drive mechanism during high speed operation, a timing motor for driving the first cam, and a high speed motor for driving the second cam and operatively engaging the first cam to position the first cam at a starting position when the second cam is driven by the high speed motor.

6. A timer according to claim 5 including clutch means to disengage the high speed motor from the second cam during timer operation.

7. The combination with a timer of the type having a switch operating cam bank and a sub-interval cam disc, of means for driving the cam bank and the cam disc to a starting position comprising, a high speed cam disc to rotate the cam bank to a starting point, and a motor for driving the high speed cam disc at high speed to thereby rapidly advance the cam bank to a starting position, said motor operatively engaging the sub-interval cam disc to simultaneously rotate the sub-interval cam disc to a starting position.

8. The combination of claim 7 including means on the sub-interval cam disc to disengage the cam disc from the high speed motor at the starting position.

9. A timer of the type having a switch operating cam bank, and a seeking circuit indicating starting points on the cam bank, slow speed drive means for driving the cam bank at timing speed, a sub-interval switch cam bank operated by the slow speed drive means and sequenced in each interval, high speed drive means for rotating the switch operating cam bank to a starting point, and means for orienting the sub-interval switch cam bank to a position corresponding to a starting point for a sub-interval switch sequence so that on energization of slow speed drive means a full sub-interval switch sequence is available.

10. A timer of the type having a switch operating cam bank, a stepping drive mechanism for indexing the cam bank at intervals, including a cam follower, first cam means engaging the follower to actuate the drive mechanism at spaced intervals, timing motor means rotating the first cam means at timing speed, second cam means engaging the follower to actuate the drive mechanism at spaced intervals, and high speed motor means for driving the second cam means at high speed, said high speed motor means being de-energized when the timing motor means is energized, and said second cam means including

means for preventing the second cam means from interfering with the operation of the first cam means.

11. A timer of the type having a switch operating cam bank comprising, means for indexing the cam bank at intervals including a cam follower, first cam means engaging the follower to actuate the indexing means at spaced intervals and having gear teeth on its outer periphery, timing motor means to rotate the first cam at timing speed, second cam means engaging the follower to actuate the indexing means at spaced intervals and having gear teeth on its outer periphery, high speed motor means operatively engaging the gear teeth on the first and second cams to simultaneously advance the first cam and the cam bank to starting positions, said timing motor being de-energized when the high speed motor is energized, a broken-out section on the periphery of the first cam to disengage the gear teeth from the high speed drive means, said high speed motor means being de-energized when the timing motor is energized, and means on the periphery of the first cam disc for preventing jamming between the gear teeth and the high speed motor means.

12. A timer comprising, a timing cam adapted for step-by-step advancement, switches operated by the timing cam

to effect a sequence of operations, a timing device adapted for rotation during the intervals between steps of the timing cam and including switch means operated thereby, motor means for advancing the timing cam rapidly through a plurality of steps, and means operable during the rapid advance of the timing cam to position the timing device at a predetermined starting point insuring proper relationship between the timing cam and the timing device.

13. A timer having a switch operating cam, function switches operated by the cam, means for periodically advancing the switch operating cam to sequentially actuate the switches at timed intervals, said advancing means including a sub-interval timing device driven during each interval of the switch operating cam, means for advancing the switch operating cam at high speed and means operable during said high speed advance to position the sub-interval timing device at its point of origin.

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