

[54] **TIMER STEPPING MECHANISM
HAVING STRETCHED INTERVALS**

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[58] Field of Search **74/112, 568, 3.5, 3.52; 200/38 B, 38 C, 38 D**

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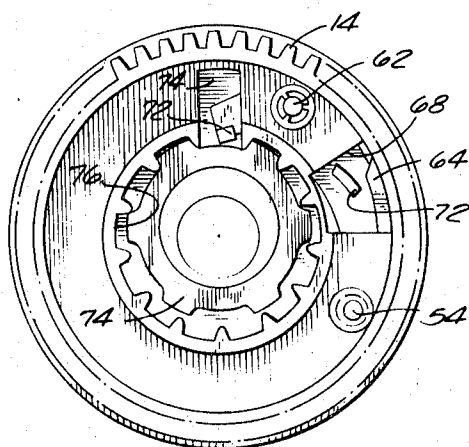
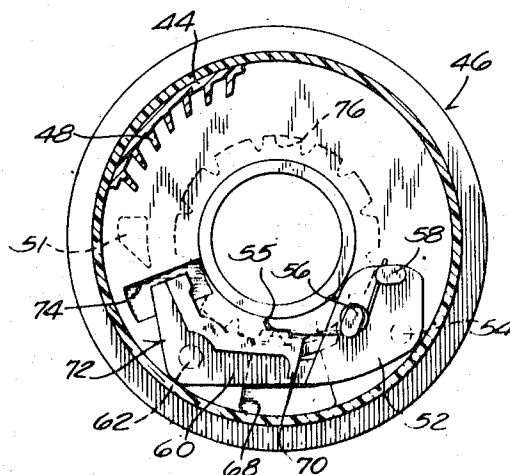
[57] **ABSTRACT**

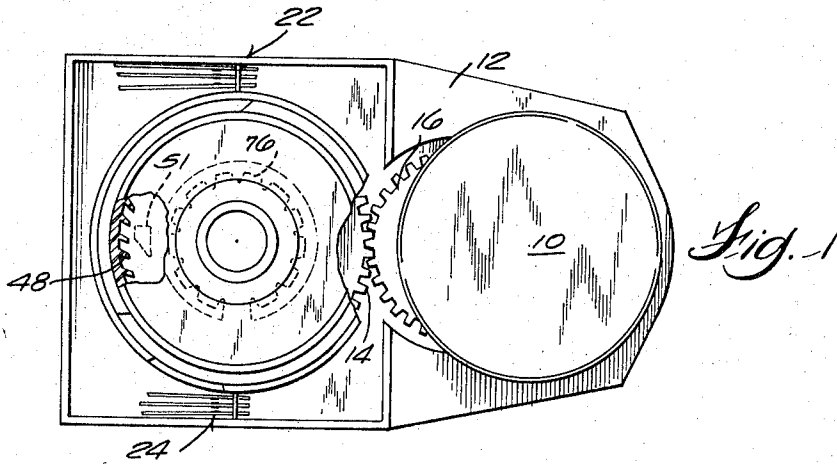
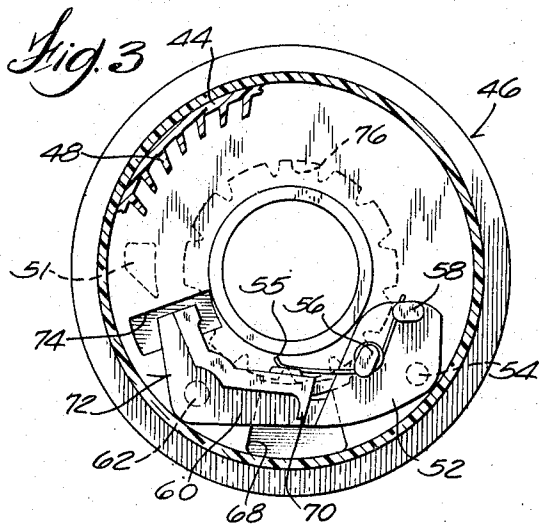
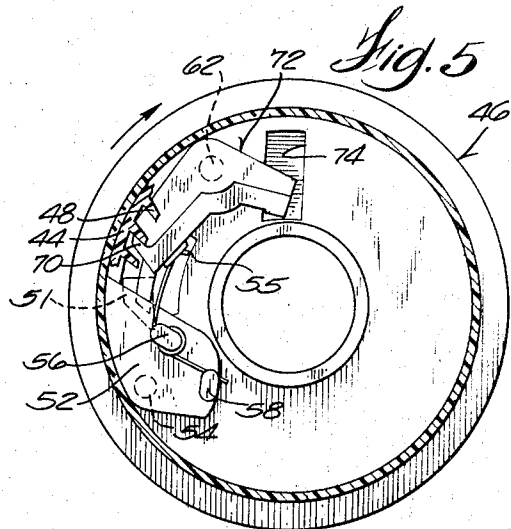
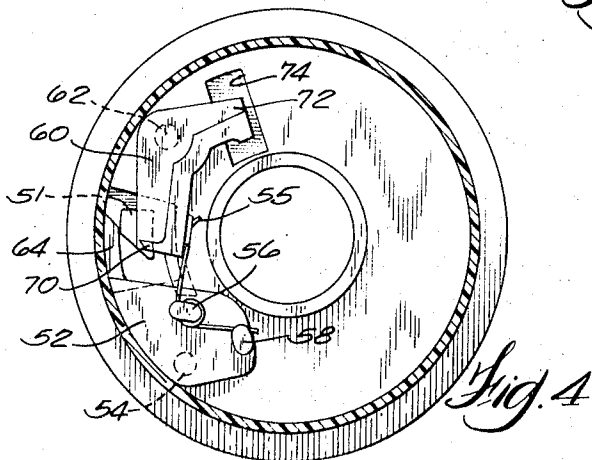
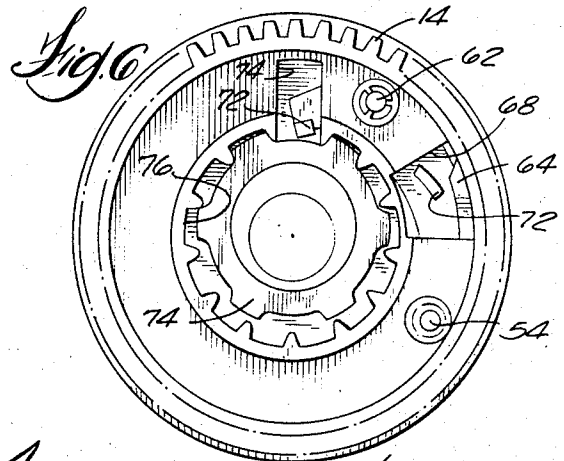
The continuously driven drive disc has a crank provided with a drive pawl on one end and a depending finger or feeler on the other end. A retracting lever is also carried by the drive disc and includes a depending cam portion which is adapted to engage a splitter fixed on the end plate of the timer. A single spring acts on

the lever to force it against the pawl crank to hold the pawl in retracted position against the bias of the same spring acting on the pawl in the engaging direction. However, when the cam depending from the positioning lever engages the splitter the retracting lever is moved to a position allowing the pawl to move into engagement with the ratchet teeth on the inside of the timing cam drum. Initially, however, the pawl is prevented from moving into contact with the ratchet teeth due to a portion of the crank engaging the splitter. When the sensing portion of the crank drops off of the splitter the spring force drives the pawl towards the ratchet. In one version this causes the pawl to engage the teeth and drive the timing cam drum until the cam depending from the lever clears the splitter, at which time the net spring force returns the pawl to a retracted position as the spring returns the lever to its restraining position.

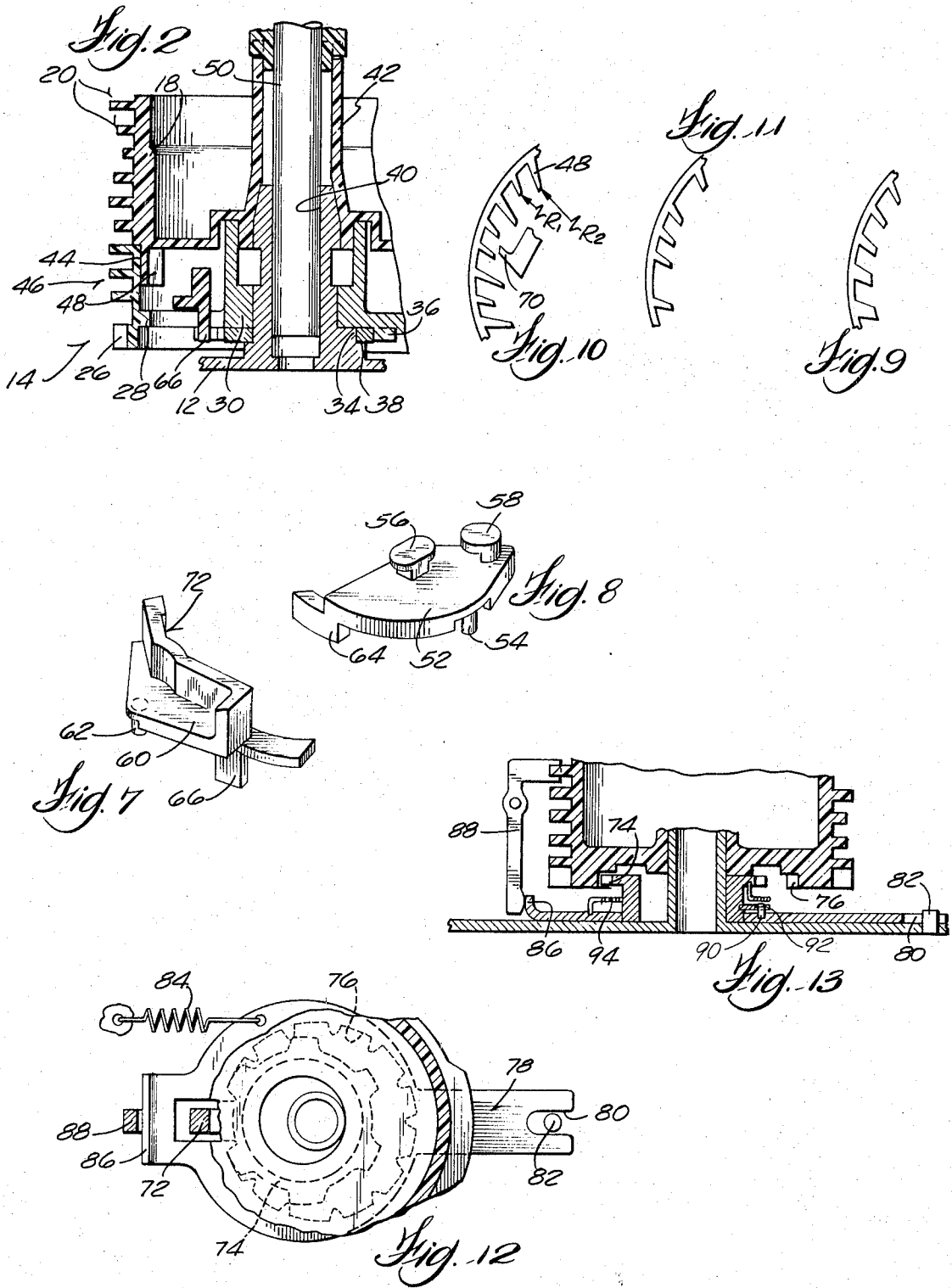
In another version the feeler portion of the pawl crank may engage a mask carried by the drive disc and prevent the pawl from engaging the ratchet teeth, thus prolonging the interval until the mask has been moved out of its blocking position. Selective use of this interval extending concept is achieved by making some of the ratchet teeth longer than others so that even if the mask is in the blocking position the pawl can reach a tooth and index the timing cam. Spacing of the teeth can be varied so long as the longest interval does not exceed any two adjacent small steps. The long tooth, short tooth, and variable step features may be combined in a different ratchet configuration. The mask may be mounted on a plate which can be actuated on each step to disengage the mask from the drive disc and permit a return spring to return the mask to a zero position to insure full availability of the interval stretching feature.

5 Claims, 13 Drawing Figures





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TIMER STEPPING MECHANISM HAVING STRETCHED INTERVALS

CROSS-REFERENCE TO RELATED APPLICATION

This invention is an improvement upon the invention shown in Obermann Ser. No. 185,527.

BACKGROUND OF THE INVENTION

The above mentioned Obermann application provides a timer indexing mechanism which might be termed intermediate the usual stored energy stepping mechanism and the creep-type timer. In effect, the Obermann construction relates the switching time to the interval between steps and where extremely short or precise switching time is sought, the Obermann construction suffers some limitations.

SUMMARY OF THE INVENTION

The present invention eliminates this problem and reduces the cost of the basic construction. Furthermore, the present invention permits the stretching of selected intervals, alone or in combination with variation in the length (or angularity) of the steps, and in all provides an extremely versatile indexing mechanism in which only those parts necessary for the desired functions are required and if the additional functions are required the added parts are compatible with the basic parts.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a timer with the cover removed to show the orientation of the timing cam (seen from one end) and the drive motor and with a portion of the timing cam broken away to show the location of the drive disc.

FIG. 2 is a vertical section showing the orientation of the timing cam drum and the driving disc (which includes subinterval cams).

FIG. 3 shows the driving disc in plan view with the splitter carried by the timer end plate shown in dotted lines and a portion of the ratchet teeth carried by the timing cam drum appearing in the upper left corner for orientation purposes.

FIG. 4 is comparable to FIG. 3 but shows the retracting lever moved to the position in which it does not restrain the pawl crank but the pawl crank is restrained by engagement with the splitter.

FIG. 5 shows the position of the parts after the pawl crank loses engagement with the splitter and is moved by the spring into engagement with the ratchet while the feeler end of the crank has moved generally radially inwardly to feel for the presence of the mask if a mask is used.

FIG. 6 is a comparable to FIG. 5 but is from the other side to show the mask.

FIG. 7 is a perspective view of the pawl crank member.

FIG. 8 is a perspective view of the retracting lever.

FIG. 9 is a fragmentary view of the ratchet teeth showing variation in the angularity and, hence, length of steps.

FIG. 10 is a view showing variation in the depth of the ratchet teeth.

FIG. 11 might be termed a combination of FIGS. 9 and 10 in that it shows variation in the angular step and in the depth of the ratchet teeth.

FIG. 12 is a plan view of pertinent parts showing the manner in which the mask pivot may be reciprocated to permit zeroing of the mask whenever the timing cam drum is indexed.

FIG. 13 is a partial cross section generally comparable to FIG. 2 but showing the further details of the manner of mounting the mask and its reciprocating support as shown in FIG. 12.

DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIGS. 1 and 2, the motor 10 is mounted on the timer end plate 12 and drives the drive disc 14 through suitable gearing 16 while the drive disc is provided with mechanism to transmit intermittent or step-by-step motion to the timing cam drum 18. The drum is provided with a plurality of axially spaced cams 20 which operate various programming switches 22, 24. The continuously driven drive disc 14 has a peripheral gearing 26 and is a single-piece molding with a web 28 between the outside of the disc and the hub portion 30 journaled on bushing 32. An eccentric bushing 34 located therebelow provides an eccentric journal for mask 36 (optional) resting on shoulder 38 immediately adjacent the end plate 12. A central guide tube 40 projects from the end plate and is received in the center aperture of the timing cam drum hub section 42. The outside of the timing cam drum is provided with a depending skirt-like portion 44 which is received inside the upstanding cam portion 46 of the driving disc. Ratchet teeth 48 are located on the inside of this skirt.

The cam portion 46 of the driving disc includes three cams which operate subinterval switches, that is they are continuously cycled each revolution of the continuously driven disc 14.

The inside of tube 40 receives the shaft 50 upon which the actuating knob, is located and which can be rotated to manually advance the timer and also moved axially for actuation of the line switch, these latter features not being shown since they are not pertinent to the present invention.

In FIG. 1 apertures have been provided in the web portion of the timing cam drum so as to expose the ratchet teeth 48 and in dotted lines there is shown a splitter 52 which is cast in the end plate. For the purpose of illustrating the advance mechanism, FIGS. 3, 4, and 5 are shown with the timing cam drum removed so as to show the pertinent portions of the indexing mechanism.

As may be seen in FIG. 3, the retracting lever 52 is pivotally mounted on pivot 54 on the drive disc. A spring is wrapped around post 56 and has one end bearing against post 58 while the other end bears against the pawl crank 60. For the moment assume pawl crank 60 to be stationary, it will then be seen that the spring will urge the lever 52 clockwise around its pivot 54 since it, in effect, wants to lift (in FIG. 3) pivot 56 and push post 58 clockwise around the pivot 54. The pawl crank 60 is, however, pivotally mounted on pivot 62 but the depending cam portion 64 lies adjacent the stop finger 66 of the crank and can act on that finger to push the crank in a counterclockwise direction about its pivot. The stop finger, in turn, gets captured between the de-

pending cam 64 and the side of the aperture 68 to limit the clockwise movement (towards the retracted position) of the lever 52. The single spring 55 has one end resting against the crank as illustrated but the force pushing on the crank is less than the net force acting on the lever 52. Therefore, the spring bias acting on the lever 52 is dominant and the spring normally holds the lever 52 in the position shown in FIG. 3 in which it retracts the pawl crank 60 to the position illustrated. In this position the pawl 70 is held in an inactive position. It will be noted the other end of the crank 60 is provided with a depending feeler 72 which projects downwardly through the slot 74 for purposes which will be described hereinafter. As may be seen in FIG. 3, there is a splitter 51 provided on the end plate of the timer. As the drive disc rotates from the position in FIG. 3 to the position in FIG. 4, the depending cam 64 which, in effect, underlies the drive disc, will strike the outwardly sloped (in the rotational sense) face of the splitter 52 and this forces the lever 52 counterclockwise against the bias of the spring. This would tend to allow the crank to follow but the depending stop 66 at this time lies on the other side of the sharp end of the splitter 52 and, therefore, the pawl is held in the inactive position and will be held in this position until the drive disc is rotated to the position shown in FIG. 5, at which time the cam is still restrained by the splitter but the depending stop finger 66 is moved past the end of the splitter and has allowed the crank to move under the influence of spring 55 to the position shown in FIG. 5 in which the pawl 70 lies between the ratchet teeth 48. At this time continued rotation of the drive disc will rotate the timing cam drum and achieve a step of the timing cam drum movement, the step being terminated when the cam 64 clears the trailing edge (in the rotational sense) of the splitter 52 and the spring can snap the retracting lever to its retracted position (as in FIG. 3, for example) which, of course, carries with it the crank, thus withdrawing the pawl from the ratchet teeth.

With the construction described to this point it will be apparent that upon each revolution of the disc the timing cam drum will be indexed one step. This construction by itself is an improvement over the Obermann construction in that but one spring is utilized in achieving the indexing function whereas Obermann required two springs.

Referring to FIG. 6, there will be seen a mask 74 which is mounted for rotation about an eccentric center so that it, in effect, wants to walk around inside the gear-like recess in the underside of the driving disc in which it is mounted. It will be noted that, in effect, the recess 76 has a 13-tooth configuration while the mask has what might be termed a 12-tooth configuration in which alternate teeth are missing. There is still enough tooth engagement (indeed, there would be with one tooth) for the mask to walk around inside recess 76. For each revolution of the disc the mask will rotate relative to the disc one mask tooth (or space) per disc revolution. Now it will be noted that the aperture through which the feeler 72 depends ends at or, in effect, constitutes one of the complementary gear spaces of recess 76 in which the mask rotates. Therefore, a mask tooth or void can underlie the feeler at the time of a step. If a mask tooth occupies a space, the pawl can

move towards the ratchet teeth but only to a limited extent and with the ratchet teeth such as shown in FIGS. 3 and 5 the pawl cannot reach the teeth and, hence, the mask functions to prevent the occurrence of a step and the driving disc must take an additional revolution in order to bring a "missing tooth" into a position adjacent the feeler 72 and thus permit the full stroke of the pawl to pick up one of the ratchet teeth and index the timing cam drum.

This arrangement affords two possibilities; (1) stretching an interval; or (2) increasing the speed of the driving disc without shortening the interval time. Since the actual speed of the driving disc is the speed of the timing cam drum during the step, it will be apparent that the switching time is cut in half by doubling the disc speed without consequent reduction in the interval period. Other possibilities would embrace considerable variation of the duration of the interval. For example, with a 2-RPM driving disc, the mask 74 illustrated in FIG. 6 would result in a 60-second interval (i.e. 2 times the frequency of engagement with the splitter). If, however, the mask were provided with alternate 2 teeth and 1 void on the mask, the interval would now be 90 seconds with no decrease in switching time, etc. If the mask has 3 teeth and then a void, etc., the interval becomes 2 minutes; 5 teeth and 1 void would result in a 3-minute interval; and 11 teeth with only 1 void on the mask would result in a 6 minute interval. Any of the above interval times can be doubled simply by cutting the driving disc RPM in half. It is obvious that it would be simple to achieve a 12-minute interval.

While there are cases where a 12-minute interval would be highly desirable since not many angular degrees of rotation of the timing cam drum would be required to achieve a long wash or soak program, such a long interval is unacceptable for many other functions. Therefore, this invention contemplates a method for selectively achieving this type of operation. See, for example, FIG. 10 where the ratchet teeth are essentially on two radii, R_1 and R_2 . In this instance if a short interval is desired, the corresponding ratchet tooth is made to extend further in or lie on the shorter radius R_2 so that even with the mask tooth preventing full depth of the pawl, the pawl can still reach this high tooth and index the timing cam. If, however, a long interval is desired, the short tooth (long radius R_1) would occupy the corresponding position and whatever the long interval might be will occur since each time the pawl is actuated with a tooth blocking full depth of the pawl can not pick up the corresponding ratchet tooth and the timing cam would remain stationary until such time as a mask void came along and permitted full depth of the pawl.

Other tooth variants are illustrated in FIG. 9 where the angular spacing between the teeth is varied. Thus it is possible to take a long step where it is necessary to achieve a sequencing of a number of switches during the step. This simplifies the manufacturing problems considerably. FIG. 11 shows what might be considered a combination of FIGS. 9 and 10 in that the angular spacing is varied as well as the length of the ratchet teeth.

Since the timer can be manually advanced at any moment it will be appreciated that the construction described thus far would not necessarily achieve the

desired results for the correct duration of a step, particularly a step immediately following manual interference with the timer. Let us assume for the moment that with a 1-RPM driving disc we may wish the interval stretched to 12 minutes. This would mean there would be but one void on the mask. If at the time the operator manually advanced the timer the void was in the next-to-come-up position and the operator turned to a soak program, the next revolution would bring the void into the prescribed position and permit the timer to advance in a minute instead of 12 minutes. This can be avoided by means of the construction shown in FIGS. 12 and 13. In this arrangement the mask is mounted on a pivot which is carried by the plate 78 which is mounted for reciprocal movement adjacent the end plate of the timer. The forked end 80 of the plate straddles a guide pin 82 and the plate is suitably spring loaded by spring 84 to a position in which the mask will be engaged with the 13-tooth cutout 76 on the underside of the drive disc. The other end of the plate 78 includes an upstanding arm 86 against which the lever 88 can act when actuated by a cam on the main timing cam drum on each step of the timing cam drum. This will then move the plate over and carry with it the mask 74. It will be noted that the outside diameter of the mask is less than the inside diameter of the mask-like cutout 76 and, hence, when the mask is moved over, the mask is free to rotate within the cutout 76. The mask is spring loaded to a zero position determined by a stop pin against which lug 92 on the mask will rest in the zero or start position. A spring 94 is coiled around the mask bearing and has one end connected to the mask and the other end connected to the plate 78. Bearing in mind that the most the mask would rotate in any one interval would be 12 complete steps or one revolution relative to the plate on which it is mounted, the spring will not be any particular problem and yet when the mask is released from engagement with the mask-like aperture 76 the spring will return the mask to its original starting position. Thus any time the timing cam drum is advanced the mask will return to zero so as to insure the full interval being available for whatever the next step might be. If desired, the plate 78 could be moved against its spring bias by means of a relay or any other suitable actuating mechanism. It will also be apparent that it would be feasible to incorporate an axially shiftable supplementary mask which could, in effect, add teeth to the mask when brought into proximity with the main mask. This would make possible the added variation of having more than one stretched interval time available.

I claim:

1. In a timer

a motor,

a drive disc continuously driven by said motor,

a timing cam provided with ratchet teeth,

a pawl pivotally mounted on the disc for movement between a retracted position and an operative position in which it engages said ratchet teeth to transmit motion from the disc to the timing cam,

a lever pivotally supported on the disc and having a portion interposed between the pawl and the

ratchet whereby the lever may be moved to an operative position in which it moves the pawl to its retracted position,

a cam portion on said lever,

stationary means engageable by the cam portion and operative to move the lever to its inoperative position as the disc rotates,

stop means carried by the pawl,

second stationary means operative to engage said stop means and prevent movement of the pawl towards the ratchet so long as the stop means is engaged with the second stationary means,

a spring acting on both the pawl and the lever and exerting a greater force on the lever than on the pawl so that absent other controlling factors the lever is biased to its active position in which the pawl is retracted,

said spring being operative to exert sufficient bias on the pawl to drive the pawl into operative engagement with the ratchet with a snap action when the pawl is not restrained either by the lever or by engagement of the stop means with said second stationary means.

2. A step-by-step timer comprising

a motor,

a disc continuously driven by the motor,

a timing cam rotatable about the same axis as the disc and including a ratchet,

a pawl carried by the disc,

means for cyclically actuating the pawl towards said ratchet teeth for a discreet number of degrees of rotation whereby the timing cam is rotated the same number of degrees when the pawl is in engagement with the ratchet,

and means for limiting the movement of the pawl towards the ratchet whereby the pawl is prevented from engaging the ratchet for a predetermined number of pawl actuations whereby the interval between advances of the timing cam is increased.

3. Apparatus according to claim 2 in which the pawl includes a feeler portion and the motion limiting means includes a masking member which obstructs movement of the feeler portion, said mask being movable to an inoperative position after a predetermined number of revolutions of the disc.

4. Apparatus according to claim 2 in which the ratchet teeth lie on at least two radii whereby the teeth on the longer radius cannot be engaged by the pawl when said mask is operative but can be engaged by the pawl when the mask is inoperative, the teeth on the shorter radius being engageable by said pawl whether or not the mask is operative thus allowing the interval between stepping motion of the timing cam to be increased at selected angular positions of the timing cam.

5. Apparatus according to claim 3 in which means are provided for returning said mask to a starting position each time the timing cam is advanced a step whereby the duration of the increased interval available by operation of the mask will always be a predictable quantity.

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