

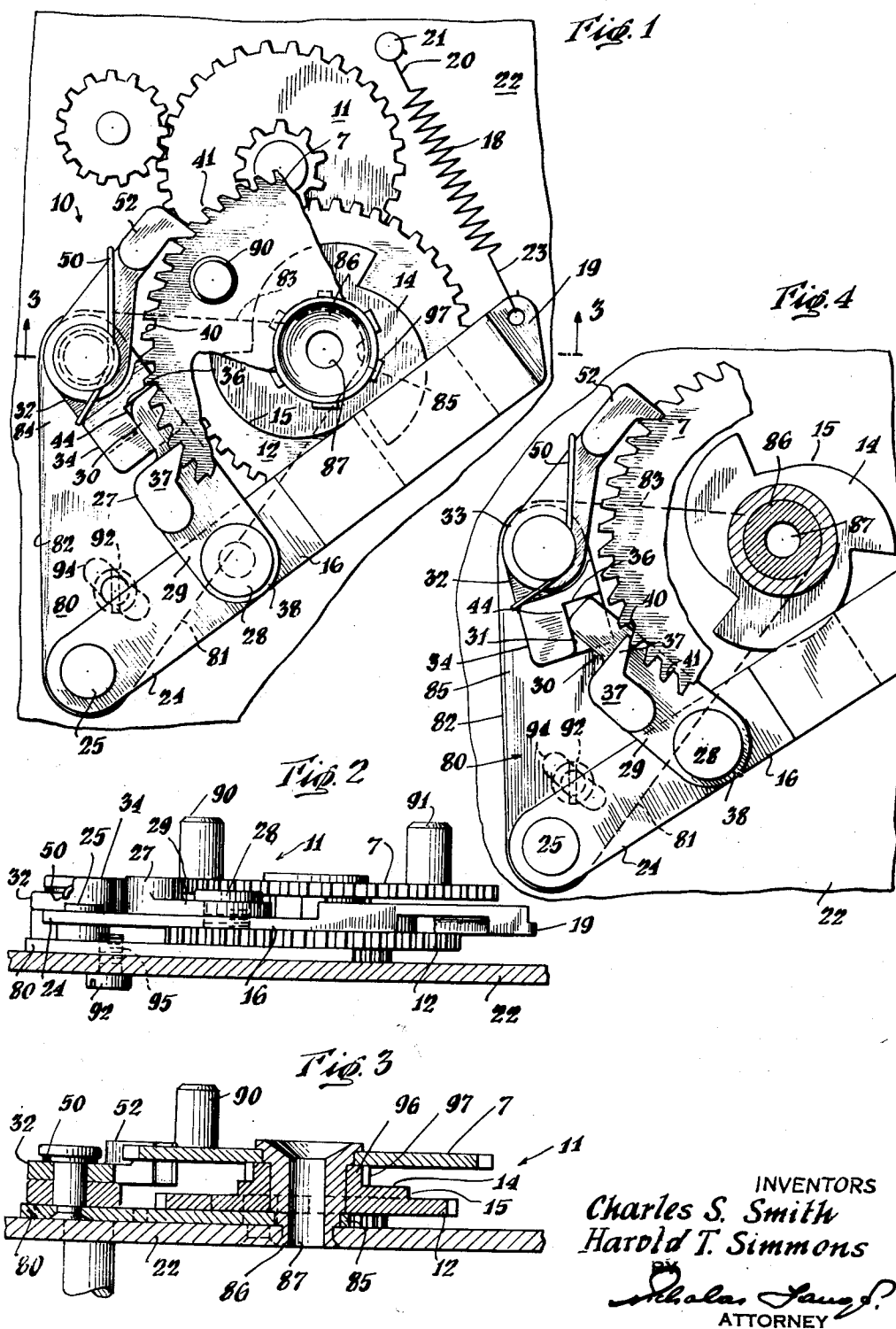
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ESCAPEMENT FOR TIMER SWITCH

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1

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ESCAPEMENT FOR TIMER SWITCH

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The present invention relates generally to timers of the type which are used to time the cycle of any apparatus, such as a washing machine, and the like, and which are operative to initiate or terminate an operating cycle after a predetermined interval, and has particular pertinency to such devices incorporating mechanical escapements.

In the use of escapements for such devices, the problem of overshooting becomes of paramount importance in determining the accuracy of the timer. Inasmuch as the proper step by step advancement of the timer cams usually associated with such escapements depends upon the accuracy of the movement of the ratchet and pawl in advancing an associated ratchet wheel, then it is necessary that positive means be provided for preventing such overthrow. The present invention of an escapement provides and includes, among other novel features, a lock-in mechanism by which the escapement moves its associated ratchet wheel or gear in positive increments and within determined limits so that the problem of overthrow is substantially obviated.

It is an object of the present invention to provide a simple, efficient and practical escapement for power drives and for timing devices.

It is also an object of the present invention to provide for power drives in general and for those used in timing devices, mechanical escapement providing for a simple and sturdy construction and one of more efficient and reliable operation.

Still another object of the invention is to provide a simple escapement consisting of a minimum of parts.

Another object of this invention is to provide an escapement in which each impulse or jump has a precise amount of travel without any over-travel.

A further object of the present invention is to provide an escapement mechanism for driving multi-contact electric switches which is more simple and compact in construction, more positive in action and lower in cost than preceding mechanism of the same general type.

Other objects and advantages of the invention will become apparent as the discussion proceeds and upon reference to the drawings, in which:

Fig. 1 is a top plan view of the mechanism of the escapement embodying the present invention with portions thereof broken away to better illustrate the same;

Fig. 2 is an end view of the escapement of the present invention;

Fig. 3 is a horizontal view of the escapement of the present invention as taken along line 3—3 of Fig. 1 and adapted to show the cooperative arrangement of the components thereof; and

Fig. 4 is a partial face view of the escapement of the invention as adapted to show the locking and guidance features incorporated therein so as to prevent overthrow of the pawl.

While the invention is susceptible to various modifications and alternative constructions and uses, there is

2

shown in the drawings only one embodiment of the invention. It is to be understood, however, that it is not intended to limit the invention by such disclosure and the aim is to cover all modifications and alternative constructions and uses falling within the scope and spirit of the invention as expressed in the appended claims.

Generally speaking, the present invention relates to escapements for timing devices through the utilization of which it becomes possible to control the intermittent operation of cam switches. These cam switches are, in turn, enabled to activate a series of contacts in a determined, sequential position. The escapement is usually operative between a continuously operating motor and the intermittently operated cam mechanism. Thus, it is constructed for a step by step motivation in determined increments of motion of the cams of a cooperating switch. Such escapements are thus usually of complicated geared relationship, including several separate components. These devices, moreover, have a tendency to produce overshoot or over-travel of the switch cams, which, in turn, makes for inefficiency and inaccuracy in the operation of the switch. The present escapement has been so constructed that the problem of "overshooting" or over-travel, found in the usual pawl and ratchet drives, has been substantially overcome by providing a lock-in means whereby the excursion of the pawl as determining the movement of the ratchet wheel is confined within a limit established by a positive lock-in guidance means.

Referring to the drawings, there is shown an escapement 10 having power adapted to be supplied from an external drive member rotating at a constant speed. In many instances the drive means for the drive member would be a constant speed motor. The power from the motor is transmitted by means of a pinion rotating at a fairly high rate of speed. The pinion, in turn, engages an idler gear cluster or reduction gear assembly 11 to reduce or step down the speed of rotation. The idler pinion thus is adapted to drive a main gear 12 at one-third the desired speed or rate. In the present escapement there is rigidly attached to the main gear a three-lobed cam 14 of novel construction. The slope of each lobe has been especially configured, as will be hereinafter described, for specific and novel utility. This cam rotates in a counter-clockwise direction, either constantly or intermittently, depending upon the type of power supply, at one-third the desired impulse rate. As the main gear 12 and cam cluster 11 rotate, the periphery surface of one of the lobes, such as 15, comes in contact with a tolling arm 16. As rotation continues, the rectangularly configured tolling or drive arm 16 is lifted by lobe 15 but is held against the cam periphery by means of a drive spring 18 having one end 20 affixed to a point 21 on plate 22 of the switch and the other end 23 attached to the outer extremity or free end 19 of the tolling arm 16. The other end 24 of the tolling arm 16 turns angularly on a journal pivot 25 that is rigidly fixed. Also, on the tolling arm 16 is a drive pawl 27 attached by means of a pivoted stud 28 rigidly attached to the tolling arm 16.

The drive pawl 27 has collar section 38 connected to a main section 29 which is, in turn, connected to a finger section 37 adapted to fall within the declivities of the associated ratchet wheel 7. Main section 29 of pawl 27 is adapted to have a top surface 30 and an under surface extend for a substantial distance into a seat or pocket 31 formed in stop pawl 32. Stop pawl 32 has a collar section 33, a main section 34 in which pocket or seat 31 is formed by means of the junction of end surface 44 and side wall 36. Surface 44 is adapted to overlay surface 30, while the tip of side wall 36 is adapted to abut the outer

surface of tip section 30 so as to provide positive stop means, as hereinafter described.

As the tolling arm 16 swings upward in an arc, the drive pawl 27 leaves the seat 31 of the stop pawl 32. As the motion continues the drive pawl follows the flank 40 or inclined surface of a ratchet tooth 41. Although the drive pawl is tightly held against the ratchet periphery by means of a spring 50, the ratchet does not rotate or back up while the drive pawl is being lifted because a holding pawl 52 prevents such action. As the driving pawl cams upward and outward as the tolling arm raises, the stop pawl also cams outward away from the ratchet due to the outward motion of the drive pawl. However, the stop pawl, owing to the force of the holding torsion spring 50, always presses against the extended tip of the drive pawl, thus holding it securely but lightly against the ratchet surface. The drive cam inclined surface lobes, such as 15, are of such a height that the tolling arm is sufficiently raised so that the drive pawl drops in behind the next tooth located counter-clockwise on the ratchet.

As the drive cam completes one third of its complete rotation, or 120°, the inclined surface of the cam abruptly ends and a straight drop-off surface is encountered. Thus, the tolling arm, which is so constructed as to permit a free falling drop-off from the cam lobe, reaches the end of the inclined surface thereof and instantaneously drops due to the force of the driving spring. When the tolling arm forcefully drops, the drive pawl engages the face of a ratchet tooth and forces the ratchet to rotate instantaneously in a clockwise direction. At the end of one tooth travel, the extreme end of the drive pawl butts tangentially against the seat of the stop pawl, thus limiting the downward travel of both the drive pawl and tolling arm. Regressing, the lobes of the drive cam are so designed that the tolling arm does not contact or seat on the lower periphery of the drive cam. Thus, the seating or sudden stop is established by the drive pawl seating or butting against the stop pawl. As shown in the drawing, the seat or tangential area 36 of the drive and stop pawls is located toward the ratchet or inside of the pivot points of the two pawls.

Because of off-center seating, the instant the drive pawl encounters the stop pawl seat, the resultant force in the two pawls due to the drive spring and the force of the inertia in the moving members wedges the drive pawl tighter into the ratchet. The harder the impact of seating the greater the wedging action of the drive pawl into the ratchet teeth. Thus, unlike prior ratchet and pawl driving devices, overthrow or continued travel of the ratchet due to inertia is positively overcome. As soon as the mechanism is at rest, the non-back-up holding pawl 52 drops behind the face of another ratchet tooth and thus the entire mechanism is in a position to repeat the operation.

Through the constant rising and falling of the tolling arm, as activated by the multi-lobed cam, the ratchet is rotated intermittently in instantaneous jumps. The time duration of jumps or advances can be arranged predeterminedly by varying the speed of the multi-lobed drive cam. Likewise, the degree of angular advancement of the ratchet can be set and determined by varying the number of ratchet teeth.

The instantaneously intermittent movement of the ratchet is highly desirable when coupled with a single or plurality of switches. The coupling may be achieved by driving cams directly by means of posts, such as 90, 91, rigidly mounted on the ratchet face, as shown in the drawing, or accomplished through subsequent gearing to cams. As the cams jump or advance, inclined or drop-off cam surfaces will impact snap-action to the switches.

If the escapement is connected to switches to form a timer or interval switch, the ratchet can be advanced manually to obtain a manual setting or skip parts of a cycle. If enough force were applied externally to the ratchet, sufficient to overcome the mechanism's spring forces, both the holding and drive pawls would cam

outwardly along the incline of the ratchet tooth, thus permitting the ratchet to rotate in a clockwise direction.

When the escapement is used to drive a timer or sequence switch, it is important that cam and switch relationship be flexible, yet adapted to be rigidly maintained when finally established. Thus, an important and novel feature of the present escapement is the provision of an adjustment plate 80 upon which are mounted the tolling arm, drive, stop and holding pawls. The adjustment plate 80 has a somewhat triangular configuration, having sides 81, 82 and 83 and a base 84; a neck portion 85 is integrally joined to sides 82 and 83. In the base is a stud 86 located in the center of the ratchet, main gear and three-lobed cam and riveted or staked into a rigid mounting plate 22. The stud 86 has a hole or aperture 87, which, in turn, becomes a journal bearing for a shaft when used in conjunction with a timing switch. The adjustment plate 80 is allowed to pivot about the stud 86 located in the center of the main gear, three-lobed cam and ratchet. The adjustment plate is pivotable so that a ratchet tooth, or, in turn, the ratchet driving finger may stop at the end of a stroke in any angular position. When the desired angular position is obtained, the adjusting plate is rigidly fastened to the rear or mounting plate 22 in a slot 94 formed therein by means of a screw and lock washer 92 passing through slot 94 in the rear plate and fastening into a tapped hole 95 in the adjusting plate.

In the construction of the escapement, too, a constant speed cam 96 with predetermined camming surfaces 97 may also be incorporated into the main gear and three-lobed cam cluster. Thus, besides being able to obtain an instantaneously intermittent drive, a constant speed drive may also be adapted for use. This alternate constant speed drive may prove valuable when the escapement is used in conjunction with timing devices and switches.

In the construction of the escapement, the tolling arm was designed so that light spring loads applied at the tip of the arm would produce a many times multiplied force upon the drive pawl during the tolling arm's downward stroke. Also, the light spring forces resulted in little wear on the three-lobed cam. The three-lobed cam was so constructed with the light spring load that the friction torque loss was small. Furthermore, the three inclined peripheries of the cam are designed with a continuously decreasing incline angle to mandate a constant input driving torque. That is: as the tolling arm is lifted, the driving spring extends itself and applies greater force against the drive cam surface. Likewise, as the three-lobed cam is rotated and the tolling arm is lifted, the actual driving torque arm is increased. With the above considerations in mind, the three cam inclined surfaces were designed with a constantly decreasing incline angle throughout the 120°. Thus, the tolling arm lift is rapid at first, then is gradually decreasing as the drive spring load and torque arm increase.

Three lobes are used on the drive cam to utilize maximum available driving torque and reduce friction losses by one-third. This is so because the friction loss is constant for one revolution of the drive cam. If the drive cam were driven faster and only one inclined surface were used, then the entire friction loss would have to be overcome in one impulse of the tolling arm. However, since three inclined surfaces are used and the cam is driven more slowly, then, even though the identical friction loss must be overcome, as in the case of a single inclined surface cam, there is triple the amount of time available in which to overcome the loss. Thus, the efficiency of the system has been greatly enhanced and an escapement of greatly improved quality provided.

The present invention of an improved escapement wherein positive guidance means prevent overshooting of the ratchet wheel and gear of a timer switch by inter-seating and locking a drive pawl and locking pawl in a nested relationship, has many novel features, such as providing for the adjustable, angular relationship of the driv-

5

ing pawl to its ratchet wheel to define the mating forces therebetween. Therefore, it is considered that the scope of the invention is to be determined from the description and the appended claims.

We claim:

1. An actuating member for a ratchet wheel, comprising a driving pawl having a wheel engaging portion for imparting movement thereto in a predetermined direction, means for driving said pawl, a second pawl mounted on a pivot having wheel engaging means for preventing movement of the wheel in the opposite direction, and pivotable locking means having a pocket formed therein cooperating with said driving pawl for accepting a portion thereof and guiding the movement of said driving pawl against said wheel so as to prevent over-driving the same, said pivotable locking means being concentrically mounted on the pivot of said second pawl.

2. An actuating member for a ratchet wheel rotatable about a fixed axis, comprising a driving pawl having a wheel engaging portion for imparting movement thereto in a predetermined direction, tolling bar means on which said driving pawl is mounted, means for angularly displacing said bar to move the same and said driving pawl, a second pawl mounted on a pivot having wheel engaging means for preventing movement of the wheel in the opposite direction, and pivotable locking means having a pocket formed therein cooperating with said driving pawl for accepting a portion thereof and guiding the movement of said driving pawl against said wheel so as to prevent over-driving the same, said pivotable locking means being concentrically mounted on the pivot of said second pawl.

3. An actuating member for a ratchet wheel having a plurality of teeth separated by spaces, said wheel rotatable about a fixed axis, comprising a driving pawl having a tooth engaging portion for imparting movement to said wheel in a predetermined direction, bar and cam means for driving said pawl, a second pawl mounted on a pivot having tooth engaging means on said wheel for preventing movement thereof in the opposite direction, and pivotable locking means having a pocket therein forming an edge overlying said driving pawl for slideably guiding the movement of said driving pawl against said wheel so as to prevent overdriving the same, said pivotable locking means being concentrically mounted on the pivot of said second pawl.

4. An actuating member for a ratchet wheel rotatable about a fixed axis, comprising a driving pawl having a wheel engaging portion for imparting movement thereto in a predetermined direction, lifting means for driving said pawl against said wheel, said lifting means actuated by a multi-lobed cam, a second pawl having wheel engaging means for preventing movement of the wheel in the opposite direction, pivotable locking means engaging said driving pawl and guiding its movement against said wheel so as to prevent over-driving the same, and means for adjusting the angular relationship of said driving pawl to said wheel to obtain improved efficiency thereby.

5. An actuating member for a ratchet wheel rotatable about a fixed axis, comprising a driving pawl having a wheel engaging portion for imparting movement thereto in a predetermined direction, said driving pawl having an adjacent tip portion integrally joined with said wheel engaging portion, lifting means pivotable about a fixed point for driving said pawl against said wheel, said lifting means actuated by a rotating multi-lobed cam, a second pawl having wheel engaging means for preventing movement of the wheel in the opposite direction, and pivotable locking means mounted on the same pivot as said second pawl having a pocket therein adapted to receive said adjacent tip portion of said driving pawl and cooperating with said driving pawl for guiding the movement of said driving pawl against said wheel so as to prevent over-driving the same.

6. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a

6

tolling bar, means for angularly moving said bar about a fixed pivot point, a driving pawl mounted on said bar having a tip portion and a finger portion, said finger portion adapted to fall within the separate declivities between said teeth of said wheel, a pivotable second pawl having a pocket engaging said tip portion of said driving pawl along an edge thereof and locking means mounted on the same pivot as said second pawl, said second pawl free of said ratchet wheel and adapted to slidably guide the movement of said driving pawl against said wheel so as to prevent over-driving the same.

7. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a tolling bar having a free end, cam means applied thereagainst for angularly moving said bar about a fixed pivot point, a spring connected to said free end of said bar to maintain the same against said cam means, a driving pawl mounted on said bar having a tip portion and a finger portion, said finger portion being unitarily joined behind said tip portion, said finger portion adapted to fall within the separate declivities between said teeth of said wheel, and a pivotable second pawl having a pocket engaging said tip portion of said driving pawl along an edge thereof, said second pawl free of said ratchet wheel and adapted to guide the movement of said driving pawl against said wheel so as to prevent over-driving the same.

8. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a tolling bar having a free end, lobed cam means for angularly moving said bar about a fixed pivot point, a spring connected to said free end of said bar to maintain the same against said cam means, a driving pawl pivotably mounted on said bar having a tip portion and a finger portion, said finger portion being unitarily joined behind said tip portion, said finger portion adapted to bear against said teeth of said wheel, and a second pivotable pawl having a pocket for engaging the top of said tip portion of said driving pawl for a distance therealong, said second pawl further having a side adapted to limit the movement of said driving pawl against said wheel so as to prevent over-driving the same.

9. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a moving lever, means for angularly moving said lever about a fixed pivot point, restraining means attached to an end thereof, a driving pawl rotatably mounted on said lever and having a tip portion and a finger portion, said finger portion adapted to bear against said teeth of said wheel so as to be adapted to move the same, a movable lock-in pawl engaging said tip portion of said driving pawl along an edge thereof, said second pawl having a pocket formed therein whereby said pawl is adapted to guide the movement of said driving pawl against said ratchet wheel so as to prevent over-driving the same, and means for angularly adjusting said driving pawl finger with relation to said ratchet wheel.

10. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a tolling bar, multi-lobed cam means for angularly moving said bar about a fixed pivot point at determined intervals, said lobes of said cam adapted to give a constant torque drive, a driving pawl pivotably mounted on said bar having a tip portion and a finger portion, said finger portion adapted to bear against said teeth of said wheel to move the same, a movable lock-in pawl having a pocket formed therein for engaging said tip portion of said driving pawl along an edge thereof, said lock-in pawl free of said ratchet wheel and adapted to guide the movement of said driving pawl against said wheel so as to prevent over-driving the same, and adjusting means for angularly adjusting the relationship between said finger of said driving pawl and the teeth of said ratchet wheel.

11. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a tooling bar, multi-lobed cam means for intermittently

7

angularly moving said bar about a fixed pivot point, a driving pawl pivotably mounted on said bar having a tip portion and a finger portion, said finger portion adapted to bear against said teeth of said wheel to move the same, a pivotable lock-in pawl having a seat formed therein for engaging said tip portion of said driving pawl along an edge thereof, said lock-in pawl free of said ratchet wheel and adapted to guide the movement of said driving pawl against said wheel so as to prevent over-driving the same, and adjusting plate means for angularly adjusting the relationship between said finger of said driving pawl and the teeth of said ratchet wheel, said means adapted to support thereon said multi-lobed cam and said ratchet wheel as adapted to move the same therewith.

12. An escapement for moving, in discrete steps, a ratchet wheel having a plurality of teeth comprising a rectangularly configured drive lever, cam means for angularly moving said lever on a stud about a fixed pivot point, a spring attached to the free end of said lever in order to maintain the same against said cam, a driving pawl pivotably mounted on said lever having a tip portion and a finger portion, said finger portion adapted to bear against said teeth of said ratchet wheel to move the same, a lock-in pawl pivotable on a stud having a portion thereof engaging and overlying said tip portion of said driving pawl along an edge thereof, said overlying lock-in pawl free of said ratchet wheel and having a biasing spring placed thereagainst to maintain its position on said drive pawl as adapted to guide the movement of said driving pawl against said wheel so as to prevent over-driving the same, and a holding pawl placed against said ratchet wheel mounted on said stud of said lock-in pawl and pivotable thereon to hold said ratchet wheel in position after each step by step movement thereof.

13. An escapement for moving, in discrete steps, a

8

ratchet wheel having a plurality of teeth and comprising a driving lever pivotably mounted on a stud, said stud being connected to an adjusting plate, a plurality of gears, a driving cam and a ratchet wheel concentrically disposed on said adjusting plate and adapted to be moved thereby, said cam having a configuration such that it is adapted to move said driving lever at a predetermined frequency and a constant drive torque, a driving spring connected to an end of said driving lever to maintain said lever against said cam, a driving pawl pivotally mounted on said lever and moved thereby against said teeth of said ratchet wheel to move the same, a lock-in pawl mounted on a stud, said latter pawl having a portion thereof adapted to fit over the end of said driving pawl to guide the same in moving said ratchet wheel and preventing overshoot thereof, said drive pawl being adjustable with relation to said ratchet wheel by movement of said adjusting plate, and a holding pawl placed on the same stud as said lock-in pawl and adapted to maintain the position of said ratchet wheel, said pawl having a biasing spring operative therewith to maintain sufficient holding force against movement of said wheel.

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