Aug. 23, 1949. E. H. GATES, JR., ET AL 2,479,922

ELECTRICAL TIMER

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Fig. 1.

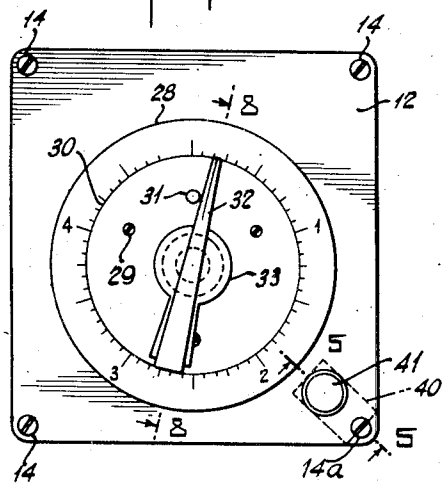


Fig. 2.

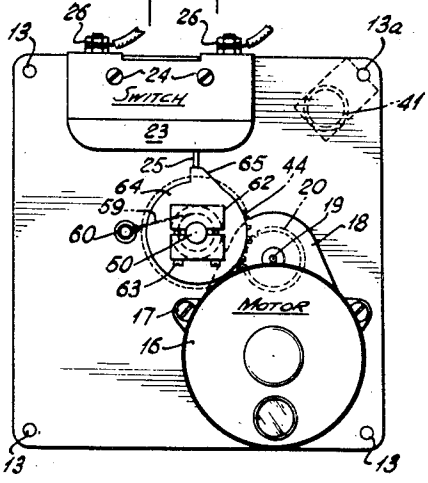


Fig. 3.

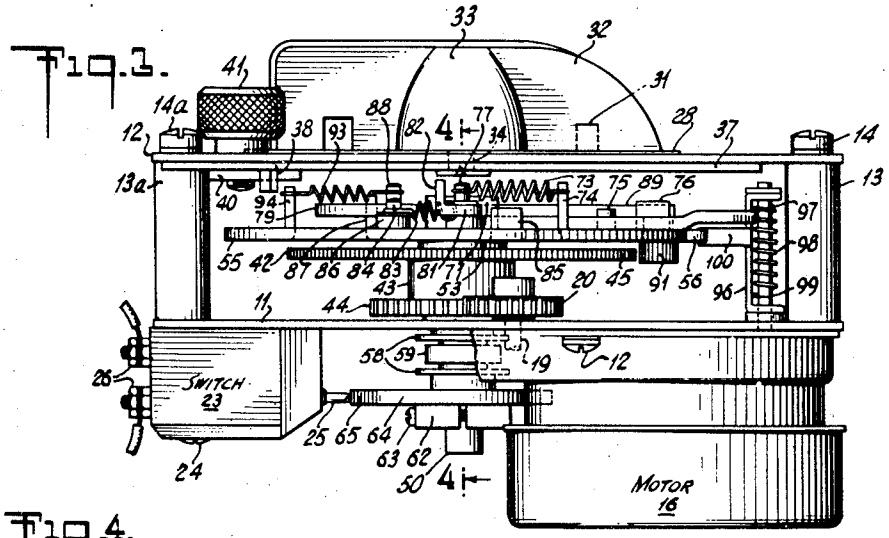


Fig. 4.

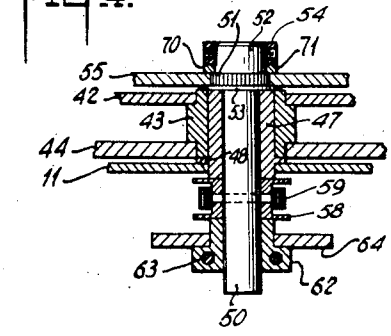
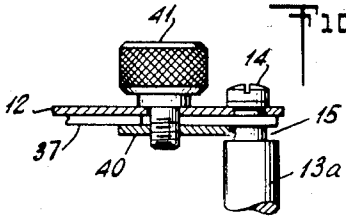


Fig. 5.



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Fig. 6.

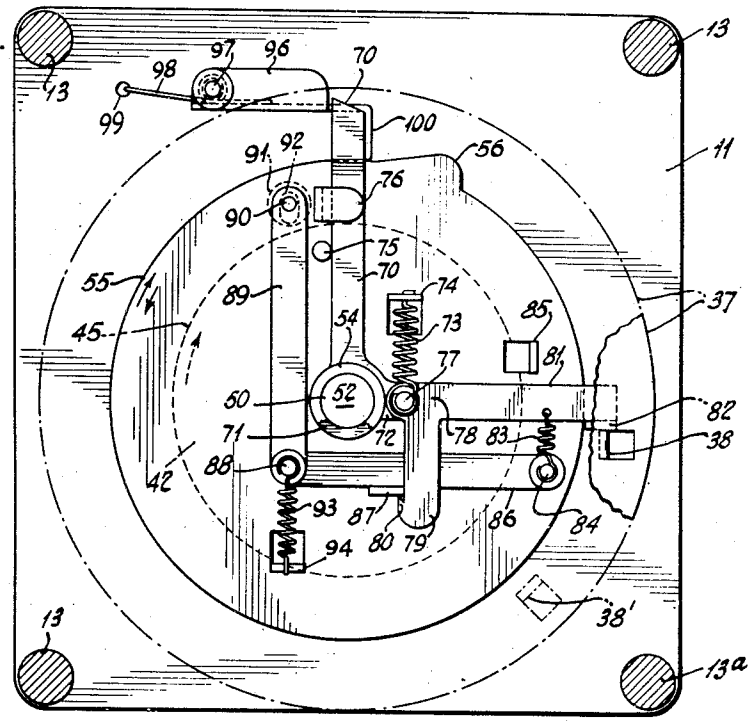


Fig. 9.

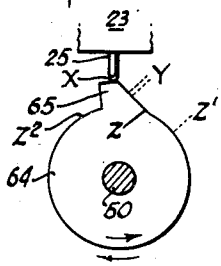


Fig. 10.

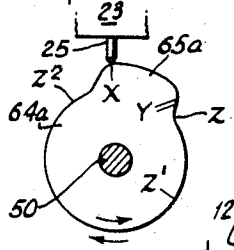


Fig. 7.

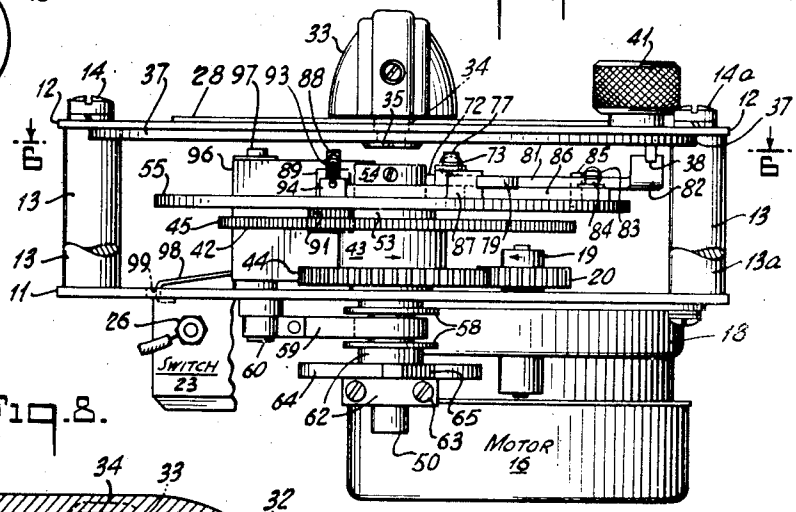
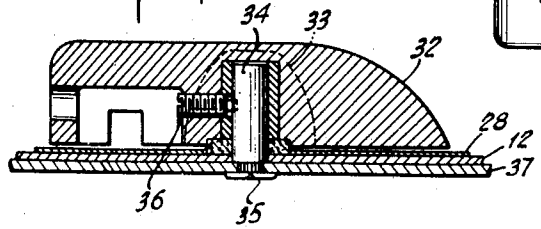


Fig. 8.



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Fig. 12.

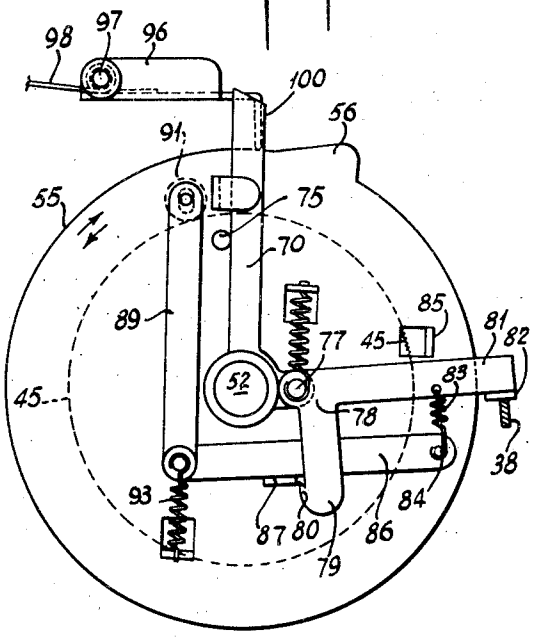


Fig. 13.

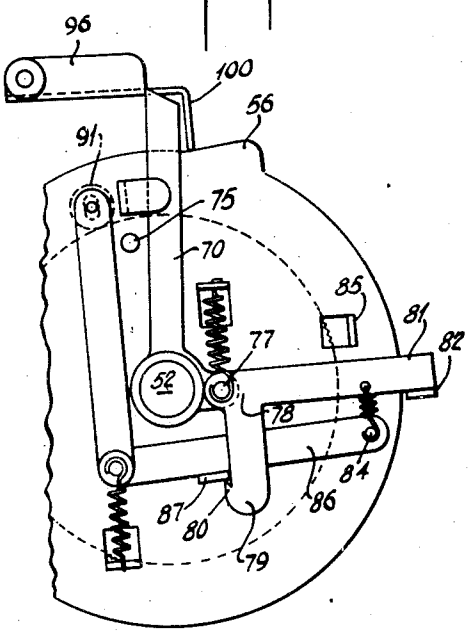


Fig. 14.

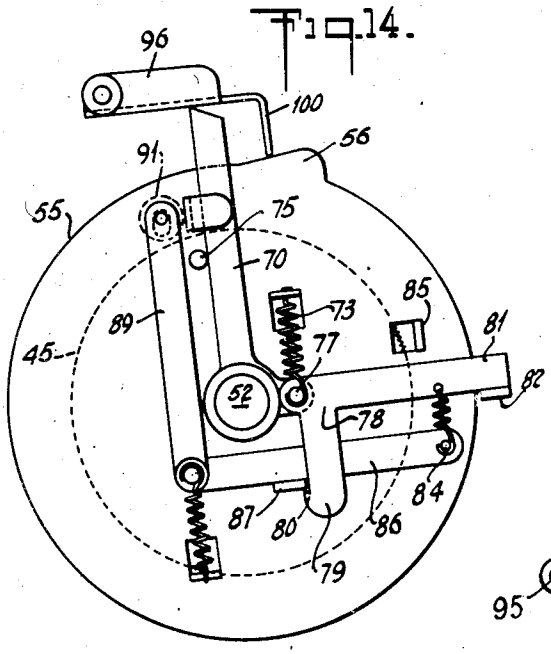


Fig. 15.

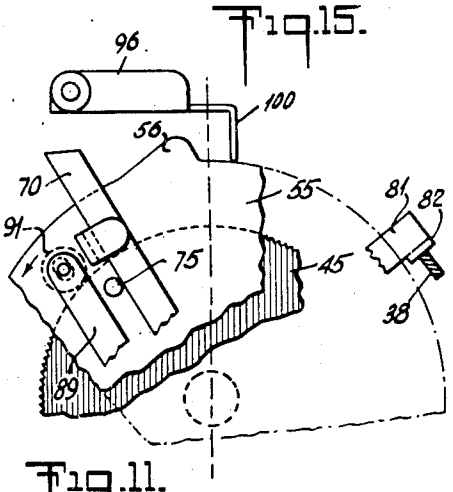
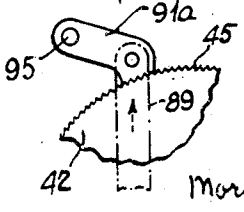


Fig. 11.



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UNITED STATES PATENT OFFICE

2,479,922

ELECTRICAL TIMER

Eugene H. Gates, Jr., and John J. Smith, Essex, Conn., assignors to The R. W. Cramer Company, Incorporated, Centerbrook, Conn., a corporation of Connecticut

Application July 17, 1945, Serial No. 605,551

22 Claims. (Cl. 161—1)

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This invention is a novel electrical timer of the kind which is driven, for example steadily by a motor, and by which certain desired operations may be automatically effected, controlled or predetermined; and the invention is illustrated as embodied in a so-called repeating impulse timer, wherein through cycle after cycle a given operation or electric impulse is effected between intervals, by the timed actuation of a switch or analogous device.

Timing apparatuses of such kind have a wide field of utility, especially for the operation of circuit make-and-break devices or switches of any desired type; as an example the so-called snap-switch, which is a self-contained device operated by the thrusting of at least one exposed button, pin or trigger, in one thrust or action to set the switch to close the circuit for an impulse, and in a succeeding release or action to open or break the circuit for an interval. Thus a timer embodying the present invention may afford cyclical control of a relay or other circuit, with repeated cycles of action, each cycle comprising usually a short impulse followed by a longer interval. Such a timer therefore provides a repeating impulse of predetermined duration and alternated with predetermined interval periods, the timer being provided with means for varying, as by manual setting, either or both the length of the time interval or the duration of the impulse, or the relation between the impulse and the interval. A timer of such characteristics has many practical uses, as it may be used in the form of a time-delay relay, with either manual or remote control; or a double reset or duplex timer; or other numerous forms; for controlling different industrial or other operations, processes, apparatuses, etc.

The general objects of the present invention are to provide an electrical timer of compact and simple structure and which is rugged, yet efficient and smooth-running, and convenient in practical use. Another object is to provide for the quick and ready predetermined setting of the total cycle period; and independently of the impulse duration, which may be adjusted throughout the limits of the member or cam by which the switch is actuated; and an accompanying object is to provide for the varying at will of the period of the intervals, thus predetermining the entire cycle consisting of the impulse and the interval. A particular object is to afford such a timer wherein may be delivered an unusually long cycle, even up to an hour or several hours, yet with a quite short impulse, of the order of one second or several seconds as is sometimes needed in particular practical situations. Another object is to provide that adjustments or settings may be effected simply and rapidly, with adjustment of the cycle and the parts thereof, even while the timer is actually running, e. g. by manual setting devices with the aid of a dial and index means.

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A still further purpose of the invention is to provide an electrical timer which is convenient of manufacture to meet a multiplicity of varying demands of customers, by such a design and construction that the timer may be kept in stock substantially fully assembled, omitting however a minimum number of parts, especially the dial and the operating cam of the timer; these parts to be selected from stock in accordance with orders received and readily mounted in the timer without the need of disassembly; in other words providing these interchangeable parts to be rapidly applied to and removed from the timer mechanism. Further advantages of the present invention will be pointed out in the hereinafter following description of an illustrative embodiment of the invention or will be understood by those conversant with the subject. To the attainment of such objects and advantages the present invention consists in the novel electrical timer and the novel features of operation, combination, mechanism and detail herein illustrated or described.

In the accompanying drawings, Fig. 1 is a top plan view of an electrical timer embodying the present invention, and Fig. 2 is a complementary or bottom plan view of the same, turned over in a manner to place the front of the timer at the far side of the figure.

Fig. 3 is a righthand elevation of the timer of Figs. 1 and 2, but on a larger scale.

Fig. 4 is a vertical sectional view of part of the mechanism taken on the section line 4—4 of Fig. 3.

Fig. 5 shows a detail in vertical sectional view taken on the diagonal line 5—5 of Fig. 1.

Fig. 6 is a top plan view of the interior parts which lie beneath the section line 6—6 of Fig. 7.

Fig. 7 is a front elevation view of the timer hereof.

Fig. 8 is a vertical section view of certain upper parts including the index and dial, taken on the axial section line 8—8 of Fig. 1.

Fig. 9 is a bottom view of the cam through which the timer actuates the switch, shown on a larger scale than in Fig. 2, and with explanatory details.

Fig. 10 is a bottom view similar to Fig. 9 but showing a modified form of switch actuating cam.

Fig. 11 is a top plan view of a modified detail relating to the clutching means of the power drive.

Fig. 12 is a top plan view similar in part to Fig. 6, but showing the mechanism in a subsequent position; while Fig. 13 similarly shows the parts in a still later position or stage, and Fig. 14 shows them again in a subsequent position, which in turn is followed by the showing of Fig. 6.

Fig. 15 is a partial detail view corresponding to the other figures but showing the timer set to a different adjustment or cycle period, namely, about 330° of the full rotation, the longest available with the specific structure disclosed.

Referring first to the frame of the timer, it is shown as comprising a frame bottom wall 11, and spaced well above it a top wall 12, these being preferably rectangular, and being rigidly interconnected by a system of upright posts or studs 13 near three of the corners and a different fourth post 13a at the right-front corner, each of which may be of reduced diameter near its ends to provide shoulders to engage the two walls. At the bottom the posts may be screwed or welded into perforations in wall 11; while at the top the four posts may be interiorly tapped to receive machine screws 14 for the posts 13 and a screw 14a for the post 13a, the perforated top wall being thus detachably secured in place.

The frame post 13a is of special structure as seen in Fig. 5, with a groove 15 slightly below the top wall 12 for purposes to be later explained.

The timer is motor driven, and for this purpose is provided with a conventional small motor such as the synchronous motor 16, shown mounted by screws 17 at the under side of the bottom wall 11 near the rear righthand corner. A known example of such a motor is that shown in the patent of Schellens No. 2,334,040 of November 9, 1943, comprising a housing in which are contained the electromagnetic elements, and a reduction gear-train which extends into a frontward extension 18 of the housing and terminates in an ultimate driven shaft 19 of the motor, which may be considered as the driving shaft of the timer; this shaft carrying a pinion 20 from which the rotary motions of certain elements of the timer are derived, as will be disclosed.

The timer being primarily intended to operate an electrical switch for controlling a circuit or circuits, there is herein illustratively shown a switch 23, which may be of a conventional type and is attached by screws 24 to the underside of the bottom wall 11 at the front left center. Between the motor 16 and switch 23 is interposed the timer mechanism to be disclosed, operated by the motor and operating the switch. The switch is provided with a member 25 which broadly considered is the reverser or trigger of the switch, being a movable part, the shifting of which brings about the making and breaking of the circuit in which the switch is interposed, preferably one movement of the trigger reversing the switch condition and a second or return movement again reversing or restoring the former condition, as to whether the switch is on or off.

For compactness the switch 23 is a small one and typically may be of the snap-switch type wherein instantaneous reversing actions occur when the switch is snapped on or off; an illustrative example being that shown in the patent of R. F. Knight No. 2,230,191 of January 28, 1941, wherein the switch mechanism is contained within an insulating housing and having its reverser 25 protruding and accessible. In the snap type of switch the trigger is usually of the character of a plunger, a relatively light shifting of which brings about the abrupt reversal of the switch position, under spring action. The trigger may take various forms, such as a lever or sliding rod or snap-pin, requiring only to be thrust inwardly to bring about one snap action and released to shift outwardly to bring about the opposite operation of the switch, which latter in this case is self-acting, the switch being resiliently self-returning to its normal or reset position. The cam-position Y in Fig. 9 or 10 may represent the critical trigger position, whereat it reverses, and this position has a short range between on and off, as the double lead line indicates and as is well understood.

Before describing the working mechanism of the timer reference is made to the setting or cycle adjusting means consisting of a scale or dial and an index. The dial 28 is removably attached by screws 29 atop the wall 12 and is inscribed with a circular series of graduations 30, illustratively shown as constituting a scale of sixty divisions. Upstanding from the dial is a stop pin 31 near the zero point of the scale, conveniently arranged for restoring quickly the index or pointer 32 substantially to the zero setting of the timer. It also prevents clash and damage by excess movement of index and connected parts. This index member is shown as supported upon a central rotatable knob or hub 33; and this has a short depending shaft 34 by which it is mounted above the wall 12 for circular adjusting movements over the dial. See Fig. 8. The shaft 34 below the wall is reduced and formed with a lower swaged head 35, and carries a stop plate or member 37, confined between the head and shoulder, the plate being fast on the shaft. The shaft extends through a bearing hole in the wall and a central aperture in the dial, and enters a bushing in the index hub, where it is secured to the hub by a set screw 36.

The stop plate 37 is what adjusts the period of the cycle, and it is set by rotation through the index 32. It may be circular and is provided or formed near its periphery with a depending lug 38, constituting an operative stop for the timing operation; the position of the stop, as determined by the setting of the index on the dial, is what determines the adjustment of the timing mechanism to be described.

When the stop-plate and stop 38 have been set to a desired adjustment, indicated by the index position, it is preferred to secure and lock it there by clamping. For this purpose a clamp-piece or lock-strip 40 is provided, Figs. 3 and 5, beneath the rim of the stop plate near the right-front corner, with one end forked to enter the groove 15 in frame post 13a for positioning it, and with a threaded hole receiving the shank of a lock-screw 41 that extends down from above the frame wall 12 through a hole therein. The screw 41 has its exposed head knurled, to constitute a thumb screw, and it may be loosened to permit the plate 37 and stop lug 38 to be adjusted, and then tightened to draw upward the clamp strip 40 and thereby squeeze and lock the stop-plate in its adjusted position.

A main transmitting element between the motor and operating mechanism is a rotor assembly consisting of the following unitary elements. A rotor member or thin wheel 42 is fast on an upright sleeve or hub 43, upon which also is a fast gear 44 engaging and driven by the motor pinion 20. The rotor wheel has disengageable engagement with the driven timing

mechanism, and for such intermittent driving action is provided means performing the function of a clutch, the rim **45** of the rotor being constituted for this purpose, for example by a gripping formation, serrations being shown, engageable by a pawl, dog or shoe member **91** to be described. The sleeve **43** may be considered as the hollow shaft of the gear and rotor and it surrounds a concentric bearing member or bushing **47** in the nature of a fixed axle and which has a flange **48** resting on the frame bottom wall **11**, the bushing or axle being extended with tight fit through an aperture in the wall to hold it firmly upright. See Fig. 4.

Taking a specific instance, the rotor may be rotated continuously in counterclockwise direction, hereinafter called C. C. W., at such a speed as one turn in 5 minutes, the pinion **20** having the reduced speed of ⅔ turn per minute, and the gear **44** having half that rotary speed. The motor may be self-starting, and for example of 110 volts, 10 amperes, with a reduction train driving the last gear at the designated speed, the rotor to make one turn in 300 seconds. Then the maximum cycle is somewhat under 5 minutes, with a practical minimum somewhat under ½ minute for reasons to appear.

By the described construction the hollow fixed member or bushing **47** forms an effective bearing for what may be considered the main shaft **50** of the timer, being an upright central shaft turning freely in said bearing. Said shaft carries a disk **55** to be described, which is a rotary carriage to be turned alternately in C. C. W. and C. W. directions, wherefore the shaft may be considered as an oscillating or reversing shaft, or as the disk shaft, operating the disk and the timing elements carried upon it. The shaft **50** has an outstanding flange **51** near its top end, and this flange may be toothed to receive the oscillating disk **55**, which is thus rendered fast upon the shaft. The shaft also has a cylindrical extension **52** above the flange **51**, and projecting above the oscillator disk **55**, to afford a central bearing stud or axle for a member of the mechanism carried upon the disk. A washer **53** is preferably inserted between the parts **43** and **47** below and the oscillating parts **51** and **55** above.

The horizontal disk or carriage plate **55**, which may be considered as a mechanical oscillator, is formed at its periphery with a tripping projection, lug or wedge **56** adapted to operate a trip **96** to be described, and it is provided with various pivots, stops and other means, including the central stud **52**, for the mounting and operating of the carried system of levers etc. to be described. First will be completed the description of the oscillating shaft **50**, turned slowly C. C. W. in one phase by its clutch connection from the rotor and C. W. more rapidly in another phase by another connection or means, such as a quick acting restoring spring as will next be described. At its top end the shaft has fast upon it a collar **54**, to confine between it and the disk **55** a hub **71** of an arm **70** to be described.

Near the lower end of the main or oscillator shaft **50** is connected a spring means to return the oscillator disk when uncoupled from the rotor. A barrel or spool **58**, forming a guide for a resetting spring **59**, is shown as pinned fast upon the shaft. The spring is wound, like a clockspring, upon the barrel in a direction to maintain a constant C. W. thrust upon the barrel and shaft, the spring outer end being carried outwards to where it is anchored to a post **60** projecting fixedly below the frame base plate or wall **11**. The spring should be long enough for effective action for a full rotation at least, and strong enough to overcome all resistance from springs, latches, trips and other sources of impedance to the clockwise resetting motion of the shaft and disk, which may be cushioned.

While the carriage disk **55** is controlled by the timing mechanism to be described, under actuation by the motor in one direction and by the motor-recharged reset spring in the other direction, the mechanical output action to the switch **23** may be from any convenient point, by any convenient operating part such as an actuator or cam element to thrust or shift the trigger or reverser **25** of the switch **23**. There is shown a collar or bushing **62** fast or clamped upon the main shaft **50** near its low end; it is formed in two halves and clamped by screws **63** in an adjustable manner upon the shaft, for correct timing of the switch action in each cycle. A thrusting cam **64**, as of Bakelite material is fast upon the collar **62** and it has a cam projection **65** which thrusts the switch-actuating pin, and later releases it, at the correct points in each cycle. By easy detachment and replacement the cam is interchangeable for various specific uses of the timer. It is below the frame wall **11** and so easily removed or adjusted, its set position on the shaft determining the length of each impulse caused by the switch. Instead of a rotary cam the actuator could include another mechanical device as a crank, linkage etc. for some uses.

Coming next to the timing mechanism which is associated with and in its preferred form includes members movable upon the oscillator disk or carriage **55**, and by which the desired timing operations are performed, this may take various forms, the following being illustrative. Referring first to Fig. 6, a main working element is a control member or long radial lever arm **70** swingable freely about an interior pivot on the disk, preferably its center, the arm conveniently having its hub **71** loose upon the top extension **52** of the upright shaft **50** and there confined by the collar **54**. The radial control or shift arm overlies and projects from the disk **55**, being long enough to project beyond the disk periphery to cooperate with an arrester or trip **96** to be described, and it has operative connections for operating a clutch, preferably through a latch **79**, to be described. For this purpose the arm **70** has connections including a short lever extension or leg **72**, shown extending from the hub at right angles to the arm; and therefrom extends a relatively strong spring **73** anchored at **74**, which exerts a pull thereby maintaining a thrust to swing the arm relatively C. C. W. upon the disk. As thus swung by its restoring spring **73** the arm **70** returns home to and meets a stop pin or abutment **75** upstanding from the disk. There is also shown as a guiding means near the free end of the arm a short guide wall or struck-up cleat **76**, overlying the arm and confining it close to the disk during its short relative swinging movements, which never carry the arm from beneath the guide. Upon the short extension **72** of the yieldable control arm **70** is shown an upstanding pin **77**, which may constitute a pivot connection to the latch **79**, and said pivot, being eccentric to the hub of arm **70**, affords operation of the latch. The cooperative action of these described elements and the other elements associated with the disk will be postponed until

the parts and their location and arrangement with respect to the disk have been described.

The latch means already referred to may comprise a latch lever 78, shown as a two-armed or bellcrank lever, swingable upon the floating pivot 77. The shorter arm 79 of this L-shape member constitutes the latch, having a hook 80 near its free end adapted to cooperate with and to latch a shiftable member or shipper 86 to be described. The latch or arm 79 as shown extends parallel to but in the opposite direction from the radial arm 70, while the other arm or tail 81 of the latch lever constitutes a latch-operating member, and extends substantially at right angles to the arms 70 and 79, or substantially radially outwards over the face of the disk 55, with its extreme end projecting outwardly beyond the perimeter of the disk. Near its extremity the operating arm 81 is provided with an upstanding contact member or lug 82, which lug therefore moves around circumferentially with the movements of the disk, in the respective directions, although controlled and limited by the cooperation of its lug 82 and the depending lug or stop 38 of the fixed but circularly adjustable stop plate 37, said depending lug standing directly in the circular path of the upstanding lug, as best seen in Figs. 6 and 7.

Continuing the description of the latch member, it is shown as provided with a spring 83 urging it C. W., shown as a tension spring extended between the operating arm 81 and a fixed anchor 84, shown in the form of a pin upstanding from the disk, which may be the same pin which serves as the pivot for a latch-controlled arm 86. The latch member 78 may thus be swung toward latching position by the pull of its spring 83, and when retracted therefrom its swing may be limited by a lug or guard 85, preventing excessive swing of the arm 81 beyond its unlatching position.

The purpose of the latch means is to control the coupling or clutching of the oscillating disk 55 to the rotor 45 and releasing it therefrom, and the following latch-controlled members take part therein. A shiftable member 86 having a latching face or offset 87 is shown in the form of a swinging arm, or clutch shipper lever, conveniently pivoted on the pin 84 already mentioned, and extending substantially parallel with the latch lever arm 81, its free end being swingable for the opposite shifting movements of the clutching means between the rotor and the disk. Thus at the swinging end of the shipper arm 86 is provided a pin or pivot 88 by which a connection or link 89 is pivoted to the arm 86. This link extends substantially parallel to the radial arm 70, its far end being provided with a depending slide, stem or stud 90, extending to a point below the disk and there carrying a clutch member shown in the form of a dog or pawl 91, adapted to act as a clutch shoe cooperable with the clutching rim 45 of the rotor. The depending stem 90 of the dog constitutes a slide by which the movements of the link and dog are guided, the stem passing through a longitudinal slot 92 in the disk and being guided thereby.

The described clutch members, the rotor perimeter 45 and the dog or shoe 91 are shown out of mutual engagement in Fig. 6 and Fig. 14, but engaged in Figs. 12 and 13. For causing their engagement a sufficiently strong pulling spring 93 is shown, attached to the first end of the link 89 and to an anchor lug 94 which may be struck upwardly from the disk 55. The dog or shoe 91 and its stem 90 are preferably in fixed connection with the link 89, and the dog may comprise a metallic or non-metallic member of suitable form, serrated or otherwise, or provided with a gripping or rubbery surface, the tension of the spring 93 tending to shift the link and shoe from the position shown in Fig. 6 to that shown in Fig. 12 wherein the dog is bearing against the rotor edge, thus to impose C. C. W. drive upon the disk. In Fig. 11 shoe 91a is a toothed dog swinging below disk 55 on pivot 95.

Referring next to the member 96, located adjacent to the carriage rim, this is primarily an arrester for blocking the projecting arm 70 during the final C. C. W. rotation; but is shown also as a retractable tripping means, seen in its Fig. 13 position as blocking the swing of the arm, its retraction however releasing the control arm for such swing. The arresting or trip member is shown mounted upon an upright pivot post 97 fixedly mounted in the bottom wall 11 of the timer, so that it may swing between its blocking position of Fig. 6 and its releasing position of Fig. 14. The trip is given a constant tendency to swing toward its blocking position by a spring 98, as of the coil type, surrounding the post 97, with the upper end of the spring pressing upon the body of the trip and the lower end anchored by insertion in a small perforation 99 in the bottom plate 11. The trip stands normally in blocking position but may be retracted at a predetermined point in each cycle by a timed means, as by having a bent extension or finger 100, acting as a follower running upon the peripheral edge of the disk 55, which for the greater part is concentric, providing a dwell, but at one point has the outward wedging or camming extension 56 adapted, as the disk rotates to the Fig. 14 position, to thrust outwardly the follower 100 and shift the trip to its tripping or arm releasing position.

Five springs have been described. The carriage reset spring 59, charged during the drive, is of ample strength to overcome the light latch spring 83 at the end of the C. W. rotation without relying on momentum. The control arm spring 73 is fairly strong, becoming charged by the C. C. W. drive; it acts as the clutch opening spring and can overpower and recharge the light closing spring 93. The latch spring is charged by the force of the resetting spring near the end of the C. W. rotation. The trip spring 98 is charged by the power drive through the disk and wedge cam 56. Thus the entire control mechanism is actuated directly or indirectly from the power of the single continuously running motor.

The cycle of operations will next be described, with respect to the oscillating disk or carriage 55 and the upright shaft 50 on which it is mounted, the operation being that these elements and the connected switch-reversing cam 64, 65 are in one phase rotated relatively slowly and steadily C. C. W. through the motor driven rotor 42, for a predetermined angle and time-period, followed by unclutching from the rotor and rapid reverse or C. W. rotation under the force of the resetting spring 59 which in the meanwhile has been rewound or charged during the motor drive. The disk is next stopped after the predetermined angel of C. W. rotation and the clutch applied for C. C. W. rotation and repeat. The spring resetting rotation is substantially instantaneous, and no pauses between the motor-driven and spring-driven stages of the disk oscillation are necessary, the motor drive being relatively slow,

for substantially the entire cycle, and the spring-drive being an immediate return or resetting of the disk, of negligible duration.

The operation may conveniently be described beginning with the intermediate position shown in Figs. 3, 6 and 7. In this position the disk or carriage **55** is rotating C. W. and has very nearly completed this rotation, under the force of the reset spring **59**. The radial shift arm or member **70**, which has a beveled end, may be considered as having just been forced by the disk, rightwardly in Fig. 6, beyond the trip, yet to undergo however a slight further C. W. rotation with the disk; and during this motion the arm rests at home against its stop **75** upstanding from the disk. The arm or shift member **70** it should be explained plays always beneath its guide cleat **76**, having only a short shift motion relatively to the disk. The clutch arm **86** and link **89** connecting it with the clutch dog or pawl **91**, are still latched by the latch **79**, so that the clutch dog is still held retracted outwardly and inoperative against the resisting pull of the clutch applying spring **93**. The second arm or tail **81** of the latch lever is positioned by reason of the abutting of the latch arm **79** against the edge of the contact part **87** of the clutch arm, namely, by the tension latch spring **83**. The upstanding contact lug **82** carried by the latch arm **81** is shown in these figures as having just met, or approximately met, the depending stop lug **38** on the stop plate **37**, the stop plate and lug having been adjusted to a desired position, determining the extent of the C. W. rotation of disk **55** for resetting and therefore also for the slow cycle-determining purposes. As stated, Fig. 6 and others show the parts in the instantaneous position just described, in a cycle of short duration.

With the continued C. W. rotation of the carriage disk **55**, beyond the Fig. 6 position, to the limit thereof as determined by the stop-lug adjustment, the following final resetting actions of the mechanism occur. In rotating C. W. slightly beyond the Fig. 6 position, the main arm **70** is carried along by the disk further away than shown, beyond and away from the trip **96**. The latch lever **78** by the final motion of the disk now gets swung C. C. W. due to the cooperation of the set stop **38** and the lug **82** on the lever, the former relatively thrusting the latter and thereby swinging the arm **81** of the latch lever. Finally when arm **81** has retracted the latch **79** from latching position, this releases the clutch arm, which at once is acted on by the clutch spring **93**, and this through link **89** pulls inwardly the dog or shoe **91** into driving engagement with the rim **45** of the rotor. See Fig. 12. In this way the C. W. rotation is positively stopped, due to the thrust of the fixed stop **38** upon the latch controlling arm **81**, without need of the latter meeting its limiting guard lug **85**. The clutch dog being carried on the pausing disk **55**, the closing of the clutch **91—45** promptly causes the engagement of rotor and carriage and the power driving C. C. W. of the latter. The description has thus passed through the transition stage between C. W. spring drive and C. C. W. motor drive.

The C. C. W. drive of the disk or carriage **55** from the rotor causes also the rotation of the connected disk shaft **50** and the rewinding of the reset spring **59**. As the C. C. W. rotation commences, a first action is that the latch lever projecting arm **81** and contact lug **82** separate from the fixed stop lug **38**, and the latch lever **78** thus

becomes freed, so that in due time by its spring **83** the latch **79** can operate to assume again its latching position and eventually to latch again the shipper **86** and clutch dog or shoe **91** in retracted position.

After nearly completing the predetermined extent of C. C. W. disk rotation the extremity of the control arm **70** meets the arrester **56** and is blocked thereby; the disk however continuing its C. C. W. motion the arm **70** is thus caused to swing relatively C. W. upon the disk, this relative movement being utilized to throw off the power drive. Specifically the relative C. W. shift of the arm causes the shifting of the eccentric latch lever pivot **77** in a direction to cause the outward shifting of the latch arm **79**. The latch spring **83** holds the latch pressed against the edge of the contact lug **87**, and when the arm **70** has been displaced sufficiently this causes the latch hook **80** to move outwardly beyond the contact lug or face **87**, the latch spring **83** then causing the latch hook to take its reset or latching position engaging the face **87**, so that it becomes adapted to pull inwardly the clutch lever **86** for disengaging the driving clutch. See Fig. 13.

A quickly following action is that the cam or wedge **56** at the perimeter of the disk **55** comes into action, thus to thrust outwardly on the follower **100** and displace or retract the trip **96**; and this in turn trips and releases the blocked arm **70**. Immediately the strong restoring spring **73** returns the arm **70** back to its home position against the stop **75**; and this motion of the arm operates, by shifting the pivot **77**, to draw inwardly again the latch arm **79**, which in turn swings inwardly the clutch arm **86**. By these operations, toward the end of the power-driven phase, the clutch dog or shoe **91** is retracted from the rotor rim, thus unclutching the disk from the power drive, and the disk becoming free and therefore subject to actuation from the spring drive means. See Fig. 14. This brings the description to the transition stage following the C. C. W. drive.

Coming now to the other phase, the C. W. drive commences, by the force of the now recharged spring **59**, which immediately starts the C. W. rotation of the shaft **50**, cam **64** and disk **55**. As the disk commences its C. W. rotation its protruding cam **56** moves away from the follower **100** and releases the trip **96** allowing the spring **98** to return the trip inwards to its normal blocking position. Also, the main arm **70** rotates around with the disk, passing under and beyond the trip. After nearly completing the C. W. rotation the position thus returns to the intermediate point in the C. W. rotation represented by Figs. 3, 6 and 7, completing the full cycle. As later explained, the drawings, except Fig. 15, represent such a short cycle that after the arm **70**, after causing unclutching, passes C. W. beyond the arrester, the latch releasing arm **81** meets the fixed stop and thereupon causes reclutching.

The result of these actions is that the disk carriage **55**, its carrying shaft **50**, and the switch operating cam **64**, oscillating as a unit, are alternately rotated C. C. W. by the slow actuation of the rotor, and then instantaneously returned C. W., through a rotation arc which is predetermined by the setting of the stop lug **38** by means of the dial and index and the thumb-screw **41**. Substantially the entire purpose indeed of the described timing mechanism is to afford in the cam **64** the desired reverse rotary movements, the cam being the connecting means between the

timing mechanism and the switch 23. In examining Fig. 2 it must be borne in mind that, being inverted, the directions of rotation of the cam must be considered in the opposite sense. In other words in Fig. 2, and similarly in Figs. 9 and 10, the cam projection 65 or 65a moves around rightwardly under the slow driven C. C. W. part of the cycle and returns leftwardly during the C. W. rapid resetting of the apparatus. The cam projection has a rise from the otherwise circular contour or low dwell of the cam, and at the top of the rise the cam preferably has an appreciable extent of high dwell.

These Figures 2, 9 and 10 may be considered as corresponding in position substantially with Fig. 14, the oscillating parts, the disk, shaft and cam, having reached the end of their slow power-driven C. C. W. rotation, that is, to the extreme of their rightward rotation in Figs. 2, 9 and 10. The cam projection 65 has an easy rise, and this has thrust frontwardly the switch trigger 25 and reversed the switch, and the parts have stopped momentarily in this transition position, awaiting the quick, opposite return rotation.

On Fig. 9 the furthest point of the cam to be contacted by the trigger is marked X. Along the rise of the cam is a critical point Y at which the shown type of switch snaps reversely, in either direction; for example, the trigger having recently passed the point Y on its rise has reversed the switch to closed position, starting an electrical impulse, and shortly thereafter the trigger will again pass the point Y on the return or drop motion, concluding the impulse and opening the switch. As a matter of fact, in the conventional snap switch the point Y has an appreciable range between the on and off positions of the switch, and this is indicated on Fig. 9 by the double leading line from the reference Y. In effect there are twin points, and on the way out the trigger reverses the switch at the outer point of the critical point, restoring it again on the way in only when reaching the inner point thereof. The return or rapid C. W. rotation, observed as a leftward rotation on Fig. 9, causes the trigger to ride down on the cam rise, beyond the point Y and thence to a predetermined point Z, which may be adjusted through the adjustment already described of the stop lug 38 which predetermines the extent of clockwise resetting rotation and therefore the extent of the subsequent slow driven C. C. W. rotation of the oscillating parts.

For convenience of illustration and description, Figs. 3, 6, 7, 12, 13 and 14 have been drawn with the stop lug 38 set for about the shortest possible length of cycle, so that, as seen in Fig. 6, as the arm 70 emerges beyond the trip 96, with the C. W. rotation of the disk, the lug 82 on the latch lever tail 81 is making contact with the fixed stop lug 38, as so adjusted, whereby, very shortly after the C. W. rotation by the resetting spring is started, it terminates while the disk guard lug 85 approaches and the latch tail 81 bears upon the fixed stop lug 38. The tail or arm 81 by its relative shift or swing on the disk causes the stoppage by its action in throwing the drive clutch into engagement through the unlatching of the shipper. Referring back to Fig. 9, the point on the cam 64 corresponding with the carriage reset or transition position just described may be approximately at the point Z, near the foot of the cam projection 65. The minimum setting of the timer may afford a cycle as low as 30°, or $\frac{1}{12}$ rotation of disk, corresponding with a 25 second cycle if the rotor is driven at the rate of one turn in 300 seconds, as first assumed.

For a longer duration of cycle it is only necessary to adjust the stop plate 37 and lug 38 around clockwise from its Fig. 6 position, which may be done while running; for example to the new position 38' there indicated, and this may afford a cycle for example of 45 seconds; the position of the switch trigger upon the cam 64 being correspondingly indicated on Fig. 9 at the reclutching point Z'. The adjustment of course may be carried much further so that a cycle approaching 5 minutes in duration is possible, such as 275 seconds of time, corresponding with 330° of oscillation and point Z^2. Fig. 15 shows the return or reset position when the timer is adjusted for the longest possible cycle, namely of 330°; the parts having reached the position wherein the stop lug has tilted the latch lever and the unlatched clutching connections have just caused the clutch to be applied for a prolonged stage of C. C. W. rotation of the disk and cam.

With the specific timing mechanism illustrated approximately 15° of action on each side of the zero position are lost, due to the necessity of providing leeway for the various actions described; and the stop pin 31 projecting above the dial, as seen in Fig. 1, serves as a guard or protection, preventing the index 32, the stop plate 37 and the stop lug 38 from being turned excessively in either direction around the general center. This limitation to about 330° of action is of no serious objection since extremely short cycles are generally unusual, whereas by proper motor speed or speed reduction from the motor the maximum period or rotary angle of the cycle may be increased to any desired point, e. g. to deliver an impulse as infrequently as once per hour. With the specific mechanism disclosed, and the rotor arranged for one rotation per 300 seconds, the timer may be adjusted to have a cycle period of anywhere between 25 seconds and 275 seconds, readily predetermined by the setting of the index 32 upon the dial.

Whatever be the total period of the cycle, the result of the timer operation is that at the end of the slow power rotation the cam 64, 65 causes an operation of the switch, e. g. for an electrical impulse, which it is usually desirable to have of quite short duration. The extent of this duration is indicated by considering the extent of the relative motion of the trigger 25 passing, as a follower, along the cam projection 65, the switch being in its impulse position as the trigger travels relatively from the critical point Y of the cam rise up to the final or transition point X, and its return to the point Y, beyond which the switch becomes reversed into open condition. The impulse for example might be of the extent of a few seconds, and with this invention some leeway is allowed since the cam may be loosened on the shaft and moved around circularly slightly to bring the most remote part of the cam projection dwell into contact with the trigger at the transition point of oscillation instead of the less remote point X shown in Fig. 9. Whatever such adjustment be made, the short impulse duration therefore falls entirely within the complete duration of the cycle, whether it be 25 seconds or 275 seconds or some intermediate duration. If in any case it were found desirable to provide a considerably longer continuance of impulse, or one which could be adjusted at will, for example up to say a half minute, this could be arranged by providing a

cam 64ª of a different design, such for example as that shown in Fig. 10, wherein the high cam dwell or contour of the cam projection 65ª is very much elongated. By this arrangement the impulse may be prolonged from a minimum, as before, up to a maximum represented by the rotary angle between the critical or switch reversing point Y and the limit point X near the extreme remote end of the high dwell. In this Fig. 10 modification also is shown the plan of having a gradual incline connecting the outer dwell to the inner dwell at both ends instead of only one end of the outer dwell; so that if during manipulation the cam should accidently be turned too far C. C. W. the trigger would not drop behind an abrupt projection and require manual rearranging as might be the case with the cam form shown in Fig. 9.

Certain further explanations will assist to make clear the essence of the present invention and its basic mode of operation; at the same time making more clear the terminology employed in the summarizing claims. One important feature of the present invention is that it dispenses with the need of a plurality of electric motors, or of a motor which is reversible, in order to afford prolonged interval periods between impulse durations, the sum of which interval and impulse constitutes the total cycle period or time of action. By the present invention a single drive motor 16 is used, of uniform speed throughout the repeating cycles, the reduced-speed of which is communicated to the carriage or disk element 55 for power drive thereof through a clutch, and with clutch release at the end of the interval period to permit a relatively rapid return or resetting movement by the restoring spring 59. All of the operative motions of all parts of the timer are derived directly or indirectly from the electric motor 16, without disturbing its continuity of rotation, communicated through the reduction gearing and the rotor 42 which latter is thus continuously turned C. C. W. at the steady predetermined speed such as one rotation in 300 seconds. When the carriage 55 is clutched by the clutch 45, 91, to the rotor, the carriage turns C. C. W. for the interval period of the cycle, and during this period the power of the motor serves to recharge the resetting spring, thus indirectly providing the force for the rapid C. W. or return rotation of the carriage and connected parts. Besides the resetting spring 59 the disclosed embodiment contains several other springs including the relatively strong spring 73 of the shift member or control arm 70 on the carriage; and another spring is the relatively weak spring 98 which urges the trip 96 into its tripping position; and both of these as well as the reset spring 59, are stressed or charged directly from the rotor through the rotation of the carriage, subsequently reasserting themselves to perform their functions. During the rapid C. W. resetting rotation of the carriage the spring 59 is of strength to overcome all other springs and to turn the carriage to its dead-stopped position. On the other hand the shift arm spring 73 is strong in relation to the latch spring 83 and the clutch spring 93, especially the latter, so that as the spring 73 draws the arm 70 back to home position it has the strength to pull the latch lever 78 and thus cause the swing of the clutch arm 86, the spring 93 of which is what later closes the clutch to cause resumption again of the slow power drive of the carriage.

In referring to common mechanical elements, such as springs, it is intended to include equivalents adaptable to affording the actions and functions desired. For example the action of a spring such as the reset spring 59 might be provided by a pneumatic device such as a dashpot, or cylinder and piston, acting through a rack and pinion, to turn C. W. the carriage shaft 50 and supported parts. The term arm is used without intention to limit the recital to a portion of a swinging lever, but to include other shiftable mechanical members capable of substantially the same action and function, such as arms or elements which slide rather than swing.

Broadly the described clutch 45, 91 is a coupling means between the motor-driven rotor and the disk carriage, and other types of openable or disengageable couplings can serve the same purpose; e. g. the rotor could be lateral of, rather than coaxial or concentric with the oscillatory carriage, and coupled and uncoupled therewith as by meshing and unmeshing the peripheral means or teeth of the two, either directly, or indirectly as through a shiftable pinion, in which cases the rotor should have steady rotation in such direction as to give C. C. W. rotation to the main or carriage shaft 50. The arm 86 on the carriage constitutes a coupling or clutch opening and closing means, and may therefore be designated a shipper, it preferably acting against a spring, as 93, which spring preferably acts to couple or clutch together the rotor and carriage. The main shiftable arm or member 70 on the carriage, by which and through the latching member 79 the shipper 86 is operated to open the clutch, may be considered as a control arm of the timing mechanism. The latch lever tail 81 may be considered a control member in the sense that when swung it releases the latch and shipper to cause clutch closing.

It should be understood that the terms C. W. and C. C. W., as applied to the two phases of rotation, are adopted for facility of description, and not to exclude a reversal with steady and slow C. W. followed by quick C. C. W. rotation, which latter would be fulfilled by viewing the illustrated timer from its underneath side.

To review the invention in certain broad aspects in explanation of the corresponding claims, it may be described as an electrical timer operable by a single continuously running motor which drives the rotor of the timer, there being an oscillatory carriage with which turns the actuator that operates an electrical device or switch, the carriage receiving its C. C. W. advancing and C. W. retreating rotations through repeated cycles by means of a clutch between the rotor and carriage to impose a slow rotary advance, and a reset spring to impose a quick rotary retreat while the clutch is open; and controlling means or mechanism operating through the clutch and comprising the following basic elements: A projecting control part or arm on the carriage, illustrated by the swinging arm 70; an arrester part located on the frame adjacent to the carriage in position to be met by the control part near the end of each phase of advancing rotation, this being illustrated by the arrester or retractable trip 96; means operable by the meeting of said two parts, the arm and arrester, to open the clutch thereby to discontinue the advancing drive, being illustrated by the connections from the arm 70 to the shipper 86, the result being to permit the reset spring to rotate the carriage in retreating direction; a projecting control member on the carriage, illustrated by the

lever extension or tail 81 of the latch lever; a stop member, illustrated by the lug 38, located adjacent the carriage in position to be met by said control member near the end of each phase of retreating rotation; and finally, means operable by the meeting of said control member and stop member to cause the closing again of the clutch for repetition of the slow advance phase of the carriage, this element being illustrated by the unlatching connections from the member 81 to bring about the shifting of the shipper to closed position.

In the preferred form of the combination so recited, as illustrated in the drawings, the projecting control part or arm 70 and the projecting control member or tail 81 are each mounted movably or swingably upon the carriage or disk, with resilient or spring resistance; and the disk carries also the shipper lever, and the connections between these elements. The opening and closing connections on the carriage to the clutch from the control arm 70 and from the control member 81, respectively, may take different forms, but preferably include the shipper lever 86 shiftable between opening and closing positions, and for shifting it to open position the latch 79 actuated from the control arm 70, while the spring 93 tends to restore the shipper; and the control member or tail 81 being connected for retracting the latch to unlatch the shipper and permit the spring return thereof into closed or clutching position. In its specific illustrated form the timer mechanism provides an arrester 96 in the form of a retractable trip, with means 56 on the carriage to retract it, timed so that the trip first displaces resiliently the control arm 70 from its home position or seat 75, and then trips it to snap back to its home position, all during the final advancing rotation of the carriage; this arrangement providing these two movements of the control arm, the displacement being utilized to reset the latch 79 to engage the shipper and the return of the arm pulling upon the latch to shift the shipper and open the clutch.

The following matters of description will explain further the principles and actions. At the outset, a single motor is desirably the only power source, it acting directly or indirectly for all parts of the action. Referring to the main operating member or disk as the reciprocatory carriage of the timer, this is turned in advancing direction through a clutch which transmits power from the motor and in the retreating direction by a reset spring which became charged during the advance rotation. Designating the transition point at which each power drive commences as the start position, the termination of the advancing phase may be called the finish position. The clutch when closed provides the force to advance the carriage from start to finish; the reset spring thereupon giving the quick return phase to starting position while the clutch remains disengaged. The entire cycle comprises these advancing and returning phases. An essential portion of the timer consists of means to unclutch the carriage at the end of its predetermined advance travel, this means acting against the load of the reset spring and the resistance of the clutch closing spring. The final advancing motion of the carriage causes its own unclutching, with a slight over-travel for assurance of action. The adjusting of the angular or time extent of the cycle is effected by (relatively) adjusting a cooperating fixed member, which has been called a stop and is in fact one of the elements taking part in the reclutching of the carriage; and it cooperates with means on the carriage to effect the closing of the clutch, causing drive, which promptly overpowers the force of the reset spring and terminates the spring-impelled retreat; which is also subject to a separate positive stopping in case of delayed reclutching action. The means by which the arrival of the carriage at its starting position causes the reclutching includes the adjusted stop member adjacent the carriage and certain means on the carriage, embodied as a control member or lever projecting to meet the fixed stop, and itself having such a light resisting force that it may be shifted by the force of the reset spring without the need of relying upon the momentum of the carriage. This control lever when so shifted on the carriage acts through another part to cause the closing of the clutch, the clutch having its own closing spring. For delicacy and lightness of action this other part consists of a latch by which the clutch is latched open and which therefore is readily unlatched by the force of the reset spring when the projecting lever arm contacts the fixed stop. The free and easy action resulting from the use of the latch is what renders the reclutching entirely reliable at the start of each cycle. The system of movable parts on the carriage includes the projecting lever member mentioned and a second lever or control arm, the latter and associated parts operating through a clutch shipper to disengage the clutch, later to be reengaged by the action of the first-mentioned lever arm. The operative parts associated with the clutch shipper and the two projecting arms include the latch already mentioned through which the clutch closing is brought about and a connection from the control arm to the latch for causing the latch first to reengage the shipper and then retract it to open position. Specifically these operations are performed by an arrester, contacted by the control arm near the finish of each advancing rotation, the meeting of the arm with the arrester causing the swinging of the arm on the carriage thereby to reengage the latch. The arrester is preferably a retractable trip, operated to release the control arm at the end of the advance rotation, said arm having a spring strong enough to pull upon the latch to swing the shipper and overcome the clutch spring thereby to unclutch the carriage. The advantages of the above are the lightness and reliability of action and the ready adjustability of the cycle by the location of the fixed stop. It may be further pointed out that notwithstanding adjustments of the cycle period, as may be needed, the duration of each electric impulse produced by the cam-actuated switch may remain constant, as is desirable. The travel of the carriage through its variable cycle distance or angle, made up for example of a predetermined angle between 15° and 320° during an open-circuit interval and then a further predetermined travel, such as 10°, during which the switch delivers an electric impulse, affords the desirable adjustment of the total cycle without changing the duration of the impulse, which also may be pre-adjusted; in all cases the arrival at the finish is accompanied by unclutching and instant return to the start position of the carriage, causing reliable reclutching and repeat.

There has thus been described an electrical timer embodying the principles and attaining the objects of the present invention; and since many matters of operation, combination, mechanism

and detail may be variously modified without departing from such principles it is not intended to confine the invention to such matters except to the extent set forth in the appended claims.

What is claimed is:

1. An electrical timer having a rotor adapted to be continuously rotated by a single uniform-speed drive motor, and an actuator adapted when rotated alternately advancingly and retreatingly to produce predetermined cycles of operations in an electrical device or switch, and in combination therewith: an oscillatory carriage with which the switch actuator is connected to partake of the rotations thereof; a clutch between the rotor and carriage adapted when closed to impose upon the carriage a slow rotary advance; a reset spring adapted when the clutch is open to impose upon the carriage a quick rotary retreat and when the clutch is closed to become recharged by the slow advance drive of the carriage; projecting means on the carriage; an arrester located adjacent the carriage in position to be met by said projecting means near the end of each advancing rotation of the carriage; means operable by the meeting of said projecting means and arrester to unclutch and discontinue the advancing drive of the carriage and permit retreating rotation thereof by the reset spring; a stop located adjacent the carriage in position to be met by said projecting means near the end of each retreating rotation of the carriage; and means operable by the meeting of said projecting means and stop to cause the closing again of the clutch for repetition of the slow advancing rotation of the carriage.

2. An electrical timer having a rotor adapted to be continuously rotated by a drive motor, and an actuator adapted when rotated alternately advancingly and retreatingly to produce predetermined cycles of operations in an electrical device or switch, and in combination therewith: an oscillatory carriage with which the switch actuator is connected to partake of the rotations thereof; a clutch between the rotor and carriage adapted when closed to impose upon the carriage a slow rotary advance; a reset spring adapted when the clutch is open to impose upon the carriage a quick rotary retreat and when the clutch is closed to become recharged by the slow advance drive of the carriage; a projecting control part on the carriage; an arrester part located adjacent the carriage in position to be met by the control part near the end of each advancing rotation of the carriage; means operable by the meeting of said parts to unclutch and discontinue the advancing drive of the carriage and permit retreating rotation thereof by the reset spring; a projecting control member on the carriage; a stop member located adjacent the carriage in position to be met by said control member near the end of each retreating rotation of the carriage; said stop member being located in a definite angularly spaced relation to said arrester part thereby to predetermine the angular extent of the oscillatory rotations of the carriage; and means operable by the meeting of said members to cause the closing again of the clutch for repetition of the slow advancing rotation of the carriage.

3. An electrical timer having a rotor adapted to be continuously rotated by a drive motor, and an actuator adapted when rotated alternately advancingly and retreatingly to produce predetermined cycles of operations in an electrical switch such as to cause alternate intervals and electrical impulses in the circuits thereof, and in combination with said rotor and actuator the following mechanical elements: an oscillatory carriage with which the switch actuator is connected to partake of the rotations thereof; a clutch between the rotor and carriage adapted when closed to impose upon the carriage a slow rotary advance; a reset spring adapted when the clutch is open to impose upon the carriage a quick rotary retreat and when the clutch is closed to become recharged by the slow advance drive of the carrriage; a shipper shiftable on the carriage and connected to cause closing and opening of the clutch; a projecting control arm resiliently displaceable on the carriage from a stopped home position; an arrester located adjacent the carriage in position to block the control arm and thereby cause its relative displacement near the end of each advancing rotation of the carriage; a connection on the carriage from the control arm to the shipper operable by the movement of the arm to move the shipper to its open position thus to unclutch and discontinue the advancing drive of the carriage and permit retreating rotation thereof by the reset spring; a projecting control member resiliently shiftable on the carriage from a stopped normal position; a stop located adjacent the carriage in position to be met by said control member for the shift of said control member near the end of each retreating rotation of the carriage; said stop being located in a definite angularly spaced relation to the arrester thereby to predetermine the angular extent of the oscillatory rotations of the carriage; and a connection on the carriage from the control member to the shipper operable by the movement of the member to move the shipper to its closed position thereby to cause the closing again of the clutch for repetition of the slow advancing rotation of the carriage.

4. An electrical timer having a rotor adapted to be continuously rotated by a drive motor, and an actuator adapted when rotated alternately advancingly and retreatingly to produce predetermined cycles of operations in an electrical switch such as to cause alternate intervals and electrical impulses in the circuits thereof, and in combination with said rotor and actuator the following mechanical elements: an oscillatory carriage with which the switch actuator is connected to partake of the rotations thereof; a clutch between the rotor and carriage having a closing spring and adapted when closed to impose upon the carriage a slow rotary advance; a reset spring adapted when the clutch is open to impose upon the carriage a quick rotary retreat and when the clutch is closed to become recharged by the slow advance drive of the carriage; a shipper shiftable on the carriage and adapted in cooperation with said clutch spring to cause closing and opening of the clutch; a latch adapted to engage and disengage said shipper and when so engaged adapted to shift the shipper to clutch-opening position and when so disengaged to permit closing of the clutch; a projecting control arm resiliently displaceable on the carriage from a stopped home position; an arrester located adjacent the carriage in position to block the control arm and thereby cause its relative displacement near the end of each advancing rotation of the carriage; a connection from the control arm to the latch operable by the movement of tthe arm to move the latch and thereby shift the shipper to its open position thus to unclutch and discontinue the advancing drive of the carriage and permit

retreating rotation thereof by the reset spring; a projecting control member resiliently shiftable on the carriage from a stopped normal position; a stop located adjacent the carriage in position to be met by said control member for the shift of said control member near the end of each retreating rotation of the carriage, said stop being located in a definite angularly spaced relation to the arrester thereby to predetermine the angular extent of the oscillatory rotations of the carriage; and a connection from the control member to the latch operable by the shift of the member to retract the latch and permit the shipper to move to closed position thereby to cause the closing again of the clutch for repetition of the slow advancing rotation of the carriage.

5. An electrical timer having a rotor adapted to be continuously rotated by a drive motor, and an actuator adapted when rotated alternately advancingly and retreatingly to produce predetermined cycles of operations in an electrical device or switch, and in combination therewith the following mechanical elements: an oscillatory carriage with which the switch actuator is connected to partake of the rotations thereof; a clutch between the rotor and carriage having a closing spring and adapted when closed to impose upon the carriage a slow rotary advance; a reset spring adapted when the clutch is open to impose upon the carriage a quick rotary retreat and when the clutch is closed to become recharged by the slow advance drive of the carriage; a shipper shiftable on the carriage and adapted in cooperation with said clutch spring to cause closing and opening of the clutch; a latch or hook member on the carriage adapted to engage and disengage said shipper and when so engaged adapted to shift the shipper to clutch-opening position and when so disengaged to permit closing of the clutch; a projecting control arm yieldingly displaceable on the carriage from a stopped home position and having a returning spring of strength to overpower said clutch closing spring; a trip member located adjacent the carriage and spring-pressed to position to block the control arm and thereby cause its relative displacement near the end of each advancing rotation of the carriage; a timed tripping means or cam operated by the carriage advance after such arm displacement adapted to retract said trip member and thereby release said control arm to return home; a connection from the control arm to the latch operable by the displacement and return movements respectively of the arm to move the latch first into position to engage the shipper and then with an action to shift the shipper to its open position thus to unclutch and discontinue the advancing drive of the carriage and permit retreating rotation thereof by the reset spring; a projecting control member yieldingly shiftable on the carriage from a stopped normal position; a stop located adjacent the carriage in position to be met by said control member for the shift of said control member near the end of each retreating rotation of the carriage; a connection between said control member and said latch operable by the shift of the member to retract the latch and permit the shipper to move to closed position thereby to cause the closing again of the clutch for repetition of the slow advancing rotation of the carriage; and light spring means tending to return said control member to normal position and said latch to latching position.

6. In an electrical timer a rotor driven steadily by a synchronous motor, an oscillating carriage or disk on a shaft coaxial with the rotor, an actuator or cam operated from the carriage or shaft for effecting the desired timing operations, a clutch comprising a shoe mounted on the carriage adapted to engage and disengage the rotor, with a movable shipper on the carriage acting on the shoe to cause clutch closing and opening, a control arm yieldingly swingable on the carriage and connected to move the shipper to open the clutch, an arrester to swing relatively the control arm and open the clutch at a predetermined point in each slow CCW rotation of the carriage, a strong spring means to return CW the carriage when so unclutched, a control member yieldingly swingable on the carriage and connected to cause movement of the shipper to close the clutch, and a stop to swing relatively the control member to cause closing of the clutch at a predetermined point in each CW rotation of the carriage.

7. A timer as in claim 6 and wherein the arrester is a trip adapted automatically to release the control arm for return after each displacement, and the shipper is spring-pressed to close the clutch, and there is a latch to engage the shipper for moving it to open position, and the control member by its swing retracts the latch to release the shipper for spring return to closed position, and the control arm by its displacement reengages the latch with the shipper and by its return shifts latch and shipper to open position.

8. In a cyclical electrical timer, a frame, a reciprocatory carriage having a coupling for coupling it to a source of steady motor drive for its advance rotation, and a reset spring for causing its retreat rotation upon uncoupling therefrom, projecting means on the carriage and cooperating blocking means on the frame, including a projecting part adapted to meet a blocking part at a predetermined point in the advancing phase of the cycle, with connections operated by the cooperation of said parts to uncouple the carriage drive, and a projecting member adapted to meet a blocking member at a predetermined point in the retreating phase, with connections operated thereby to recouple the drive; and means for relatively adjusting said projecting and blocking means to predetermine a desired angular extent of advancing and retreating rotation and thereby the time-period of the cycle of the timer.

9. An electrical timer having a continuously motor-driven rotor, a shaft for a switch actuator adapted to be rotated alternately CCW and CW, an oscillatory disk on said shaft, a clutch between the rotor and disk having a closing spring and adapted when closed to impose upon the disk a slow CCW advance; a reset spring adapted when the clutch is open to impose upon the disk a quick rotary retreat and when the clutch is closed to become recharged by the slow advance drive of the disk; a shipper lever swingable on the disk and adapted in cooperation with said clutch spring to cause closing and opening of the clutch; a control lever having a projecting radial arm and swingable on the disk for displacement from a stopped home position and having a returning spring of strength to overpower said clutch closing spring, said control lever having also a laterally extending arm; a latch lever swingable on an eccentric pivot on the control lever lateral arm and arranged for its latch arm to engage and disengage said shipper and when so engaged adapted to shift the shipper to clutch-opening position and when so disengaged to permit closing of the clutch; a trip member located adjacent the disk periphery and spring-pressed to normal

position to block the control arm and thereby cause its relative displacement on the disk near the end of each CCW rotation of the carriage; a timed tripping means operated by the disk CCW advance after each control arm displacement adapted to retract said trip and thereby release said control arm to return home, whereby the displacement and return movements respectively of the control arm move the latch first into position to engage the shipper and then reversely to swing the shipper to its open position thus to unclutch and discontinue the advancing drive of the disk and permit retreating rotation thereof by the reset spring; said latch lever having a second arm or tail resiliently yieldable from a stopped normal position; and a stop located adjacent the disk periphery in position to be met by said latch lever tail for the shift of said latch and unlatching of the shipper near the end of each retreating CW rotation of the disk whereby to cause the closing again of the clutch for repetition of the slow advancing rotation of the disk.

10. A timer as in claim 8 and wherein is means for adjusting the total angle and period of the timer cycle by selectively shifting angularly the position of the final stop relatively to the arrester.

11. A timer as in claim 8 and wherein is means for adjusting the total angle and period of the timer cycle by selectively shifting angularly the position of the final stop relatively to the arrester; namely by providing a concentric stop-plate from which projects the final stop in the form of a lug standing in the path of the extremity of the control member or latch lever tail, a clamp means for holding the stop-plate where adjusted and a hand screw for closing the clamp.

12. A timer as in claim 8 and wherein is means for adjusting the total angle and period of the timer cycle by selectively shifting angularly the position of the final stop relatively to the arrester; namely by providing a concentric stop-plate from which projects the final stop in the form of a lug standing in the path of the extremity of the control member or latch lever tail, a clamp means for holding the stop-plate where adjusted and a hand screw for closing the clamp; with a dial and index for indicating the adjusted position and the period of the cycle.

13. A timer as in claim 2 and wherein the switch provides in each total cycle period a short duration of electrical impulse and a long period of interval, the switch actuator being a cam with a long and a short dwell and an interconnecting slant wherein the switch reversals occur during cam oscillations acting upon the follower or switch trigger.

14. A timer as in claim 2 and wherein the switch provides in each total cycle period a short duration of electrical impulse and a long period of interval, the switch actuator being a cam with a long and a short dwell and an interconnecting slant wherein the switch reversals occur during cam oscillations acting upon the follower or switch trigger; and means for adjusting the impulse duration. comprising means for loosening the cam upon the carriage shaft and resetting it in a position wherein the follower at its furthest point of travel comes to a selected point on the shorter dwell.

15. A timer as in claim 5 and wherein the operative movements are caused by the motor power acting through the rotor and by a system of springs charged directly or indirectly from the drive of the rotor; such drive being able to overpower the reset spring plus the control arm spring and the trip spring; the reset spring able to overpower the latch spring; and the control arm spring able to overpower the clutch spring.

16. A timer as in claim 9 and wherein is a frame with post-connected bottom and top walls, the rotor and disk carriage being mounted between the walls supported on the bottom wall; the fixed stop being depending from a stop-plate concentrically rotatable at the underside of the top wall to adjust the angular location of the stop, with accessible clamp-means to set the adjustment of the plate and stop; a vertical shaft carrying the stop-plate below the top wall and extending through the wall and carrying an index above the wall whereby to rotate the plate and adjust the stop; a dial atop the top wall around which the adjusting index plays and readily interchangeable according to the uses of the timer; the motor and switch being mounted below the bottom wall for ready assemblage or interchange; and the carriage having its oscillatory shaft extending below the bottom wall and there provided with clamp means for interchangeably (and adjustably) attaching the switch actuator or cam to the shaft.

17. In an electrical impulse timer, a frame, an oscillatory carriage having alternate slow advancing rotation and immediate quick return rotation through an angle which is adjustable to determine the cycle period of the timer, a clutch to cause in each cycle the slow carriage advance from the motor, and a spring acting on the carriage to cause the quick return thereof when unclutched; a shiftable clutch-operating shipper or arm carried by the carriage; cooperating means on the frame and carriage to cause the opening shift of said shipper and thereby the opening of the clutch whereby to terminate each slow rotary advance of the carriage at a predetermined point, and cooperating means on the frame and carriage to cause the closing shift of said shipper and thereby the closing of the clutch at a predetermined point in each spring-impelled quick return of the carriage; and means operable by the carriage oscillations adapted to actuate a device or electrical switch automatically in a predetermined manner through cycle after cycle.

18. In a repeating cyclical electrical impulse timer, a frame, an oscillatory carriage having alternate slow advancing rotation and immediate quick return rotation through a predetermined angle which is less than 360 degrees, an electrical drive motor operable at constant speed, a clutch to cause in each cycle the slow carriage advance from the motor when the clutch is closed, and a spring acting on the carriage to cause the instant return thereof when the clutch is opened; a shiftable clutch operating shipper carried by the carriage, cooperating means on the frame and carriage to cause the shift of said shipper to its position for opening the clutch and terminating each slow rotary advance of the carriage at a predetermined point, and cooperating means on the frame and carriage to cause the shift of said shipper to its position for closing the clutch at a predetermined point in each spring-impelled quick return of the carriage thereby to repeat the slow rotary advance of the carriage; whereby the carriage slow and fast oscillations are adapted to actuate any means or device automatically in a predetermined manner through cycle after cycle.

19. The timer as in claim 18 and wherein the means to shift the shipper to opening position to

to unclutch the carriage comprises, a projecting control arm swingable on the carriage and resiliently displaceable from a stopped home position, and an arrester mounted on the frame in position to block said control arm and thereby displace it on the carriage, with trip means by which the arrester thereupon releases the control arm, and with a connection from the control arm to the shipper and operated by the displacement of the arm to shift the shipper to its clutch-opening position.

20. The timer as in claim 18 and wherein the means to shift the shipper to opening position to unclutch the carriage comprises, a projecting control arm swingable on the carriage and resiliently displaceable from a stopped home position, and an arrester mounted on the frame in position to block said control arm and thereby displace it on the carriage, with trip means by which the arrester thereupon releases the control arm, and with a connection from the control arm to the shipper and operated by the displacement of the arm to shift the shipper to its clutch-opening position; with a latch operable first to latch the shipper in clutch-open position, and later to unlatch and release the shipper for clutch closing, the clutch having resilient means to close it; the means causing the shift of the shipper to closing position acting through said latch to unlatch and release the shipper for the resilient shift thereof to closing position.

21. The timer as in claim 18 and wherein the means causing the shift of the shipper to closing position for reclutching and driving advancingly the carriage comprises, a projecting control member swingable on the carriage and resiliently displaceable from a stopped home position, and a stop mounted on the frame in position to block said control member and thereby displace it, and a connection including a

latch from the control member to the shipper and operated by the displacement of the member to cause the shifting of the shipper to its clutch-closing position.

22. The timer as in claim 18 and wherein the means causing the shift of the shipper to closing position for reclutching and driving advancingly the carriage comprises, a projecting control member swingable on the carriage and resiliently displaceable from a stopped home position, and a stop mounted on the frame in position to block said control member and thereby displace it, and a connection including a latch from the control member to the shipper and operated by the displacement of the member to cause the shifting of the shipper to its clutch-closing position; and wherein the means to shift the shipper to opening position to unclutch the carriage comprises, a projecting control arm swingable on the carriage and resiliently displaceable from a stopped home position, and an arrester mounted on the frame in position to block said control arm and thereby displace it on the carriage, with trip means by which the arrester thereupon releases the control arm, and with a connection from the control arm to the shipper and operated by the displacement of the arm to shift the shipper to its clutch-opening position.

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