Dec. 23, 1958 E. B. HILDUM 2,866,021

CIRCUIT CONTROLLING DEVICE

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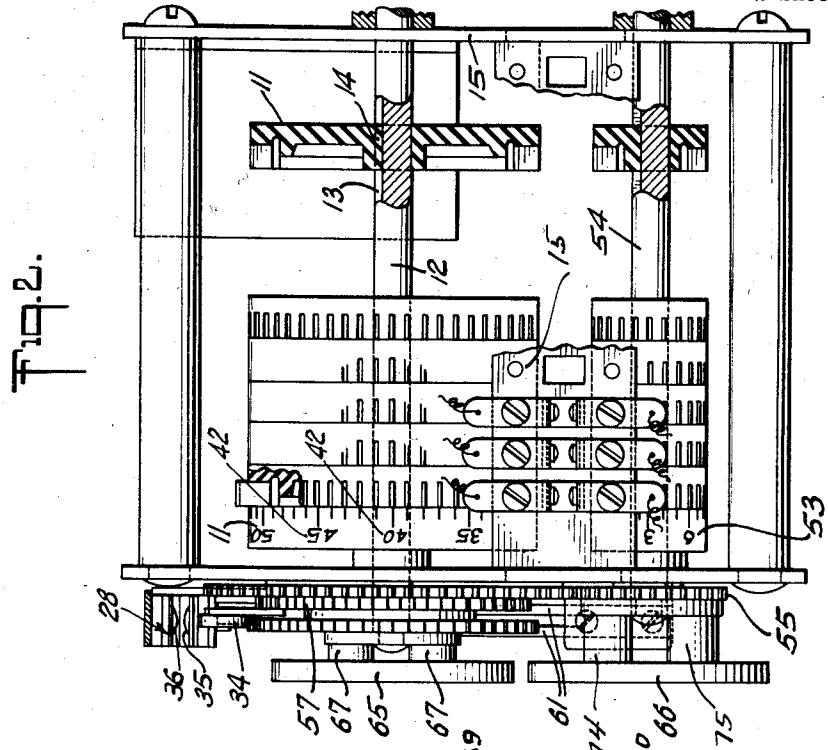


Fig. 2.

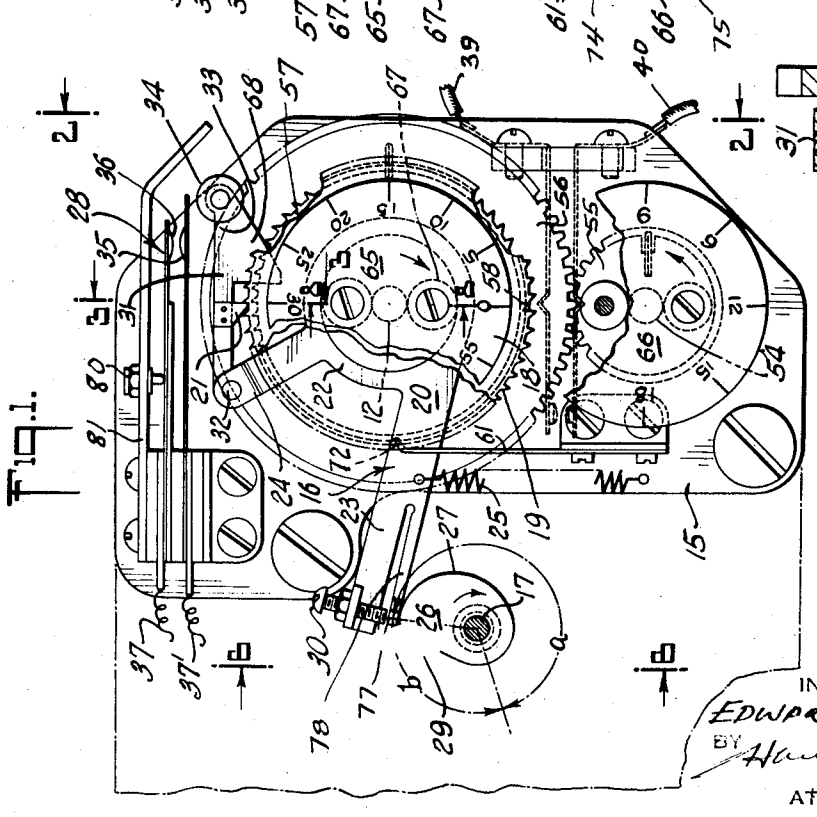


Fig. 1.

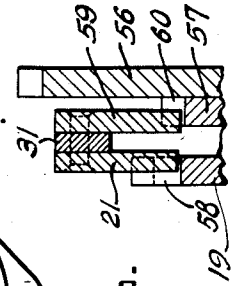


Fig. 3.

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Fig. 4.

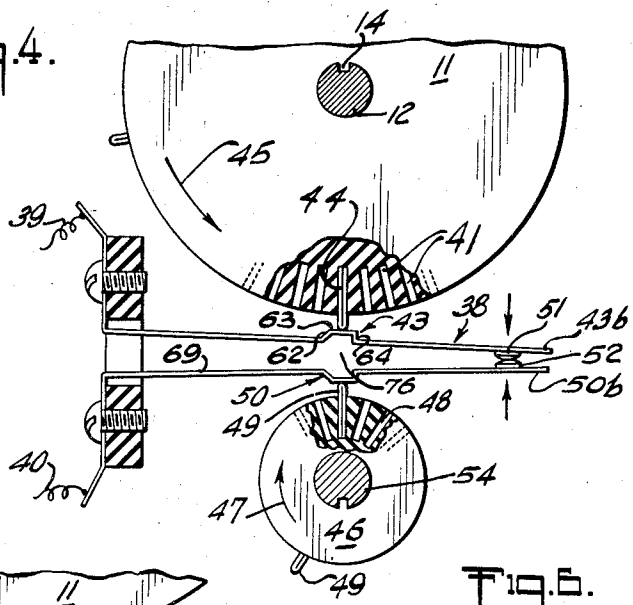


Fig. 5.

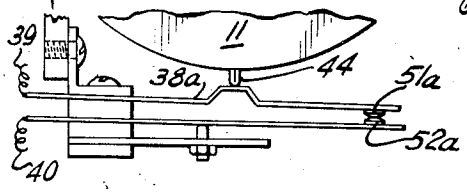


Fig. 6.

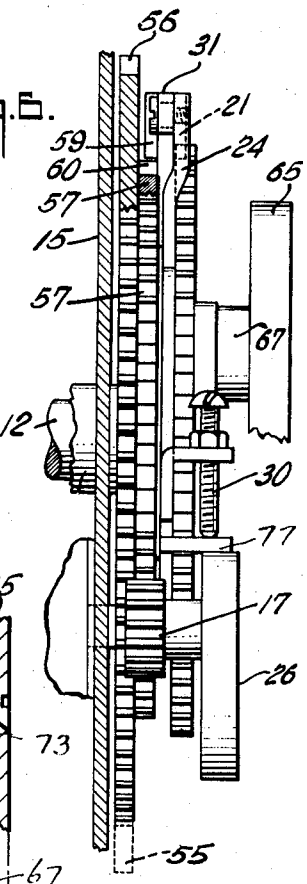


Fig. 7.

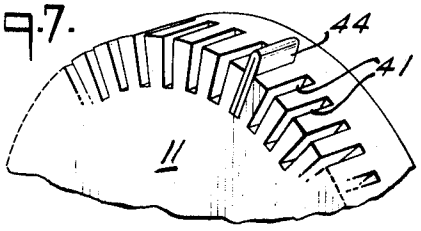


Fig. 8.

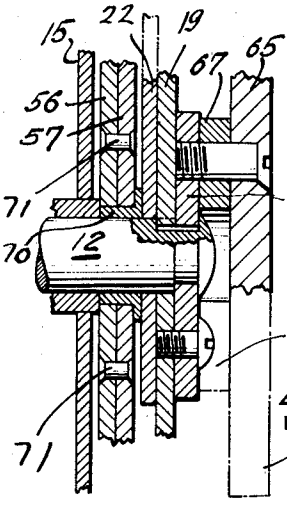
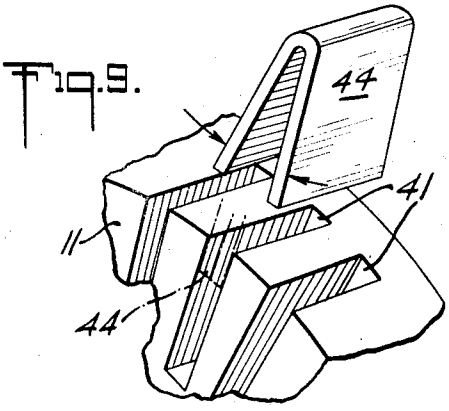


Fig. 9.



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CIRCUIT CONTROLLING DEVICE

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Application July 18, 1957, Serial No. 672,797

8 Claims. (Cl. 200—38)

This invention relates to a device for closing an electric circuit, at a pre-set time, for a pre-set duration cycle. While various devices have been proposed in this art for attaining objectives such as those above and below noted, the present invention provides a novel device for the purpose which is precise, accurate, efficient, reliable, compact and highly durable in operation, and which may be built and operated at a fraction of the cost of conventional devices heretofore used for such purposes. The device of the invention has the further advantage of providing for the simple setting thereof for measurable fractions of repeated time duration cycles for which the electric circuit is to be controlled, and at the predetermined times at which such circuits are to be closed or otherwise controlled. The device is adapted for an infinite variety of uses, including, for example, those wherein a program, such as the ringing of bells is to be controlled, or for opening or closing of relays, solenoids and other electric circuits and equipment, or for other purposes, timed to occur automatically at predetermined times and for predetermined fractions of standard units of duration cycles. Examples of practical devices embodying the invention are described below and in the accompanying drawings; the invention is not limited thereto, but covers all other forms coming within the scope or purview of the disclosure herein.

In the drawings:

Fig. 1 is an elevational, partly fragmentary view of a device embodying the invention,

Fig. 2 is an end elevational view thereof, taken on line 2—2 of Fig. 1,

Fig. 3 is a fragmentary, enlarged, sectional view of parts of the device, taken on line 3—3 of Fig. 1,

Fig. 4 is a fragmentary, sectional, elevational view of drums and a switch to be actuated on the coincidental registration of time-set members projecting from the drums, as below more particularly described,

Fig. 5 is a similar view, showing the use of a single drum for the purpose,

Fig. 6 is a fragmentary, enlarged, elevational view taken on line 6—6 of Fig. 1,

Fig. 7 is a fragmentary, perspective view of drum 11,

Fig. 8 is a view similar to Fig. 6, but with parts broken away to show details, and

Fig. 9 is a fragmentary, enlarged exploded view of drum 11 and time-setting member 44 to be positioned in the selected time slot 41 therein.

Devices made pursuant to the invention may be connected to relays, circuits, or other equipment to be controlled thereby, automatically controlling said equipment or circuit at predetermined times and for predetermined duration cycles. Such devices embodying the invention may comprise a drum or series of drums 11 (Figs. 2 and 4) suitably journaled in a casing 15, as, for example (Fig. 2), by keying them to a shaft 12 rotatable in said casing, said shaft having a keyway 13 with which a key 14 formed on or positioned in the hub of the drum engages. Means, presently described and broadly designated at 16 (Fig. 1, illustrating one of a number of such means which may be used) are provided, moving in a

given path, for serially rotating said drum (or series of drums) through consecutive arcs of rotation. Such means 16 may be constantly driven from a power source, such as pinion 17, which may be part of or driven by a clock mechanism or the like.

Thus, the means 16 will rotate the drum 11 for consecutive arcs representing standard units of time. For example, the means 16 may be such as to move the drum 11 for consecutive one-minute arcs. To that end, the shaft 12, to which the drum 11 is keyed, may have also keyed thereto a ratchet disc 19 (Figs. 8 and 1). Means intermediate pinion 17 and the ratchet disc 19 rotate the latter for the desired fractions of the time unit arcs; such means may be of any desired form, as for example, a link 20 having a pawl 21 for engagement with the ratchet teeth 19. The link 20 is suitably journaled in the casing 15, as, for example, by providing the link with a hub portion 22 (Figs. 1 and 8) freely journaled on the shaft 12. The link is provided with a pair of radial, spaced arms 23, 24 (Fig. 1) and means, such as a spring 25, may be provided to urge the free end of the arm 23 into contact with a cam 26 keyed to the pinion 17. The cam 26 has surfaces 27, 29 so formed relative to the center of driving pinion 17 to which the cam is keyed that the link 20 will be rotated by the cam against tension of spring 25 for a fraction of the time unit defined by a revolution of the pinion 17, so that the pawl 21 of the arm or lever 31 of said link (pivotally connected to link 20 as at 32) will engage a tooth of ratchet 19 and rotate the latter (in a clockwise direction, viewing the parts as shown in Fig. 1). Then the arm 31 of link 20 will be returned to its initial position responsive to the spring 25; on the return stroke, the pawl 21 will ride up and over the tooth of the ratchet 19. This elevation of the pawl 21 and arm 31 of link 20 will move the end 34 of the arm 31 (which may have a roller for smoother operation) into the path of switch 28, closing said switch. Thus, for that fraction of the time unit spelled out by a complete revolution of the pinion 17, so predetermined by the cam surfaces 27, 29, the ratchet 19 will be rotated and the switch 28 closed. This operation is performed in accurate, repeated cycles, as the pinion 17 rotates continuously responsive to a clock movement or other power source. The switch 28 will be closed for just that fraction of time—such as a fraction of a minute, defined by one revolution of pinion 17, as is determined by the formation of cam surfaces 27, 29. Such duration cycle may further be controlled by adjusting the screw 80 in bracket 81 against the switch arm which carries the contact 36. It is thus possible, by use of the invention, to attain accurate time control of very small segments of time units, for actuating electrical apparatus for such precisely predetermined time duration cycles. When the switch is so pressed and closed, its contacts 35, 36 are closed, completing the circuit through leads or wires 37, 37' for the thus predetermined duration cycle.

Equipment to be controlled by the device, may be actuated at a time predetermined by a second switch (38, Fig. 4) having leads 39, 40 connected to first switch 28, the switches 28, 38 being connected in series between the power source and the equipment to be controlled. Thus, when the second switch 38 is closed at the desired predetermined time, the closing of first switch 28 will close the circuit to be controlled for the time duration of closing of first switch 28. Closing of switch 28 at all other times (when the second switch 38 is open) would have no effect on the equipment to be controlled. As above noted, the (roller 34) end of arm 31 of link 20 is elevated in riding up and over the tooth of the ratchet 19 on the return stroke of the link, and such elevation of the end of the arm 31 of link 20 occurs during engagement of the link

with surface 29 of cam 26. Thus the switch 28 will be closed (or opened depending on the nature of the switch) when said switch is engaged by the end 34 which is elevated for the aforementioned fraction of the return stroke of the link 20. By contouring link 20 and by the adjustment of the relative juxtaposition of end 77 of link 20 on cam 26, the fractional interval of engagement of the link with the switch may be controlled, enabling a very fine control of duration cycles for opening or closing the switch 28. Since there is continuous rotation of the cam 26, the second surface 29 of the cam 26 next engages the link 20, so that said link is then held out of contact with switch 28, which then opens. As above mentioned, the link 20 has a pawl 21 which is moved during each cycle of such movement of link 20 to rotate ratchet 19 one unit of time, for example, ratchet 19 being keyed to shaft 12 (Fig. 8) of drum 11. The drum 11 (Figs. 7 and 9) is provided with a plurality of slots 41 extending inwardly of the periphery thereof and with time markings 42 (Fig. 2) thereon, registered with the slots 41 to indicate the time values of such slots. Thus, for example, if the drum 11 is to be rotated once in every hour, the markings 42 may be for minute or other segments of an hour.

The second switch 38 (Fig. 4) or a protuberance 43 formed thereon, may be engaged by a member 44 positioned in the desired minute slot 41 of drum 11 by the user (Fig. 9) and projecting from the slot so that when the drum 11 is rotated (as in the direction of arrow 45, Fig. 4) by the means 16 the member 44 will register with the time station 76 (Fig. 4) at that minute of the hour so predetermined, and member 44 will then engage switch 38 and actuate the latter.

The said second switch may be in the form 38*a* shown in Fig. 5 so that it would be closed by such engagement of the projecting member 44 of the drum 11 to complete the circuit through the lead wires 39, 40 of said switch. By connecting the lead wires 39, 40 of specific drums 11 to different apparatus to be controlled, one device embodying the invention may control times of operation of a number of different pieces of equipment.

A second drum 46 may be provided (Fig. 4) rotated in a direction such as indicated by arrow 47, and provided with slots 48 in which the projecting members 49 may be positioned (corresponding with the slots 41 of the drum 11 in which the members 44 are positioned). The projecting members 49 of the second drum 46 may actuate a second arm 69 of said switch 38 (Fig. 4) or a protuberance 50 of said second arm 69. Said protuberances 43, 50 might be provided on the spring arms of the switch 38 carrying the contacts 51, 52 so that the switch would be closed (in an arrangement of two drums as in Fig. 4) only when both arms or protuberances 43, 50 of the switch are engaged by the projecting members 44 and 49 of said drums.

The second drum 46 may be rotated at a predetermined ratio to the cycles of rotation of the first drum 11 to provide a relative time value or ratio for the second drum (such as 24 hours) and the slots 48 thereof; markings 53 (Fig. 2) on second drum 46 might mark hourly divisions of said second drum. Thus, for example, the second drum 46 might be rotated one twenty-fourth of a revolution or 15 degrees at the end of or for each revolution of first drum 11.

By the arrangement described, the device may be used for closing (or opening by designing the switches to be pressure opened and normally closed) a circuit to be controlled at a given hour and at a given time past the hour, as for example, at (Fig. 4) that moment of the day, such as 1:15, 1:30, 1:40 a. m. or p. m., etc. when the projections 44, 49 of the drums are registered with time location or station 76. Any suitable means may be used for driving second drum shaft 54 such as ratchet 57 (Fig. 1) of smaller diameter than ratchet 19 keyed as at 71, Fig. 8, to a larger gear 56. Said ratchet and gear 57, 56 are freely journaled on the collar 70 on shaft 12 (Figs. 6 and 8). A pinion 55 (Fig. 1) is keyed to shaft 54 to which the second drum 46 is keyed. Means are provided to intermittently rotate smaller ratchet 57 to thus (through gears 56 and 55) rotate the second drum 46. Ratchet 19 may have one tooth 58 (Figs. 1 and 3) therein deeper than the others, and the lever 31 of link 20 may have fixed thereto a second pawl (inner pawl 59, Figs. 3 and 6) for meshing engagement with the tooth 60 of the ratchet 57 when pawl 21 engages deep tooth 58 of ratchet 19. The second pawl 59 then drops far enough to engage the tooth 60 of ratchet 57, link 16 thus rotating the keyed gears 57 and 56 in unison (Fig. 8) and thus rotating pinion 55 of the second drum 46.

By provision of additional drums as desired (Fig. 2), other time settings and combinations may be effected. Thus a very large order of numbers of minute-hour combinations may be arranged in a simple and convenient manner, using only one device of the invention and setting it rapidly and simply, without requiring any special or technical skill or tools on the part of the user.

Means may be provided to preclude free movement of the drums, such as (Fig. 1) a spring member 61 secured at one end to the casing and having free ends 72 engaging ratchets 19 and 59.

The projecting members 44, 49, positioned in the slots 41, 48 may (Fig. 9) be of V-shaped cross section and made of spring material so that the ends of the projecting members may be compressed for insertion into the slots 41 for expansion therein, holding said projecting members firmly in place.

The protuberances 43, 50 of the switch 38 preferably extend beyond the plane of the switch proper (Fig. 4) and have a first surface (62 of 43) angularly inclined in the direction of rotation of the drum, so that as the member 44 engages said protuberance it will smoothly depress the spring finger of the switch. The protuberance 43 has a second surface 63 disposed at substantially right angles to the axial plane of the projecting member 44 when it is contacted by said member (Fig. 4) and a third surface 64 connecting the second surface with the switch proper, at substantially right angles to the second surface, so that the member 44, when moved past the second surface 63, will drop past said surface 64 and there will be no residual inertial further frictional contact of the parts such as might urge the drum to continue rotating beyond the protuberance 43.

The drums 11, 46, may (Fig. 1) have display and setting knobs 65, 66 keyed to their shafts (as by keying knob 65 to the ratchet 19) by means 67, 73, said ratchet 19 being in turn keyed to drum shaft 12, and securing knob 66 to pinion 55 by similar means 74, 75 (Fig. 2), pinion 55 being in turn keyed to the drum shaft 54. The knobs 65, 66 enable setting of the drums manually, if desired, as, for example, to the initial true time (which should be read at point 76) or to correct the time reading of the drums at point 76 in case of failure of the power source or for any other reason. Said knobs 65, 66 may have time markings thereon (Fig. 1) coinciding with the time markings 42, 53 of drums 11, 46.

Means may be provided for aligning the link means 20 with the ratchet 19 as, for example, by providing an enlarged nosing 68 on lever 31 to be freely received (Fig. 2) in the space between ratchet 19 and the smaller ratchet 57.

By use of the device of the invention, it is possible, for example, to close a circuit for that given minute as shown in Fig. 4, at which the projecting members 44, 49 of the pair of drums are juxtaposed at opposite sides of the switch 38 in registry with the time station 76, and to close the circuit for such fraction of the time for which switch 38 is closed as is determined by the contour of the cam 26 and the pin 30. Thus, by use of the invention, a highly controlled timing device of superior operation and

results is attained. The user may readily substitute cams with portions **27**, **29** of different contours for closing switch **28** and thus the circuit, for different fractions of the minute, or other time unit for which the switch **38** has been closed. It is possible to adjust the travel of pawl **21** with respect to the teeth of ratchets **19** and **57** by adjustment of stop pin **30** of link **20**. To that end, the stop pin **30** may bear against flanged end **77** of split segment **78** of the arm **23** of link **20**. The flanged end **77** of link **20** contacts the cam so that adjustment of the pin **30** against said flanged end **77** will adjust the location of the latter (end **77**) and thus the position of link **20** on cam **26**, adjusting the position of pawl **21** with respect to the ratchet teeth.

The drawings illustrate typical forms of switches **28**, **38** useful in carrying out the invention; the invention is not limited thereto and includes any other form of switch suitable for the purpose, whether actuated by pressure or other means, such as photo-electric switches, which would be actuated by interruption of their light beams by the members projecting from the drums **11**, **46**. The projecting members **44**, **49** may be secured to the drums by means other than slots.

I claim:

1. In a device for controlling an electric circuit for a predetermined fraction of a predetermined unit of time, a switch in said circuit juxtaposed for actuation when contacted at a given point thereof to control said circuit for that predetermined fraction of a unit of time for which said switch is so contacted and actuated, means to so contact said switch comprising a cam rotated for consecutive units of time corresponding with the revolutions of the cam, and an actuator in said device engaging said cam and moved thereby during a fraction of each revolution of the cam into contact with said given point of said switch to actuate said switch for said fraction of said unit of time so predetermined by the cam surface of said cam, and means in series with said first switch engaged by said actuator, to control said circuit for a predetermined one of said consecutive units of time, and for such fraction thereof as is so predetermined by said cam surface of the cam.

2. In a device as set forth in claim 1 for controlling an electric circuit for a predetermined fraction of a predetermined unit of time, said actuator comprising a link journalled in said device and having an arm so engaging said cam and having a second arm moved into contact with said given point of switch whereby said actuator is so moved by said cam into said contact with said given point of said switch.

3. In a device as set forth in claim 1 for controlling an electric circuit for a predetermined fraction of a predetermined unit of time, a roller on said actuator engaging the switch when said actuator is so moved by said cam into contact with said switch.

4. In a device as set forth in claim 1 for controlling an electric circuit for a predetermined fraction of a predetermined unit of time, said actuator including a link journalled in said device and engaging said cam and thereby so moved in one path and then retracing said path by said cam on each rotation of the cam, a lever pivotally connected at one end to said link and moved thereby, a pawl on said lever, said means engaged by said actuator to control said circuit including a ratchet engaged by said pawl and moved thereby for a unit of time during part of each single rotation of the pawl in which the actuator link so engages said cam and is thereby so moved in said path, said pawl riding over said ratchet and being thereby moved into contact with said switch to so actuate the switch.

5. In a device as set forth in claim 2 for controlling an electric circuit for a predetermined fraction of a predetermined unit of time, adjustable means on said arm so engaging said cam.

6. In a device for controlling an electric circuit for a predetermined fraction of a predetermined unit of time, a switch in said circuit juxtaposed for actuation when contacted to control said circuit for that predetermined fraction of a unit of time for which said switch is so contacted and actuated, means to so contact said switch comprising a cam rotated for consecutive units of time corresponding with the revolutions of the cam, and an actuator in said device engaging said cam during a fraction of each revolution of the cam and moved thereby into contact with said switch to actuate said switch for said fraction of said unit of time so predetermined by the cam surface of said cam, and means in series with said first switch engaged by said actuator, to control said circuit for a predetermined one of said consecutive units of time, and for such fraction thereof as is so predetermined by said cam surface of the cam.

7. In a device for closing an electric circuit for a predetermined fraction of a predetermined time unit, a switch in said circuit juxtaposed for actuation when contacted to control said circuit for the predetermined fraction of the time unit for which said switch is so contacted and actuated, means to so contact said switch, comprising a cam rotated for consecutive units of time and an actuator engaged by the cam and adapted to contact said switch to actuate the same, a drum journalled in said device and provided with a plurality of slots extending inwardly of the periphery thereof, a member positioned in one of said drum slots and projecting therefrom, a second electric switch, a second drum journalled in said device and provided with a plurality of slots extending inwardly of the periphery thereof, means to rotate said second drum, a member positioned in one of said second drum slots and projecting therefrom, said second electric switch being positioned in said device in the path of movement of said members projecting from the drums, so as to be actuated only on the concurrent registration of said members, with the second switch, so that on connecting said switches to a circuit, said circuit will be closed at the predetermined time at which the second switch is so actuated by the projecting members, for the predetermined duration cycle for which the first switch is so actuated.

8. A device for actuating an electric circuit at a preselected time consisting of a major time unit and a preselected fractional division of said major time unit, said device comprising a pair of switch elements adapted to be actuated when contacted and a pair of drums rotatably juxtaposed adjacent and at opposite sides of said switch elements, said drums having a plurality of slots disposed radially inwardly of the circumferences thereof, and members for insertion in preselected slots of the first and second drums to project therefrom for actuating contact with the switch, means for rotating the first drum at a predetermined constant speed so that one revolution thereof will mark the passing of a predetermined major time unit and for rotating the second drum in synchronism with the first drum at a multiple of the speed of rotation of the first drum, to mark the passing of fractional divisions of the major time unit, so that the switch will be actuated when, on rotation of said drums, said projecting members will simultaneously contact the switch elements and thereby actuate the switch.

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