April 3, 1962 R. D. SMITH 3,028,456

BACKSETTABLE ROTARY TIME SWITCH

Filed March 6, 1959 3 Sheets-Sheet 1

Fig. 3

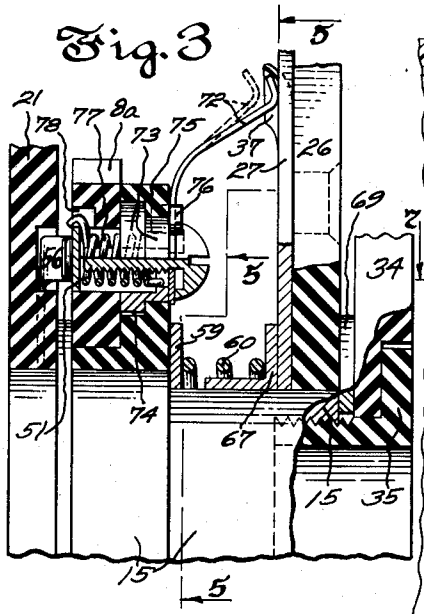
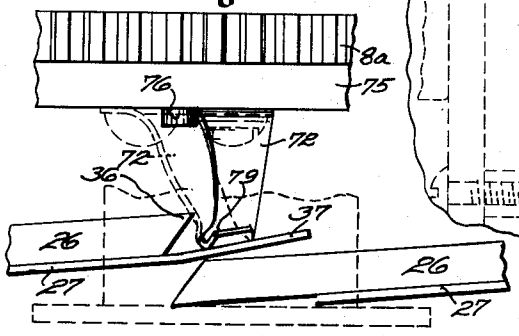


Fig. 4



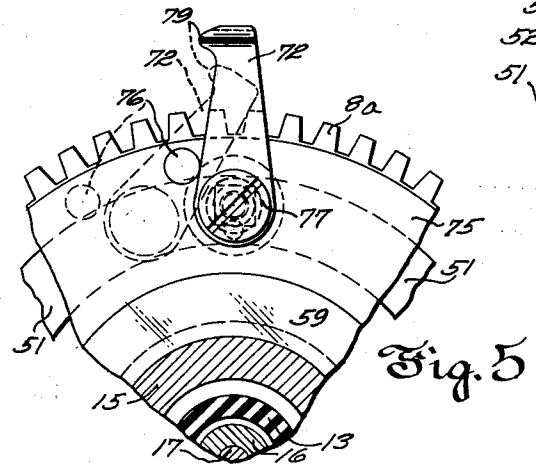


Fig. 5

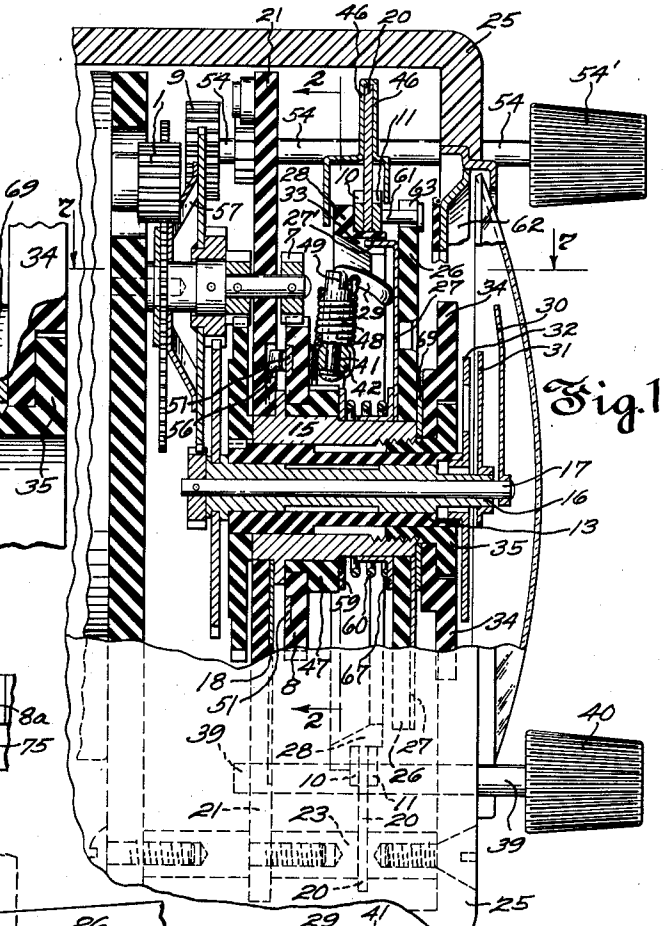


Fig. 1

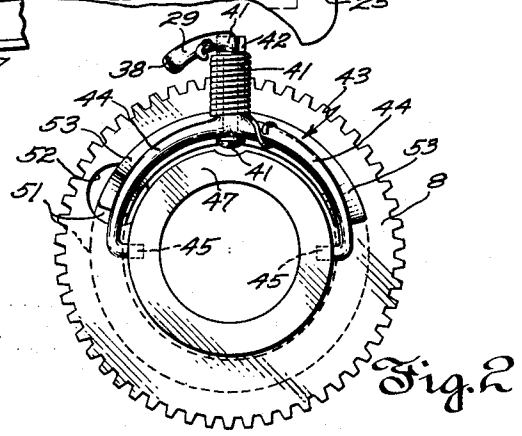


Fig. 2

INVENTOR

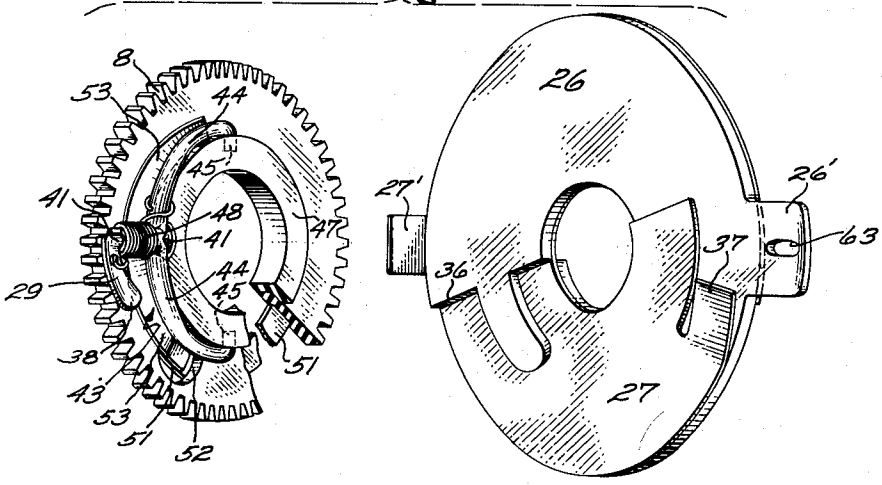
Raymond D. Smith

April 3, 1962 R. D. SMITH 3,028,456

BACKSETTABLE ROTARY TIME SWITCH

Filed March 6, 1959 3 Sheets-Sheet 2

Fig. 6



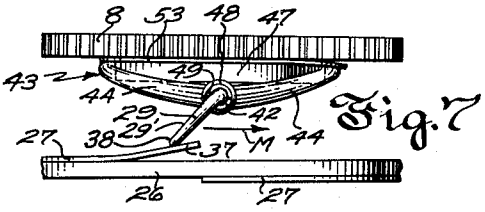


Fig. 7

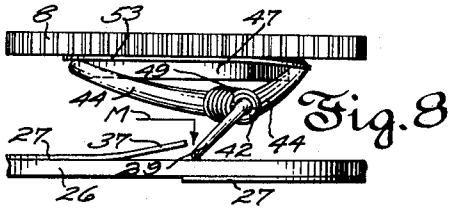


Fig. 8

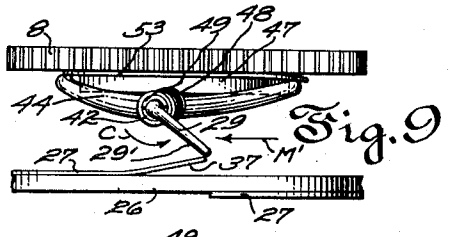


Fig. 9

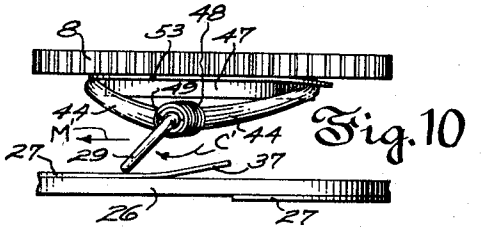


Fig. 10

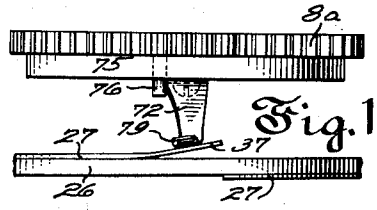


Fig. 11

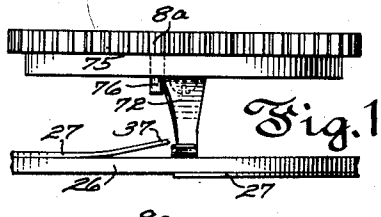


Fig. 12

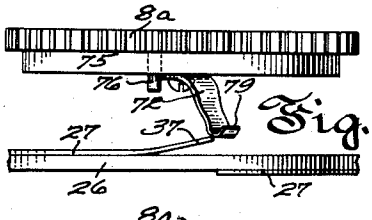


Fig. 13

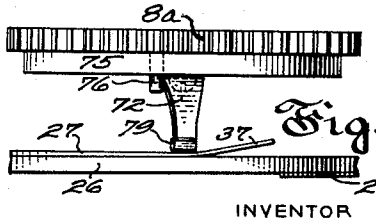


Fig. 14

INVENTOR

Raymond D. Smith

April 3, 1962 R. D. SMITH 3,028,456

BACKSETTABLE ROTARY TIME SWITCH

Filed March 6, 1959 3 Sheets-Sheet 3

Fig. 16

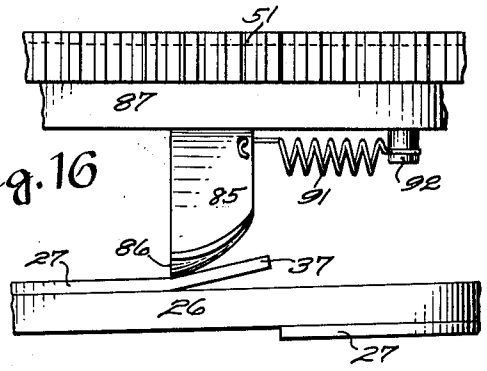
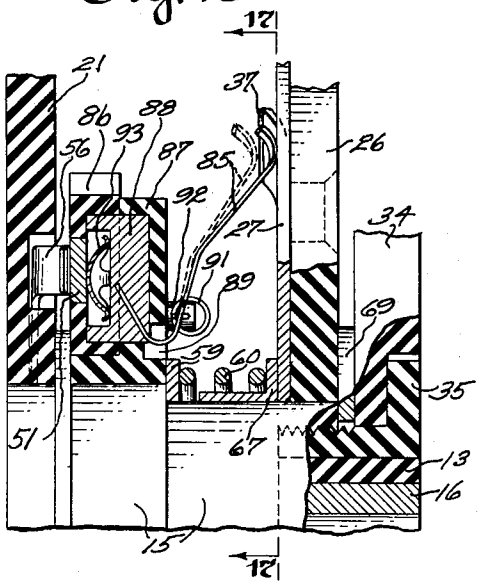


Fig. 15



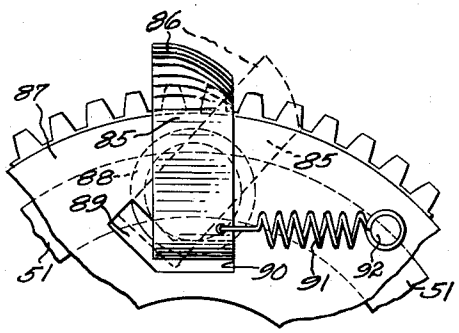


Fig. 17

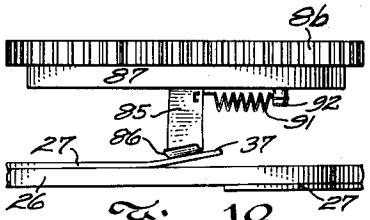


Fig. 18

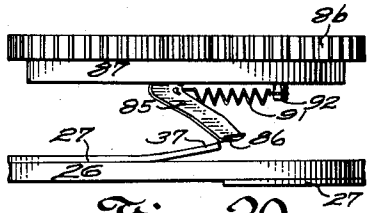


Fig. 20

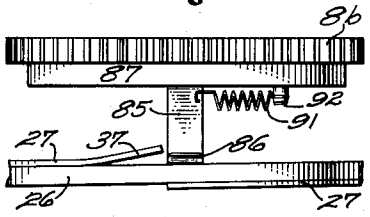


Fig. 19

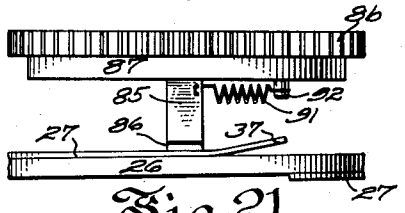


Fig. 21

INVENTOR

Raymond D. Smith

United States Patent Office 3,028,456 Patented Apr. 3, 1962

3,028,456

BACKSETTABLE ROTARY TIME SWITCH

Raymond D. Smith, 37 Ridgeway Road, Easton, Conn.

Filed Mar. 6, 1959, Ser. No. 797,724
18 Claims. (Cl. 200—36)

This invention relates to a type of electric circuit controlling switch in which a circuit making and breaking contact wipes over a conductive switch track and snaps over the abrupt shoulder of a ratchet step in such track to control a load circuit of which the conductive surface of the ratchet step is a terminal. The ratchet step may form a component section of a completely circuitous conductive track and be shiftable in position along the circuitous extent of such track. If the track is annular the wiping contact sweeps therealong in a circular course in some cases impelled by clockwork to revolve at an extremely slow linear speed as for instance to complete one revolution in twenty-four hours. Such kind of time switch is disclosed in my U.S. Patent, Reissue No. 23,783, wherein at a predetermined time in the extremely slow travel of the wiping contact the latter snaps off from the abrupt terminal shoulders of successive ratchet steps both in the circuit making and circuit breaking action of the contact. The step shoulders are shiftable at will along the circuitous switch track to various stations in the circular course of travel of the contact for predetermining the set times at which making and/or circuit breaking of the load circuit will automatically take place.

Heretofore a wiping switch contact in this kind of time switch has required restriction to unidirectional advancing travel because of inability of the contact to pass the drop-off shoulder of the ratchet step in a retrogressive direction after it has passed thereover. This principle of mechanical reaction is the same as characterizes a ratchet wheel and its driving pawl which latter may be compared to the traveling contact and the former compared to the stepped switch track. Conversely the adjustive manual shifting of the drop-off shoulders along the switch track has been restricted to time setting movement in only a single direction, namely that opposite to the clock impelled travel of the wiping contact. As a consequence, error of excess movement of the drop-off shoulder past its intended time setting placement has been correctable only by continuing the setting movement of the drop-off shoulder in the direction of its excess movement all the way around the circular course of the switch track until it again reaches the time position at which it was originally intended to be stationed. An uniformed operator is confused by this limitation to unidirectional turning of the time setting controls and is apt to force or damage delicate mechanism in attempting to correct erroneous time settings. At the best the condition is inconvenient, even for expert users.

An object of the present invention is to enable all time setting in the kind of switch concerned to be effected by control knobs and switch parts moved thereby that are free to be turned to an unlimited extent and repeatedly in either of opposite rotary directions.

A contributary object is to enable a track wiping electric switch contact to be restored onto the inclined surface of the ratchet step of a switch track after dropping off with a snap action from the terminal of such inclined surface at the shoulder of the step, whereby the wiping contact is enabled to retrogress past the snap action producing step shoulder in backward direction of relative movement therebetween.

A further object is to incorporate a sectionally adjustable, stepped switch track and track wiping contact having this new ability of backward cooperative circuit controlling movement in a time switch of the type disclosed in my aforesaid U.S. reissue patent wherein the feature may be appropriately referred to as "back setting."

These and other objects of the invention will appear in greater particular from the following description of preferred embodiments of the improvements having reference to the appended drawings wherein:

FIG. 1 shows in section on a central vertical plane the mechanism of a time switch similar to that disclosed in my copending application Serial No. 564,905, filed February 13, 1956, now U.S. Patent No. 2,981,807 and having the present improvements incorporated therein.

FIG. 2 shows a detail of the improved wiping contact and its carrying gear as viewed from the plane **2—2** in FIG. 1, looking in the direction of the arrows.

FIG. 3 is a fragmentary view of the time switch mechanism of FIG. 1 on an enlarged scale showing a modified form of the improved wiping contact.

FIG. 4 is a plan view looking down on FIG. 3.

FIG. 5 is a view taken in section on the planes **5—5—5** in FIG. 3 showing normal and yielded positions of the wiping contact.

FIG. 6 is an exploded perspective view of the wiping contact and settable sections of the ratchet stepped switch track that are traversed thereby in the construction of FIG. 1.

FIG. 7 is a plan view of the ratchet stepped switch track of FIG. 6 showing the track wiping contact slowly advancing therealong toward the drop-off shoulder of the ratchet step in the direction of the arrow M.

FIG. 8 shows the wiper contact having just passed the drop-off shoulder to break the load circuit with a snap action.

FIG. 9 shows the yieldable swinging of the wiper contact in the direction of arrow C which enables it to be dragged back over or around the drop-off shoulder onto the ratchet step in a reverse or retrogressive direction of travel designated by arrow M'.

In FIG. 10 continued retrogressive travel of the wiping contact in the direction of arrow M' has enabled it to resume its original direction of slant in relation to the switch track by swinging in the direction of arrow C'.

FIGS. 11 to 14 inclusive shown the yielding performance of the modified wiping contact of FIGS. 3, 4 and 5 which permits backsetting thereof in stages of action comparing respectively with FIGS. 7–10.

FIG. 15 is a view showing a modified form of the pivotal mounting for the wiping contact of FIG. 3.

FIG. 16 is a fragmentary plan view looking down on FIG. 15.

FIG. 17 is a fragmentary elevation looking at the wiping contact from the plane **17—17** in FIG. 15.

FIGS. 18–21 inclusive show the yielding performance of the wiping contact of FIGS. 15, 16 and 17 in stages of action comparing respectively with FIGS. 11–14.

Since the main operating parts of the clock and the time switch mechanism presently used to illustrate the invention are similar to those of the time switch disclosed in my aforesaid copending patent application and in my U.S. Patent No. Re. 23,783, the parts of the present time switch corresponding therewith need be described only briefly.

The framework includes a front frame plate **20** having a large circular aperture in which is journaled a bearing ring **28** of insulating material projecting somewhat both forward of and at the rear of plate **20** so as to carry at respectively opposite sides of the latter coaxially rotatable ring gears **10** and **11**. These gears are alike except that gear **10** is fast to ring **28** while gear **11** can rotate relatively thereto. By means of an internal keyway **33** in ring **28** that is receptive to a rearwardly bent ear **27'** on a white indicator disc **27**, the turning of ring gear **10**

adjusts disc 27 and stations the disc in selective rotary positions. By means of a pin 61 projecting forward from ring gear 11 which engages a hole 63 in a radial extension 26' of a red indicator disc 26, the turning of ring gear 11 adjusts disc 26, both in absolute position on the circle, and relatively to disc 27 if disc 27 remains stationary. The discs 26 and 27 are radially split and helically interleaved with each other as clearly seen in FIG. 6 and explained in full detail in my U.S. Reissue Patent No. Re. 23,783. Thus each of discs 26 and 27 can can be stationed independently of the other in selective rotary positions about a hollow stationary main bearing post 15 which supports both of the discs and is fixedly mounted in an aperture in an intermediate frame plate 21 of insulative material. Frame plates 20 and 21 are connected in spaced rigid relation by spacer posts 23. Bearing post 15 at its front end supports a clock dial 34 graduated to tell time of day as shown in my aforesaid copending patent application.

Ring gear 10 is turned by means of a meshing pinion (not shown) on a spindle 39 journalled in plates 20 and 21 and turned in either rotary direction by a handle knob 40 accessible outside of housing 25. Gear 11 is turned by a separate meshing pinion (not shown) on a spindle parallel with but spaced from spindle 39 and separately turnable by a handle knob (not shown) like knob 40 also accessible outside of housing 25. Guard flanges assist in maintaining ring gears 10 and 11 close to intermediate frame plate 21, two such flanges comprising depending portions of a clip-like retainer 46 that straddles the top edge of plate 20 and is fixed thereto. The rear face of white disc 27 is one component of a track surface that has at least an annular portion that is continuously conductive about the circle while the rear face of red disc 26 is another component of the track surface is continuously insulative about the circle at the same radius of circular curvature as the annular conductive portion of disc 27. Thus there is provided a rearwardly facing continuous circular switch track composed of component arcuate portions of those surfaces of each disc which are exposed by the other disc to wiping contact with an electrically alive tip or edgewise extremity 38 of a clockwork driven, slowly revolving, blade-like contact member 29. Thus the whole circular extent, or any desired arcuate portion, of the whole circular switch track can be made conductive or insulative by the manual setting of each or both of discs 26 and 27 in selective circular relation to each other as well as in selective circular relation to the frame plate 20. Any desired relative arcuate extent of insulative and/or conductive track face can be exposed to the wiping engagement of contact 29.

Clock dial 34 bearing the hour graduations (not shown) is fixedly stationed on post 15 by the head flange of an externally threaded bushing 35 which bushing engages internal threads in the front end of the post. At least the rear surface of clock dial 34 is insulative and serves axially to retain the interleaved signal discs 26 and 27 in their swivelling relation on the bearing post 15. The discs are constantly pressed forward against a conductive washer 69 clamped between the front end of post 15 and clock dial 34. The axial expansion of a spring coil 60 exerts thrust between a conductive washer 59 stationed against the shoulder on post 15 and the flange of an axially slidable conductive sleeve 67 that is constantly thrust forward against the discs 26 and 27 by spring 60. The front colored faces of discs 26 and 27 are constantly visible fully or in part through an annular space about the clock dial 34 between the latter and a stationary mat ring 62.

Clock hands 30, 31 and a signal rotor 32 are turned respectively by their telescopically related spindles 17, 16 and 13, driven by the power pinion 1 of a clock motor through a speed reducing system of transmission gears which for the purpose of explaining the present improvements it is not necessary to describe beyond saying that a particular pinion 7 in such system of transmission gears drives a gear 8 of insulative material which has rotary bearing on and is free to rotate about bearing post 15. The speed at which gear 8 is thus driven is one revolution in twenty-four hours and this likewise is the speed at which signal rotor 32 revolves in the time switch disclosed in my aforesaid copending application, Serial No. 564,905, now U.S. Patent No. 2,981,807. The clock hands 30, 31 and signal rotor 32 can be set manually at correct time of day independently of motor pinion 1 by means of the knob 54' operating through spindle 54 and pinion 9 as permitted by friction slippage at the thrust spring 57 in keeping with customary practice in clock train mechanisms.

The present improvements are mainly centered in the construction of the track wiping contact tongue 29 and its manner of cooperation with the drop-off shoulder or insulative track surface terminal 36 of the red or insulative disc 26 and the drop-off shoulder or conductive track surface terminal 37 of the white or conductive disc 27. As best shown in FIG. 6 contact tongue 29 is in part formed as a flag-like angled extension of its mounting pintle 41 which is journaled for free swiveling movement about a pivotal axis in a rotary carrier comprising the tubular bearing extension 42 of a carrier yoke 43 whose branching arms 44 have their ends pivotally hinged at diametrically opposite, spaced apart points 45 in the hub 47 of carrier gear 8. The face 29' lengthwise the left or trailing side of contact tongue 29 in FIGS. 7 to 10 inclusive is hereinafter termed a camming face for reasons that will later appear. Arms 44 straddle hub 47 and the pintle 41 is headed over at the crotch of these arms to retain the contact tongue 29 in the bearing extension 42 of the yoke. A coiled spring 48 serves as resilient means loosely surrounding extension 42 and is anchored at one end to a yoke arm 44 and at its opposite end to the contact tongue 29 in a manner to bias the latter constantly and yieldably into stationed engagement with an abutment or stop shoulder 49 bordering a cut-away end portion of the tubular yoke extension 42. When so stationed the angular disposition or posture of contact tongue 29 is as shown in FIGS. 7, 8 and 10, relative to the planar course of the switch track in which direction the aforesaid track surface mainly extends. In such posture said camming face 29' on the contact tongue will encounter the drop-off terminal 36 or 37 upon travel of the tongue retrogressively or toward the left in FIGS. 8 and 9 and thereby pilot the tongue extremity smoothly past the drop-off terminal.

Also best shown in FIG. 6 is an annular brass conductive collector ring 51 fixedly sunk in the flat side of insulative gear 8 that is opposite to its hub 47 to come flush with the left face of said gear 8 in FIG. 1. Ring 51 extends past an aperture 52 in gear 8 in which aperture there is mounted, as by soldering, the anchored end of an arcuate helically bowed leaf spring 53 which extends through the aperture and whose free end bears outward or away from gear 8 and presses on arm 44 of yoke 53 in a direction resiliently to urge the wiping contact tongue 29 to be swung with yoke 43 about yoke pivots 45 away from gear 8 toward and constantly against the switch track containing the drop-off shoulders 36 and 37. The pressure of the contact tip 38 against the switch track is positively sustained by the arresting action of stop shoulder 49 on the tubular bearing extension 42 which limits the swing of contact 29 in a clockwise direction to the inclined position shown in FIGS. 7, 8 and 10.

A stationary leaf spring conductive member 56 shown in FIG. 1 is fixed on the insulative frame plate 21 and is constantly in conductive wiping contact with collector ring 51. The electric load circuit to be controlled by the revolving of wiping contact 29 comprises in series relationship the following parts that now have herein been described; member 56, collector ring 51, leaf spring 53, yoke arm 44, tubular bearing 42, pintle 41 and/or coil spring 48, wiping contact 29, disc 27, washer 69 and/or

slide sleeve 67, post 15, and terminal strap 18. Binding posts (not shown) provide for connection of two line wires respectively to member 56 and to terminal strap 18 whereby the time switch shown in FIG. 1 causes making or breaking of the load circuit at a time of day predetermined by the position in releation to the clock face that the drop-off shoulder or track surface terminals 36 or 37 is manually set by handle knob 40 or its herein before mentioned counterpart (not shown).

FIGS. 7 to 10, inclusive, are flow diagrams explaining the action of the wiping contact tongue 29 according to this invention. The running of the clockwork driven by motor pinion 1 impels the gear 8 to rotate clockwise in an advancing direction in FIG. 6 whereby the tip or edgewise extremity 38 of contact 29 resiliently pressed against conductive disc 27 by spring 53 travels very slowly in said advancing direction of travel toward the right in FIG. 7 maintaining the aforesaid load circuit closed until it climbs and mounts component 27 of the switch track surface to the conductive surface terminal at shoulder 37 from which it snaps off abruptly crosswise said advancing direction of travel into its position shown in FIG. 8 and thus causes a quick break of the load circuit by the quick separation or departure of contact tongue extremity 38 from the conductive track surface terminal at shoulder 37. In FIG. 8 the extremity 38 of the contact tongue is now pressed against the switch surface of insulative disc 26 and will continue to be impelled toward the right in said advancing direction of travel by the clockwork until it arrives at the insulative track surface terminal at drop-off shoulder 36 in the switch track. At this point the contact tongue extremity 38 will snap off from insulative shoulder 36 and return into circuit making contact with the conductive surface of disc 27 with a quick snap action like that by which the circuit was broken at the conductive track surface terminal 37.

If, while the wiping contact 29 is virtually standing still because of its extremely slow movement in clock driven direction, attempt should be made to "back set" or adjustively move the track shoulder 37 or 36 toward the left in FIG. 8, as for changing the setting of the shoulder to a different predetermined time for automatic circuit breaking action, the contact tongue extremity 38 would engage, and except for the present improvements would interlock with, the drop-off shoulder 37 and thwart the attempt to back-set the disc 27. This would likewise occur in any similar attempt to back-set the contacts and track affording discs of my aforesaid patents.

In the present improvement, because of the construction of the connections between the contact tongue 29 and its impelling carrier gear 8, the camming face 29' on the left or trailing side of said contact tongue in FIGS. 7 and 8 can shift to the posture of opposite angular inclination shown in FIG. 9 which enables the extremity of the travelling contact tongue to pass shoulder 36 or 37 in a retrogressive direction of travel in passing from its FIG. 8 position to its FIG. 9 position. This shifting in posture or direction of slant is permitted partly by the yielding of coil spring 48 and partly by the yielding of leaf spring 53 as the yoke 43 is caused to swing slightly toward the carrier gear 8. As the extremity 38 of contact tongue 29 reaches the apex of shoulder 37 as shown in FIG. 9 it will escape from said shoulder toward the left and be snapped back to its position shown in FIG. 10 in the direction of arrow C' in FIG. 10 by the tension in coil spring 48 where it is positively arrested in its swinging movement relative to yoke 43 by stop shoulder 49 on the tubular bearing 42 of the yoke member. Hence the snap action of contact 29 is caused by leaf spring 53 in advancing direction of contact tongue travel and is permitted by said leaf spring while caused by coil spring 48 in retrogressive direction of travel. Arrows M and M' show directions of movement of carrier 44 while arrows C and C' indicate directions of resultant swinging action of tongue 29.

The back settable cooperative relationship between contact tongue 29 and conductive terminal 37 of the white disc 27 exists in like manner between the same contact tongue and the insulative shoulder 36 of the red disc 26 whenever the latter shoulder is passed in the aforesaid retrogressive direction by the contact tongue. Such passing in retrogressive direction can occur, not only when the hands of the clock together with gear 8 are turned backward by means of knob 54', but also when either terminal or shoulder 37 or 36 is turned to the right in FIG. 9 by means of knob 40 or its counterpart (not shown) that turns disc 26 as hereinbefore mentioned. Thus the present improvements remove all restrictions that have heretobefore been imposed on direction of turning of knobs 54' and 40 either in setting the hands of the clock to correct time of day or in setting at selective positions the shoulders 36 or 37 to predetermine the times of automatic switch action.

In FIGS. 3, 4, 5 and 11 to 14, inclusive, there is shown a modified and simplified construction wherein in the blade-like wiping contact tongue 72 is a conductive leaf spring swingably mounted on carrier gear 8*a* by means of a shouldered trunnion 73 journaled in a counterbored hole 74 through the gear hub 75. The joinder of hub 75 face-to-face against gear 8*a* partially covers the counterbore of hole 74 so that the flange of trunnion 73 is retained therein and free to rotate clockwise about the pivotal axis of trunnion 73 whereby the contact tongue 72 is free to swing in a clockwise direction in FIG. 5 from its full line position relative to a stop pin abutment 76 fixed in gear hub 74 to a position displaced from said stop pin represented by broken lines in FIG. 5 in which latter position the carrier gear 8*a* with its hub 74 is assumed to have travelled a small distance in a counterclockwise direction. The corresponding positions of contact tongue 72 in relation to shoulder 36 on track disc 26 are shown respectively in full and broken lines in FIG. 4.

One end of a coil spring 77 within a hole 78 through carrier gear 8*a*, forming a continuation of hole 74 through hub 75, resiliently exerts rotary torque on trunnion 73 constantly biasing contact tongue 72 to swing toward and into arrested contact with stop pin 76. The opposite end of spring 77 is anchored to the conductive collector ring 51 embedded in gear 8*a* as in FIGS. 1 and 6 whereby contact 72 is always electrically alive with ring 51 while the latter, as in FIGS. 1 and 6, is maintained constantly connected in the load circuit to be controlled by the time switch by means of the conductive brush 56 stationed on the insulative frame plate 21.

FIGS. 11 to 14, inclusive, more fully illustrate the mode of back settable operation of the wiping contact tongue construction shown in FIGS. 3, 4 and 5 and which accords with the principle of operation of the back settable contact tongue 29 hereinbefore described. For comparison therewith, FIGS. 11 to 14 correspond to successive stages of contact action respectively like those indicated in FIGS. 7 to 10. In FIG. 11 the conductive extremity 79 of contact tongue 72 is traveling in advancing direction toward the right while wipingly pressed against the conductive track surface of disc 27 by the resilience in the spring arm of the contact tongue which normally remains engaged with the pin 76. In FIG. 12 contact tongue extremity 79 has just passed and has been snapped off from the switch surface drop-off terminal 37 onto the insulative switch surface of disc 26 by the automatic action of said resilience because always urged thereby toward the switch surface. Upon the impelling of contact tongue 72 by gear 8*a* in retrogressive direction, or toward the left in FIG. 13, the camming face consisting of the left or trailing edge of the spring arm of the contact tongue nearest the drop-off shoulder 37 cams wipingly against said shoulder at the track surface terminal as the yielding of coil spring 77 (see FIG. 3) permits the swinging of the contact tongue relatively to gear hub 75

about the pivotal axis of trunnion **73** from its full line position to broken line position in FIG. 4. As in FIG. 10, when the contact tongue extremity **79** reaches the apex of shoulder **37** in FIG. 13 it will escape the shoulder and swing counterclockwise and thus automatically be snapped back to its position shown in FIG. 14 by the tension in spring **77** where again it is positively arrested in its swinging movement relative to gear hub **75** by the stop pin **76**.

FIGS. 15 to 21, inclusive, show a further modified construction by which the resilient conductive arm of a flexible, blade-like, spring leaf contact tongue **85** is pivotally mounted on the carrier gear **8***b* so that its conductive extremity **86** can be back set in retrogressive direction past the switch track terminal shoulder **36** or **37** after having passed the same and departed from the switch surface terminal with a snap action crosswise the advancing direction of tongue travel. In this construction a circular recess in the gear hub **87** faces a circular recess of equal diameter in the gear **8***b* thereby to form a cavity in the combined gear and hub which serves as a rotary bearing for a cylindrical trunnion **88** in which is fixedly lodged the pivotal end of the spring leaf contact tongue **85**. The spring leaf arm of said contact tongue extends through a clearance aperture **89** whose edge **90** serves as a stop to arrest the contact arm in its full line positions shown in FIGS. 16 and 17 in which position the contact tongue is normally maintained by tension in the spring **91** which connects contact tongue **85** and an anchorage stud **92** fixed in gear hub **87** and yieldably opposes swinging of contact tongue **85** clockwise in FIG. 17. Good and permanent electrical transmission from the collector ring **51** to trunnion **88** is assured by the metallic spring-armed cup washer **93** which is compressed axially therebetween and occupies a recess in the trunnion. The flow diagrams in FIGS. 18 to 21, inclusive, make clear without further explanation how the contact tongue **85** performs in the back setting operation just as contact tongue **72** is diagrammed to perform in FIGS. 11 to 14, inclusive.

As is the case with contact tongue **29** in FIGS. 7 to 10, inclusive, the features of these improvements which permit backsetting of the tongue extremity past stationary switch track surface terminals at the shoulders **36** or **37** equally well permit backsetting of said switch track shoulders past the contact member when the latter is substantially stationary in the operation of setting discs **26** and/or **27** to predetermine the times of future automatic circuit switching action of the time switch.

The timing switch mechanism hereinbefore described will operate successfully if built to a large variety of scales as to size, a preferred size being identified by making the radial distance from axis of revolution of the extremity of contact tongue **29** to its circular path of wiping contact approximately ¾" or more and the other parts in the proportion thereto shown in the drawings.

The principles of the present invention can be incorporated in electric switches, time-controlled and otherwise, having track surfaces formed of ring-like elements spirally inter-leaved in a variety of ways as for instance those shown in my U.S. Patent No. 2,032,774, FIG. 12 and my U.S. Patent No. Re. 23,783, FIGS. 9 to 16, inclusive. Also the track surface terminals **36** and **37** of the portion of the disc or ring that overlaps the other disc or ring may be slightly beveled or inclined in the opposite direction of slant from that shown in FIG. 4 hereof to assist in the easy passing of the traveling contact **29**, **72** or **85** past such terminals of the serially exposed components of the continuous track face formed respectively by overlapping surfaces of the spirally interleaved split discs or rings **26** and **27** in cases where the voltage and amperage of the load circuit controlled by the traveling contact is sufficiently low not to require a quick make or break of the circuit.

In regard to electrical capacity of the backsettable time controlled circuit switching mechanism herein disclosed, it has been found to operate satisfactorily without trouble from arcing or pitting of contacts in the control of electrical loads as heavy as required by the larger sizes of household television receiving sets when the track disc **27** is made of spring Phosphor bronze preferably silver plated and the contact **29** is made of silver cadmium oxide. The track wiping travel of the contact tongue extremity maintains in clean condition the path in the circular line of the track that is traversed and wiped thereby. The backsetting movement of contact which results from turning the clock hands backward by counterclockwise turning of manual **54'** and the backsetting movement of the disc edges **36** and **37** which results from turning the manuals such as **40** counterclockwise is incapable of producing as slow separation of the traveling contact from the conductive component of the switch track as is the extremely slow linear speed of travel of the contact when driven by the clockwork at the speed of one revolution in twenty-four hours.

Whatever the material of contact tongue **29**, I prefer to bevel or make wedge-shaped the extremity of the contact tongue that wipes along the switch track so that such bevel shall accord in direction of slant with the bevel of the disc edge **36** in FIG. 4 wherefore there will be no escaping movement of the contact tongue extremity toward the switch track until the clear, sharp and clean departure of the extremity of the bevel or wedge shape from the sharp corner of the track surface terminal at the drop-off shoulder of the track.

The electrical capacity of the switch can be increased by the use in the relatively movable tracks and contact tongues of precious metal alloys containing platinum, gold, tungston and other well-known contact materials.

The following claims are not limited to the particular specifications of parts herein suggested but are intended to apply to and cover all equivalents for the parts and arrangements herein chosen to illustrate the principles of the invention.

I claim:

1. A backsettable time controlled circuit switching mechanism comprising, a circuitous course of circular switch track having serially exposed components of its continuous track surface formed respectively by overlapping surfaces of spirally interleaved rings, each of said surface components having an abrupt drop-off surface terminal spaced crosswise said course from the surface of the adjoining component to form a gap between said surfaces, means to adjust said rings circularly in a manner to vary the relative extents of exposure of said track surface components, a circuit controlling electric contact tongue having an edge-like extremity, a time keeping movement connected to impel said tongue along said course, resilient means yieldably biasing said tongue extremity toward and against said track whereby upon passing from one to another of said surface components said tongue extremity performs a circuit controlling snap motion across said gap, and a camming face on said tongue disposed to engage with and wipe past at least one of said component surface terminals in a manner to permit said member extremity to pass said terminal in either direction of travel therepast by yielding of said resilient means.

2. A backsettable time controlled circuit switching mechanism as defined in claim 1, together with separate manuals connected respectively to adjust said rings in either rotary direction independently of each other.

3. In a circuit switching mechanism including a trackable switch surface ending abruptly at a drop-off terminal thereof, the combination with said surface of, an elongate circuit controlling contact tongue terminating in an abrupt extremity, a rotary carrier on which said tongue is mounted to perform limited reciprocal swinging movement relative to said carrier about a pivotal axis and whereby said tongue is conveyed bodily in an advancing direction of travel along said switch surface, resilient means yieldably

biasing said tongue extremity toward said switch surface whereby to cause said extremity to wipe along said surface and then escape automatically from said terminal with a snap action crosswise said advancing direction of tongue travel, a camming face lengthwise the trailing side of said tongue with respect to said advancing direction of travel, said face extending from said extremity toward said pivotal axis in a posture to encounter said drop-off terminal upon travel of said tongue retrogressively to said advancing direction of travel after escape of said extremity from said terminal, an abutment on said carrier limiting said swinging movement of said tongue to a position in which said camming face assumes said posture, and additional resilient means yieldably biasing said tongue toward said abutment whereby swinging of said tongue away from said abutment relatively to said carrier enables said camming face to depart from its said posture against the bias of said additional resilient means and thereby pilot said extremity smoothly past said drop-off terminal of the switch surfaces during said retrogressive travel of said tongue.

4. In a circuit switching mechanism the combination defined in claim 3, together with an additional trackable switch surface underlying the said drop-off terminal in sufficient proximity thereto to receive and bear the thrust of the said tongue extremity after departure thereof from said terminal.

5. In a circuit switching mechanism the combination defined in claim 3, in which the said additional switch surface also has a drop-off terminal from which the said tongue extremity departs with a snap action crosswise the said direction of advancing tongue travel.

6. In a circuit switching mechanism the combination defined in claim 5, in which the said switch surfaces are respectively conductive and insulative in a continuous course throughout a circuitous extent of the track, whereby the said tongue extremity can pass the said surface terminals successively and repeatedly during travel of said tongue in either of opposite directions along said track thereby alternately to make and break a switch controlled circuit.

7. In a circuit switching mechanism the combination defined in claim 3, together with clockwork geared to impel the said tongue carrier at angular speed not exceeding one revolution in twelve hours in the said advancing direction of travel.

8. In a circuit switching mechanism the combination defined in claim 3, in which the said tongue carrier rotates about a fixed axis, and the said contact tongue is pivotally mounted on said carrier eccentrically of said fixed axis in a manner to swing relatively to the latter about the said pivotal axis while traveling in unison with said carrier about said fixed axis of the latter.

9. In a circuit switching mechanism the combination defined in claim 8, in which the said pivotal axis is directed crosswise the said fixed axis.

10. In a circuit switching mechanism the combination defined in claim 8, in which the said pivotal axis is directed substantially parallel with the said fixed axis.

11. In a circuit switching mechanism the combination defined in claim 10, in which the said circuit controlling member comprises a metallic leaf spring swingable about the said pivotal axis on the said carrier and slanting from said pivotal axis in approximately radial disposition relative to the said fixed axis of said carrier and toward the said switch surface so as to maintain said member extremity in sliding contact therewith, whereby the said wiping of the said camming surface against the said drop-off surface terminal during retrogressive bodily travel of said member diverts said leaf spring angularly from its said radial disposition.

12. In a circuit switching mechanism the combination defined in claim 11, together with resilient means biasing the said leaf spring to swing edgewise about its said pivotal axis toward its said radial disposition, the said abutment being positioned on the said carrier to be encountered by and arrest the edgewise swinging of said leaf spring in its said radial disposition.

13. In a circuit switching mechanism the combination defined in claim 3, in which the said carrier rotates about a fixed axis, together with a holder for the said current controlling contact tongue mounted on said carrier in a manner to be swingable relatively to the latter about a holder axis contained in a plane perpendicular to the said fixed axis, and the said pivotal axis of said tongue is angularly related to said holder axis.

14. In a circuit switching mechanism the combination defined in claim 13, in which the said holder is a swingable yoke pivotally connected at two spaced apart points to the said rotary carrier, and the said contact tongue is an angled conductor having a pintle portion journaled in said holder and a flag-like arm portion in angular relation to said pintle portion extending therefrom into sliding contact with the said switch surface.

15. In a circuit switching mechanism the combination defined in claim 14, the first said resilient means biasing the said yoke to swing relatively to said rotary carrier toward the said switch surface, and the said additional resilient means biasing the said arm portion of the said contact tongue to swing relatively to said yoke toward said switch surface.

16. In a rotary snap switch for making and breaking an electric circuit by quick contact action, the combination of a circuit governing switch track comprising a plurality of track surfaces inclined in similar fashion to form consecutive ratchet-shaped detent steps terminating respectively in abrupt drop-off shoulders, a circuit making elongate contact tongue terminating in a sharply defined extremity, a tongue carrier movable to convey said tongue optionally in advancing or retrogressive directions along said track, means constantly biasing said tongue extremity resiliently against one or another of said track surfaces in a manner to cause automatic snap action departure of said tongue extremity off from said step shoulders crosswise said advancing direction of tongue travel when passing said shoulders in said advancing direction, a cam surface on and extending lengthwise of said tongue, and means mounting said tongue on said carrier in a manner to permit shifting of said tongue to a position relative to said carrier enabling said camming surface to wipe smoothly against and past said shoulder in retrogressive direction of tongue travel along said track, whereby to cause said tongue extremity to pass said shoulders in said retrogressive direction of tongue travel.

17. A back settable circuit switching mechanism comprising, a switch track extending in a continuous course having an exposed surface shaped in one location to form an inclined step ending in an abrupt drop-off shoulder, a circuit making elongate contact tongue having an edge-like extremity adapted to travel along said course, resilient means biasing said extremity toward and against said track surface whereby upon reaching and passing said shoulder in an advancing direction of travel said extremity snaps off from said shoulder crosswise said advancing direction of travel onto a continuation of said track, means to impel said contact tongue either in an advancing direction of travel or in the reverse direction of travel along said course, a conductive cam face extending from said extremity lengthwise on said tongue in differently inclined positions of the latter relative to said track course and normally inclined in a posture to remain out of contact with said shoulder while said extremity passes said step in said advancing direction of tongue travel, and yieldable mounting means connecting said tongue to said impelling means with freedom of movement relative thereto enabling said tongue to shift from said normally inclined position into an angularly divergent position such that said cam face wipes smoothly against said drop-off shoulder and enables said tongue

extremity to pass said shoulder in said reverse direction of travel.

18. A back settable time controlled circuit switching mechanism as defined in claim 17, in which the said means to impel the said contact tongue comprises clockwork including friction connected gearing arranged to drive said tongue in its said advancing direction of travel with ability of slippage in said reverse direction, and a time setting manual connected to impel said tongue in its said reverse direction of travel against the resistance of said driving friction.

References Cited in the file of this patent

UNITED STATES PATENTS

Re. 23,783	Smith	Feb. 16, 1954
773,485	Dubinski	Oct. 25, 1904
1,767,347	Coward	June 24, 1930
1,941,828	Dekany	Jan. 2, 1934
2,203,944	De Haes	June 11, 1940
2,232,384	Gubenick	Feb. 18, 1941
2,310,090	Kalaydjian	Feb. 2, 1943
2,458,322	Van Sickle	Jan. 4, 1949