Oct. 6, 1964 W. J. SEARS 3,152,229

REPEAT MECHANISM FOR A CLOCK CONTROLLED SWITCH

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Fig. 1.

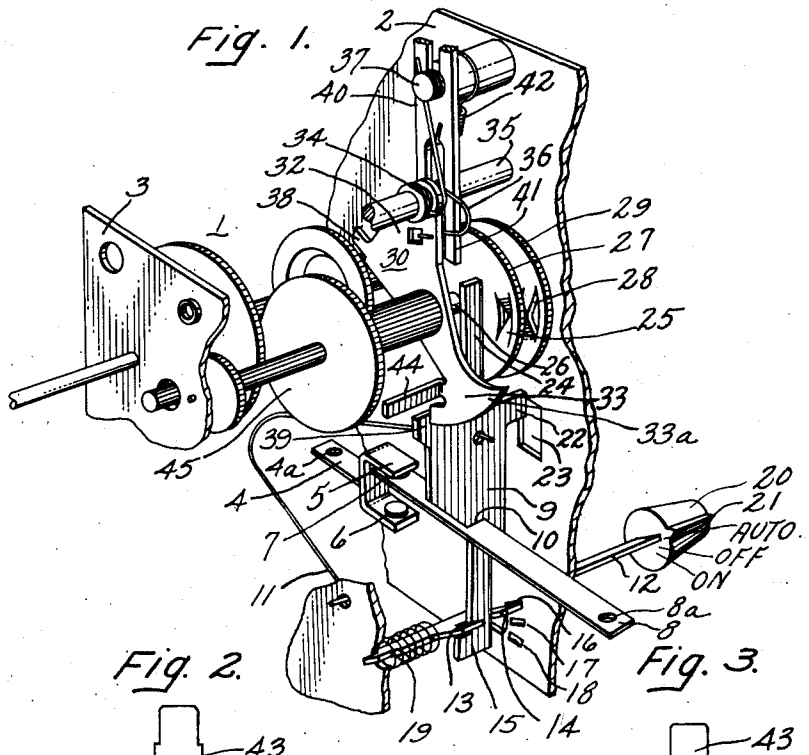


Fig. 2.

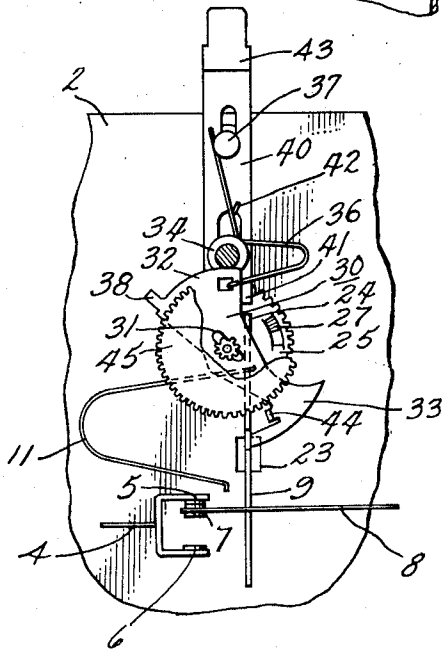
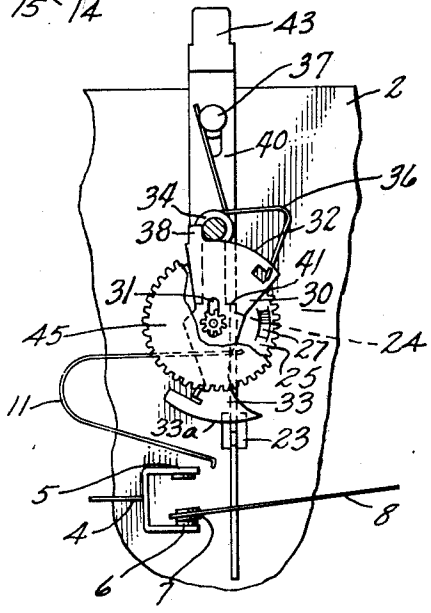


Fig. 3.



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Fig. 4.

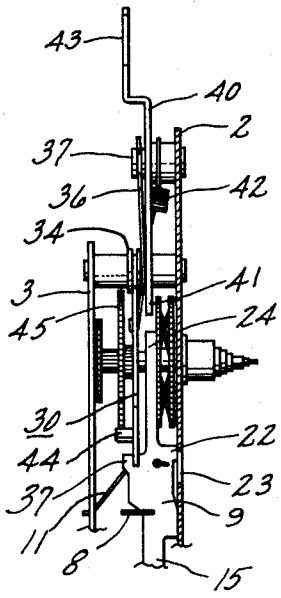
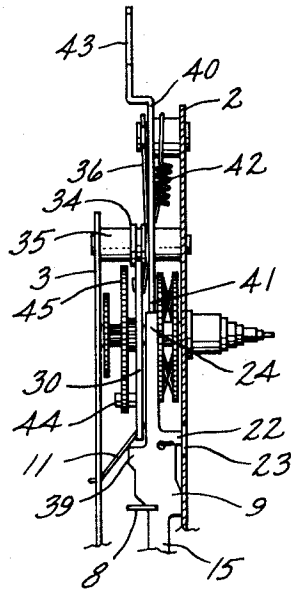


Fig. 5.



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3,152,229

REPEAT MECHANISM FOR A CLOCK CONTROLLED SWITCH

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7 Claims. (Cl. 200—38)

The present invention relates to a clock or time controlled switch and, more particularly, to a mechanism for temporarily opening a switch actuated by an electric clock.

As is well known in the clock art, combinations of electrical switches and synchronous electrical clock works afford inexpensive and highly precise controls for household appliances and other electrical apparatus. In Patent 2,782,274 by H. A. Powers et al., assigned to the same assignee as the present invention, there is disclosed a particularly simple and inexpensive time controlled switch. A simple temporary switch opening mechanism combined with such a switch would be highly desirable. With such a mechanism, a person awakaned by an appliance actuated by the clock controlled switch may actuate the temporary opening mechanism and return to sleep for a short period of time without fear of over-sleeping since the switch will be closed again after a short time interval. This invention is concerned with such a temporary opening mechanism combined with a simple low cost clock controlled switch.

Accordingly, it is a primary object of this invention to provide an improved low cost reliable mechanism for temporarily opening a clock controlled switch having a minimum number of parts.

It is a further object of this invention to provide an improved temporary switch opening mechanism which may be uniquely and easily combined with the time switch of the type disclosed in the above-mentioned patent.

Briefly stated, the invention relates to a clock including an electric switch, a switch actuator controlling the switch and normally biased into a switch closed position, an arrangement for restraining the actuator and the switch in the switch-open position, a timing mechanism for releasing the actuator to close the switch, and a temporary switch opening mechanism to open the switch for a short interval and subsequently permit the switch to close once again. The primary element of the temporary switch opening mechanism is an interval lever which cooperates with the switch actuator in a unique manner whereby the actuator and the lever alternately restrain each other. The interval lever is urged to move by a spring; but when the actuator is in the switch-closed position it is normally in the path of the lever to prevent the lever from moving. A manually controlled element is employed to move the actuator to the switch-open position and such movement is sufficient to release the interval lever permitting it to move. Releasing the manual element permits the actuator to move back into engagement with the interval lever, but in its new position the lever prevents the actuator from moving to the switch-closed position. When the actuator once more engages the lever, a timing gear is connected to the interval lever to move the lever against its spring biasing force so that after a predetermined short interval the lever is returned to its original position, releasing the actuator to thus allow the switch to close.

Further features, objects and advantages will become apparent with reference to the following drawings in which:

FIG. 1 is an exploded perspective view of a portion of an alarm clock incorporating the switch and temporary switch opening mechanism of this invention;

FIG. 2 is a side elevation of a cut-away portion of the mechanism of FIG. 1 with the switch in the automatic closed position;

FIG. 3 shows the structure of FIG. 2 with the temporary switch opening mechanism shown in operation;

FIG. 4 depicts a side elevation, partially sectionalized, of the mechanism as shown in FIG. 2; and

FIG. 5 is a side view of the mechanism shown in FIG. 3.

Referring now to FIG. 1, a clock gearing mechanism is generally shown at **1** supported between a front plate **2** and a rear plate **3**. Since not essential to an understanding of the invention, all details of the clock have not been shown; however, it should be understood that the clock may be provided with a suitable time indicating face and corresponding hands. Also, the clock may be driven by a suitable electric synchronous motor of a conventional type.

The electric switch incorporated in the clock is preferably of the three-position variety including a fixed contact member **4** having a bifurcated end forming an upper contact **5** and a lower contact **6**. Contacts **5** and **6** cooperate with a movable contact **7** mounted on a flexible arm **8**. The contacts are encased within a suitable insulated housing (not shown) in a manner to hold contacts **5** and **6** in a fixed position and to hold a portion of arm **8** in a fixed position while permitting its end carrying contact **7** to be moved. The end **8***a* of arm **8** and the end **4***a* of the contact member **4** form terminals to be connected to a suitable source of power and to the electrical device to be operated by the clock, such as a radio. It will be appreciated that the switch is closed whenever contact **7** engages either contact **5** or contact **6** and that the switch is open when contact **7** is positioned intermediate contacts **5** and **6**.

For controlling the position of the contact arm **8**, there is provided an insulated switch actuator **9** having a plurality of fingers or projections for performing its various functions. The actuator **9** is a flat plate-like member preferably made of a rigid insulating material. The actuator is formed with a slot **10** adapted to receive the contact arm **8** so that vertical movement of the actuator **9** will open or close the switch. The actuator **9** is normally biased upwardly to the position where contact **7** engages contact **5** by means of a suitable spring **11** having one end secured to the actuator and its opposite end secured to back plate **3**.

For manual movement of the switch actuator, there is provided a manual selector shaft **12** being rotatably supported in front plate **2** and back plate **3**. The shaft is provided with two radially extending projections **13** and **14**, with projection **13** cooperating with a lower finger **15** of actuator **9**. Projection **14** cooperates with detents **16**, **17** and **18** formed in front plate **2** to positively position the switch selector shaft **12** in three different positions. Projection **14** is urged into engagement with the detents by means of spring **19** which is compressed between back plate **3** and projection **13**. The opposite end of the shaft **12** extends beyond the clock casing terminating in a knob **20** to provide a suitable control. The knob **20** may be provided with a pointer **21** which cooperates with suitable indicia formed on the clock face which is schematically shown in FIG. 1, to indicate the three operating positions, "auto" for automatic, "off," and "on." When the pointer **21** is aligned with the "auto" position, projection **14** cooperates with detent **16** and projection **13** cooperates with actuator finger **15** to permit actuator **9** to move to its extreme upper position, unless otherwise restrained, wherein contact arm **8** is moved to its upward position so that contact **7** engages contact **5**. When the knob **20** is rotated to its "off" position, projection **14** cooperates with detent **17** to hold projection **13** where it urges actuator **9** downwardly against the bias of spring **11** and wherein contact **7** does not engage either of the fixed contacts. When knob **20** is rotated to the "on" position, actuator **9** is moved further downwardly against the bias of spring **11**

wherein contact 7 engages contact 6, and the switch is thus permanently closed.

To place the switch under the control of the clock mechanism, there is provided a finger 22 which extends forwardly to cooperate with an opening 23 in front plate 2. In addition to being movable vertically to open or close the switch, actuator 9 is adapted to tilt or rock about an axis perpendicular to the actuator approximately in the area where contact arm 8 extends through actuator 9. Spring 11 urges actuator 9 to tilt so that finger 22 extends partially through opening 23 and engages the edge of the opening to limit the upward movement of the actuator, which is also in response to the urging of spring 11.

For tilting the actuator 9 to release finger 22 from opening 23, an additional actuator finger 24 extends upwardly to cooperate with the face of cam gear 27. Cam gear 27 is slidably mounted on shaft 26 and is provided with a cam 25 adapted to cooperate with a cam 28 extending rearwardly from cam gear 29 mounted for rotation on shaft 26. The cams formed on the cam gears are adapted to become aligned every twelve hours, which action causes cam gear 25 to move rearwardly engaging finger 24 causing switch actuator 9 to tilt releasing finger 22 from opening 23. Consequently, actuator 9 is free to move upwardly in response to the urging of spring 11 to thus close the switch. In order to obtain such automatic operation it will be appreciated that the switch selector shaft 12 must be set for closure by being placed in the "auto" position. As is well known in the art, the clock may be provided with a suitable control for rotating cam gear 27 to the angular position corresponding to the time setting desired so that switch actuator 9 will be released at such time. Once placed in the automatic "on" position, the switch will remain so situated until the actuator is moved downwardly to the "off" position or the permanent "on" position. As described, this may be accomplished by rotating selector shaft 12.

The time switch arrangement which has been so far described is very similar to the switch shown in the aforementioned Powers et al. patent. It will be appreciated that such an arrangement is simple and reliable involving relatively few parts which are easily manufactured. In accordance with the present invention, a simple short-interval switch opening mechanism is provided to open the switch for a short period of time after the switch has been permitted to close in response to the movement of the timing cam gears 27 and 29.

The primary element of the short-interval mechanism is interval lever 30, which is adapted to uniquely cooperate with switch actuator 9. Lever 30 is provided with a centrally positioned opening or slot 31, which may be seen in FIGS. 2 and 3, for positioning the lever on shaft 26. The slot 31 permits the lever 30 to pivot or rotate on shaft 26 and also permits the lever to move transversely or radially with respect to shaft 26 within the limits of slot 31. The lever 30 is formed with two diametrically spaced sectors 32 and 33. Sector 33 is guided within a grooved portion 34 formed on pillar 35. The interval lever 30 is urged to rotate or pivot in a clockwise direction, when viewed from the rear of the clock as shown in FIG. 1, by means of a spring 36 having one end secured to lever 30 and its opposite end secured to the end of supporting stud 37 and with an intermediate portion wound around pillar 35. The spring 36 also laterally positions lever 30 with respect to its slot 31, but the direction of movement caused by the spring is dependent upon the angular position of the lever, as will be hereinafter described. The rotational movement of the lever 30 in response to the urging of spring 36 is limited by a stop 38 formed at the end of upper cam sector 32.

When the switch actuator 9 is in the automatic position or the "off" position, a projection 39 on the actuator normally extends in the arcuate path of sector 33 of interval lever 30 so as to prevent lever 30 from pivoting or rotating in response to the urging of spring 36. In such position,

the interval lever is inoperative to perform its short interval switch opening function. The interval lever 30 may be placed in an operative position by moving the actuator 9 downwardly so that its projection 39 no longer restrains the interval lever thus permitting the lever to pivot or rotate its limited amount as determined by stop 38 formed on sector 32.

For depressing the switch actuator 9 to release the interval lever 30, there is provided a slidably mounted pushbutton lever 40. The lower end of the lever is bifurcated to straddle supporting pillar 35, and the lower end of one arm 41 of the bifurcated portion is adapted to engage the upper end of actuator finger 24 so that the actuator may be depressed by depressing pushbutton lever 40, as shown in FIG. 3. The upper end of lever 40 is slotted to be guided by supporting stud 37. A spring 42 having one end secured to support stud 37 and its other end secured to lever 40 normally urges the lever to its upper position, wherein the lever does not engage actuator finger 24. A control button 43, FIG. 2, may be positioned on the upper end of lever 40 to facilitate movement.

Assuming now that the manual selector shaft 12 has been set for automatic closure by being placed in the "auto" position and the timing cams 27 and 29 have become aligned to release actuator 9 from front plate 2 permitting the switch to close, the radio or other appliance connected to the switch will be in operation. In the event the user desires to open the switch for a predetermined short interval and then have it automatically reclose after the lapse of the interval, pushbutton lever 40 may be depressed moving actuator 9 downwardly to open the switch. This downward action moves the actuator sufficiently so that its projection 39 no longer restrains interval lever 30, and the lever is therefore permitted to snap into its operative position in response to the urging of spring 36. The relationship of the components before pushing lever 40 is shown in FIGS. 2 and 4; FIGS. 3 and 5 show the arrangement of parts after pushbutton lever 40 has been depressed. Upon releasing pushbutton lever 40, spring 42 moves the lever 40 upwardly to its original position being disengaged from actuator 9. This permits actuator 9 to move upwardly in response to the urging of spring 11, but the movement is limited in that the upper surface of projection 39 on actuator 9 engages the curved cam surface 33*a* of sector 33 on the interval lever 30. When the actuator 9 is restrained in this position the movable contact arm 8 is held in the switch-open position.

To move the interval lever from this switch-open position in a predetermined short interval, the lever 30 is provided with a rearwardly extending lug 44 adapted to cooperate with a continuously rotating gear 45. By the urging of spring 11 actuator 9 slides interval lever 30 upwardly within the confines of its slot 31, as may be seen from FIG. 3, causing lug 44 to become engaged with gear 45. Spring 36 assists in moving lever 30 upwardly when the lever is in its operative position. Gear 45 rotates in a counterclockwise direction as viewed in the drawings so that lever 30 is rotated in a counterclockwise direction against the rotational urging of spring 36. Lever 30 is rotated in this direction until the end of cam surface 33*a* is reached whereupon actuator 9 is released and moved upwardly by spring 11 causing the switch to close once more. Interval lever 30 is of course no longer biased upwardly by spring 11 and actuator 9. Further, the rotation of lever 30 has changed the direction of the force caused by spring 36 so that lever 30 is not moved upwardly in response to the urging of spring 36 but instead is moved somewhat downwardly thus releasing lug 44 from the teeth of gear 45. When so released, lever 30 is once more urged in a clockwise direction by spring 36, but is prevented from moving in this direction by virtue of the fact that actuator 9 is once more in position to restrict such movement.

The time interval during which the switch is held in the open position can of course be varied as desired. When the mechanism is used to allow a sleeper to obtain a few more minutes of sleep, a typical time interval employed is approximately ten to fifteen minutes. After the time interval has elapsed, the pushbutton lever **40** can be depressed again to obtain another short interval period. The number of times which the operation may be repeated is determined by the duration of time which the cams on cam gears **27** and **29** remain aligned so that switch actuator finger **22** does not engage the edge of opening **23** and front plate **2** to prevent actuator **9** from moving upwardly to the switch-closed position.

From the foregoing it will be appreciated that a simple and reliable temporary switch closing mechanism has been described and that the mechanism uniquely cooperates with the time controlled switch to provide a low cost dependable arrangement. It should be apparent from the foregoing that the specific embodiment of this invention disclosed herein is of a descriptive rather than a limiting nature, and that various changes, combinations, substitutions or modifications may be employed in accordance with these teachings without departing in spirit or scope from this invention in its broader aspects.

What I claim is:

1. In an electric clock, a three-position electrical switch, an insulated switch actuator engaging said switch, first manually operable means which when moved in one direction moves said actuator from a switch open position to close said switch and which when moved in the opposite direction sets the actuator for automatic closure of the switch, spring means urging said actuator in said opposite direction, timing means for restraining the actuator in the switch open position for releasing the actuator at a pre-set time to permit said spring means to move the actuator to close the switch when said manually operable means has been used to set said switch for automatic closure, a temporary switch opening mechanism comprising an interval lever which engages and cooperates with said actuator in a manner such that the actuator restrains the lever when said switch has been set for automatic closure and said opening mechanism has not been placed in operation and said lever holds said actuator in the switch open position when the actuator is moved to the switch open position by operation of said mechanism, second manually operable means for moving said actuator to the switch open position and placing said mechanism in operation, and gear means for moving said lever from its actuator holding position after a predetermined short interval so that the actuator is permitted to return to its switch closed position responsive to said spring means.

2. In an electric clock having a driving means, an electric switch, an insulated switch actuator engaging the switch having a switch open position and a switch closed position, means biasing said switch actuator into the switch closed position, means restraining said switch actuator in the switch open position against said biasing means, presettable timing means automatically movable by said driving means to release said switch actuator from said restraining means permitting the biasing means to move the switch actuator to the switch closed position, a temporary switch opening mechanism comprising a pivotally mounted interval lever, a spring urging said lever to rotate, said lever having an operative position wherein the interval lever restrains said actuator in the switch open position and an inoperative position wherein the interval lever does not restrain the actuator but the actuator restrains the interval lever from rotating into the operative position in response to the urging of said spring, a gear rotated by said driving means and connected to rotate said interval lever against the urging of said spring when the interval lever is in its operative position, manual means for moving said actuator to simultaneously open the switch and release said interval lever permitting the lever to move to its operative position, and biasing means urging said manual means to its original position so that upon release of said manual means the actuator is restrained by said lever in its switch open position until the interval lever is rotated by said gear to its inoperative position thereby releasing said actuator and allowing said switch to close.

3. In an electric clock, a support plate, an electric switch including at least one fixed contact and a movable contact arm, an insulated switch actuator engaged in moving relation with said contact arm, means urging said actuator and said arm to a switch closed position, said switch actuator having a finger for engaging said support plate to hold the actuator against said urging means, presettable timing means engaging said actuator to automatically release the actuator from the support plate permitting said switch to close, a temporary switch opening mechanism comprising a rotating shaft, an interval lever loosely mounted on said shaft to permit limited movement in a radial direction relative to the shaft, means biasing said lever to pivot about said shaft, said actuator having a portion engaging said interval lever to prevent the lever from rotating when the opening mechanism is inoperative, a manually operated lever slidably mounted on said support plate for moving said switch actuator against said urging means to open said switch and to release said interval lever permitting the interval lever to pivot responsive to said biasing means to a position wherein after release of said manual lever the interval lever holds said actuator in the switch open position, and a gear having a toothed periphery mounted on said shaft, said interval lever having a projection which is urged into engagement with said gear teeth when the lever is holding the actuator in the switch open position, said gear being adapted to rotate said lever against said biasing means to a position whereupon said actuator is released causing the switch to close, the interval lever to move radially on said shaft permitting said projection to become disengaged from said gear, and said lever to be once more rotationally restrained by said actuator.

4. In an electric clock, an electric switch, a plate-like switch actuator connected to operate said switch, means urging said actuator to a switch closed position, catch means for restraining said actuator in a switch open position against the force of said urging means, presettable timing means engaging said actuator to automatically release the actuator from the catch means permitting the switch to close, a temporary switch opening mechanism, a rotatably mounted interval lever whose rotational plane is perpendicular to said switch actuator, spring means biasing said lever to rotate, said actuator having a portion engaging said interval lever to prevent the lever from rotating when the actuator is in the switch closed position, manual means for moving said switch actuator against said urging means to open the switch and to release said interval lever permitting the interval lever to rotate responsive to said biasing means, spring means for returning said manual means to its original position when released, said interval lever having an edge surface which engages said actuator when the manual means is released to thereby hold the actuator in the switch open position, continuously rotated gear means, said interval lever having a projection which is urged into engagement with said gear teeth by said actuator when the lever is holding the actuator in the switch open position, said gear being adapted to rotate said lever against said biasing means so that said lever edge portion is released from said actuator permitting the actuator to close said switch and simultaneously releasing said projection from said gear means so that the lever is once more rotationally restrained by said actuator.

5. In an electric clock, an electric switch, an insulated switch actuator for opening and closing said switch, manually actuatable means for controlling said actuator to open said switch and to set the switch for automatic closure, a mechanism for controlling said actuator at a preset time

to close said switch when said manually actuatable means has been used to set said switch for closure, a temporary switch opening mechanism comprising an interval lever having a centrally located elongated opening, a continuously rotating shaft extending through said opening for pivotally supporting said interval lever, spring means for urging said lever to rotate in a direction opposite to said shaft rotation, said interval lever having an arcuate cam sector having an edge portion engaging said actuator to prevent the lever from rotating when the switch is in the automatic closed position, a projection extending from said arcuate sector in a direction parallel to said shaft, a gear mounted on said shaft for receiving said projection, a manually operated pushbutton for moving said actuator from the automatic closed position to the switch open position thus permitting said arcuate sector to rotate, spring means urging said pushbutton to its original position so that upon release of the pushbutton said actuator is restrained in the switch closed position by engaging the edge of said cam sector and said interval lever is radially moved by said actuator within the limits of said elongated opening to move said projection into driven engagement with said gear, said gear being adapted to remain engaged with said projection for a predetermined short interval until said arcuate sector is rotated so that it no longer restrains said actuator thereby permitting the actuator to once more move to the switch closed position.

6. In an electric clock having a driving means, an electric switch, a plate-like switch actuator for controlling the switch, first spring means biasing said switch actuator into a switch closed position, catch means restraining said switch actuator in a switch open position against the biasing of said first spring means, means automatically movable by said driving means to release said actuator from said catch means permitting said first spring means to move said actuator to the switch closed position, a temporary switch opening mechanism comprising a pivotally mounted interval lever having an arcuate cam portion adapted to cooperate with said actuator, second spring means urging said lever to rotate in a plane perpendicular to said actuator into an operative position wherein said arcuate sector restrains said actuator in a switch open position, said actuator being adapted to hold the lever in an inoperative position wherein the arcuate sector does not restrain the actuator but the actuator engages the arcuate section to prevent said interval lever from rotating to the operative position, a gear rotated by said driving means and connectable to rotate said interval lever against

said second spring means when the interval lever is in its operative position, returnable manual means for moving said actuator to simultaneously open the switch and release said interval lever permitting the lever to move its operative position so that the actuator is restrained in its closed switch position until the interval lever is rotated by said gear to its inoperative position thereby releasing said actuator allowing said switch to close.

7. In an electric clock, a support, an electric switch including at least one fixed contact and a movable contact arm, an insulated switch actuator engaged in moving relation with said contact arm, means urging said actuator and said arm to a switch closed position, said switch actuator having a finger for engaging said support to hold the actuator against said urging means, presettable timing means engaging said actuator to automatically release the actuator from the support permitting said switch to close, a temporary switch opening mechanism comprising a rotating shaft, an interval lever loosely mounted on said shaft to permit limited movement in a radial direction relative to the shaft, means biasing said lever to pivot about said shaft, said actuator having a portion engaging said interval lever to prevent the lever from rotating when the opening mechanism is inoperative, a manually operated lever for moving said switch actuator against said urging means to open said switch and to release said interval lever permitting the interval lever to pivot responsive to said biasing means to a position wherein the interval lever holds said actuator in the switch open position, and a gear mounted on said shaft for engaging said interval lever when the lever is holding the actuator in the switch open position, said gear being adapted to rotate said interval lever against said biasing means to a position whereupon said actuator is released causing the switch to close, the interval lever to move radially on said shaft permitting said interval lever to become disengaged from said gear, and said interval lever to be once more rotationally restrained by said actuator.

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