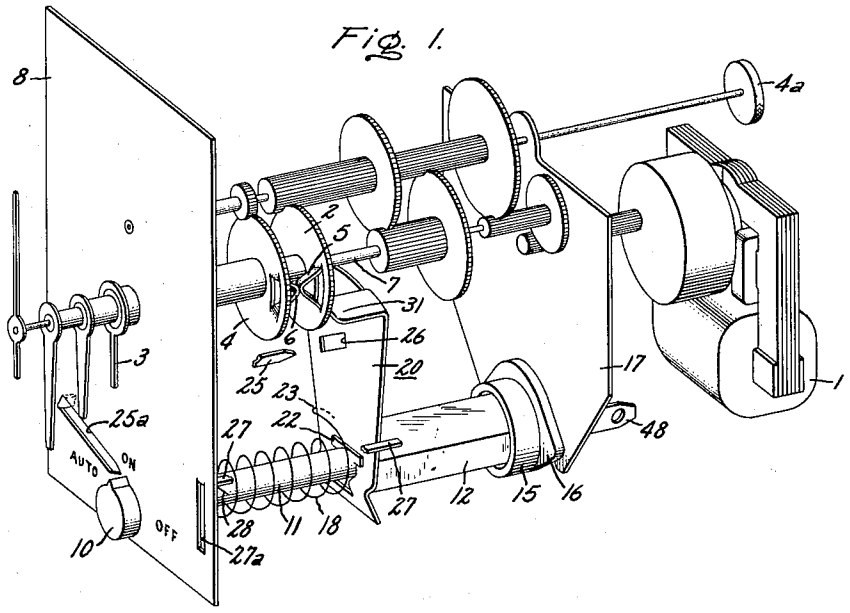
June 23, 1964 R. L. BOYLES 3,138,674

ELECTRICAL TIME SWITCH MECHANISM

Filed March 29, 1962 2 Sheets-Sheet 1

Fig. 1.



Inventor:
Robert L. Boyles,
by Leonard J. Platt
His Attorney.

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Fig. 3.

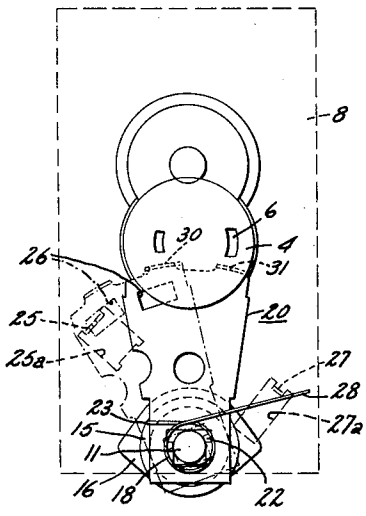


Fig. 2.

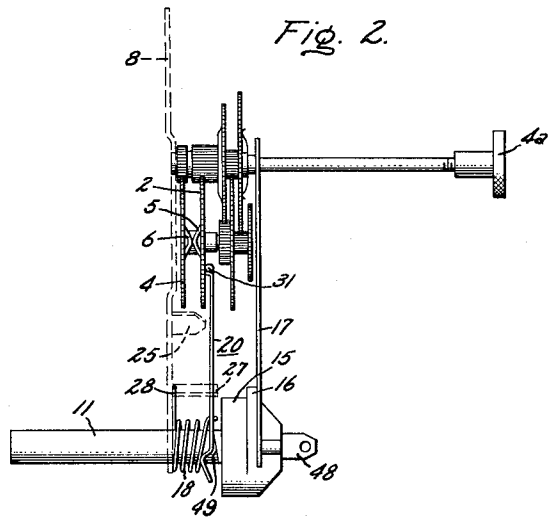
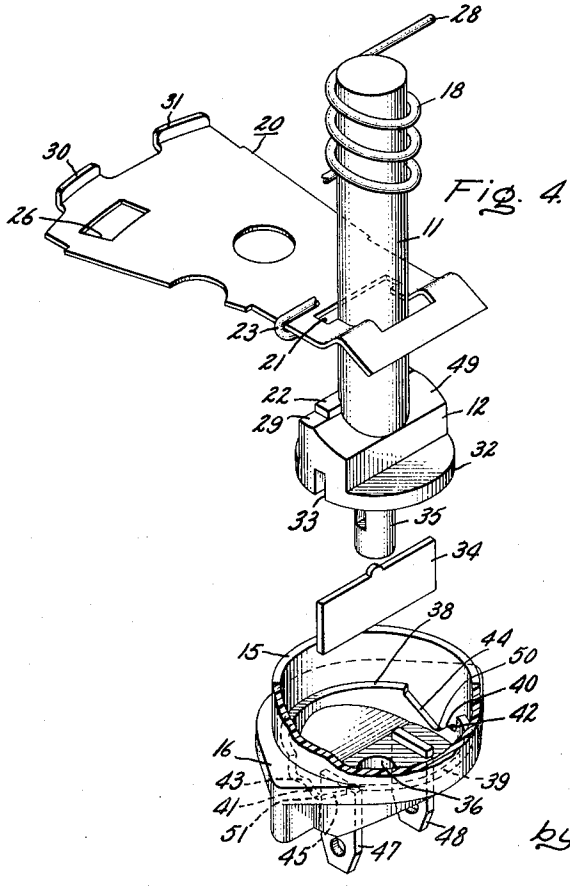


Fig. 4.



Inventor:
Robert L. Boyles,
by Leonard J. Platt
His Attorney.

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3,138,674

ELECTRICAL TIME SWITCH MECHANISM

Robert L. Boyles, Wayland, Mass., assignor to General Electric Company, a corporation of New York

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10 Claims. (Cl. 200—38)

This invention relates to an electrical time switch, and more particularly to a switch mechanism for controlling a radio receiver or the like. In devices of this type, the radio or appliance being controlled may be turned on or off manually at any time, or the switch may be set to turn the radio on automatically at a predetermined time. My invention is concerned with such a time switch.

Accordingly, it is a primary object of this invention to provide an improved reliable time switch having a minimum number of structural components thus producing a relatively inexpensive assembly.

A further object of the invention is to provide a time switch having uniquely designed and arranged components for facilitating ease of manufacture.

Briefly stated, in accordance with one aspect of the present invention, a timer switch assembly is provided having a three position switch that may be either manually operated or automatically actuated by a timer. The switch assembly includes a contact which may be selectively moved in one direction from an "ON" position to an "OFF" position and in the opposite direction from the "ON" position to an "AUTOMATIC-OFF" position. Means are provided to bias the shaft from the "AUTOMATIC-OFF" position to the "ON" position. A latch means retains the contact in the "AUTOMATIC-OFF" position against movement of the biasing means until the contact is released at a predetermined time by the timer movement so that the contact may be moved by the biasing means from the "AUTOMATIC-OFF" position to the "ON" position.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter, which may be regarded as the invention, the organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is an exploded perspective view of a timer movement and switch assembly in accordance with the present invention with parts elongated along the axis of the shafts;

FIG. 2 is a side view of the timer movement and switch assembly in accordance with the present invention with a front plate of the timer movement shown in phantom;

FIG. 3 is a front view of the timer movement and switch assembly representing certain details of the latch lever interaction with the timer; and

FIG. 4 is an exploded perspective view of the switch assembly in accordance with the present invention.

Referring to the drawings, particularly to FIG. 1 and FIG. 2, there is illustrated a timer switch assembly having an electrically driven clock movement. A self-starting synchronous electric motor **1** drives the clock movement at a regulated speed such that an hour hand gear wheel **2** will be caused to rotate at one revolution every 12 hours in a clockwise direction. A time setting pointer **3** is correlated to the angular position of an alarm set gear **4** that is manually revolved in a conventional manner by the setting knob **4***a* to position the pointer as may be desired.

The hour hand gear wheel **2** and the alarm set gear **4** have suitable cam projections **5** and **6** punched into the respective gears and so aligned radially as to be in exact angular alignment once every 360° revolution of the

hour hand gear. The hour hand gear **2** is capable of being moved axially along the peripheral surface of a minute hand sleeve **7** as the cam projections **5** and **6** are rotated into exact angular alignment. The effect of this timer axial movement of the hour hand gear **2** is the primary control means for the automatic actuation of the electrical switch assembly of the invention that will be hereinafter described.

In the form of the present invention, particularly shown by FIG. 1 and FIG. 4, the respective indicia having relation to the improved electrical switch assembly are shown positioned adjacent to the periphery of a manual set button **10** that is positioned generally at 6 o'clock location on a front plate **8** of the clock movement. The manual set button **10** is fixed to a selector shaft **11** which is adapted for angular movement when the button is moved. The selector shaft **11** has an integral molded portion that defines a specially shaped and enlarged portion **12** of the selector shaft. A molded switch cup **15** of the switch assembly has a radially extending cup flange **16** that fastens the cup to a rear or base plate **17** of the clock movement and receives the selector shaft **11** under axial urging of a latch spring **18**.

The latch spring **18**, in the form shown, is a helix spring positioned under compression between the front plate **8** and a latch lever **20**. The latch lever **20** extends radially from the axis of the selector shaft **11** and is keyed to the selector shaft by a suitable keyway **21** in the latch lever **20**. An axially extending key **22** integral with the portion **12** of the selector shaft **11** engages the keyway **21**. When the latch spring **18** is thus positioned under compression, an axial spring bias is developed not only upon the latch lever **20** but also upon the selector shaft **11**. The latch spring **18** further provides a spring bias against rotary action of the selector shaft **11** in a counterclockwise direction since the latch spring end **23** is formed to engage a related edge of the latch lever **20**, most clearly shown by FIG. 1.

When the selector shaft **11** is moved in a counterclockwise direction, a front plate lug or latch means **25**, punched from the front plate **8** at **25***a* and bent to extend rearwardly in a generally axial direction with relation to the selector shaft axis, engages and retains the latch lever **20** by means of a suitable catch **26** therein. This engagement of the catch **26** by the latch lug **25** is dependent upon the angular position of the hour hand gear **2** as will be hereinafter described. A limit post **27** is also punched from the front plate **8** at **27***a* and bent rearwardly to serve as a stop for the latch spring end **28** when the selector shaft **11** is positioned in the extreme counterclockwise or "AUTOMATIC-OFF" position. This limit post **27** for the latch spring end **28** is more clearly shown by FIG. 3.

Referring now to FIG. 4, the rotary electrical switch assembly of the present invention is shown in an exploded view. The selector shaft **11** of the switch assembly receives the concentrically positioned latch spring **18** and also the latch lever **20** thereon. The latch lever **20** has the keyway **21** adapted to engage the key **22** which extends above a flat portion **29** of the portion **12** of the selector shaft **11**. The latch lever **20** also has the catch **26** adapted to engage the front plate latch lug **25**, which engagement is again dependent upon the angular position of the hour hand gear **2** as will be hereinafter described. The latch lever **20** is further provided with a segmented arcuate lip edge that forms a plurality of tips or bearing surfaces **30** and **31** to ride upon the rear surface of the hour hand gear **2** as best shown by FIG. 1. The shaft portion **12** has an integrally formed, radially extending flange **32** providing an enclosure for the switch contacts when the switch is assembled. The portion **12** of the selector shaft **11** has a suitable lateral slot **33** to receive

a freely positioned electrical switch contact bar 34 therein. The selector shaft 11 terminates in a reduced diameter journal portion 35 inserted into an aperture or toe bearing 36 in the base of the molded switch cup 15.

The molded cup 15 has collar bearing surfaces 38 and 39 that do not extend for a full 360° but terminate in opposed inclined cam surfaces to be more fully described. The collar bearing surfaces 38 and 39 provide the necessary axial restraining or limit means, when the switch is assembled, for the selector shaft flange 32. The opposed inclined cam surfaces together with the spring 18 provide the means to fully accomplish the respective three switch positions of the present invention. Opposed "OFF" cam surfaces 40 and 41 lie 180° apart and terminate in suitable flats or detents 42 and 43 which provide a limit means when the assembled switch is moved to the first or manual "OFF" position. Automatic "OFF" cam surfaces 44 and 45 oppose each of the "OFF" cam surfaces 40 and 41 but are not provided with detents or flats such as those related to the "OFF" cam surfaces. The base of the molded switch cup 15, in addition to having the centrally positioned toe bearing, has stationary contacts 47 and 48 on either side of the toe bearing. The stationary contacts 47 and 48 extend axially from the molded cup 15 to provide suitable switch terminals which receive conductors not shown.

When assembled, the latch lever 20 is adapted, by means of an inclined plane 49 on the selector shaft 11, for limited arcuate movement in an axial direction against the axial spring bias. This provides the necessary tolerance to permit spring bias of the tips 30 and 31 riding upon the rear surface of the hour gear wheel 2 and the axial displacement thereby as will be hereinafter described. The tips 30 and 31 of latch lever 20 continuously engage the rear surface of the hour gear 2.

FIG. 2 shows the timer movement of the present invention in a position when the cam projections 5 and 6 of the hour hand gear wheel 2 and the alarm set gear 4 are in exact angular alignment such that the hour gear 2 is axially displaced away from the front plate 8 in a rearward direction toward the base plate 17. When the hour gear 2 is thus axially displaced, the segmented lip edge of the latch lever 20 which forms the tips or bearing surfaces 30 and 31 is also axially displaced. Such axial displacement causes the lever 20 to describe an arcuate movement in an axial direction about an imaginary lateral pivot point developed through the selector shaft 11 adjacent the key 22. The inclined plane 49 on the enlarged portion 12 of the selector shaft 11 permits this pivotal movement of the latch lever in the axial direction under the spring bias of the latch spring 18. As more clearly shown in FIG. 2, the latch lug 25 extending rearwardly from the front plate 8 shown in phantom, is disengaged from the catch 26 of the latch lever 20 when the cam projections 5 and 6 are in exact angular alignment. In the remaining angular positions of the hour gear wheel 2, as related to the alarm set gear 4, the cam projections 5 and 6 will not be in exact angular alignment and as such, under the urging of the latch spring 18, the hour hand gear will be urged in an axial direction toward the front plate 8.

Referring now to FIG. 3, a front view of the timer switch assembly of the present invention is shown. The solid lines of FIG. 3 illustrate the electrical switch assembly as it is set in an intermediate "ON" position by the selector shaft 11 so that the tips 30 and 31 of the latch lever 20 ride upon the rear surface of the hour hand gear wheel 2. FIG. 3 also shows by dashed lines the position of the latch lever 20 when the selector shaft 11 is rotated in a counterclockwise direction to an "AUTOMATIC-OFF" position where the latch lug 25 engages the catch 26 of the latch lever 20 to restrain the latch lever in the automatic "OFF" position. This restraining action by the latch lug 25 is possible only during those portions of arcuate movement of the hour hand gear 2 when the respective cam projections 5 and 6 of the hour gear 2 and the alarm set gear 4 are not in exact angular alignment. When cam projections 5 and 6 become angularly aligned at the set time the latch lever 20 will be moved arcuately away from engagement with the latch lug 25 as previously described to release the switch for movement from the automatic "OFF" to the intermediate "ON" position.

In the switch assembly of the present invention, when the selector shaft 11 is manually moved in a clockwise direction from the intermediate "ON" position to the "OFF" position, the switch contact bar 34 is displaced from the inverted apexes 50 and 51 of the opposed automatic cam and "OFF" cam surfaces and will ride up the opposed "OFF" cam surfaces 40 and 41 to axially displace the selector shaft 11 and the contact bar 34 away from the stationary contacts 47 and 48. Clockwise movement is restricted when the switch contact bar 34 reaches the upper limit of each of the "OFF" cams and engages the detent portions 42 and 43.

Manual rotation of the selector shaft 11 from the "OFF" position in a counterclockwise direction to the intermediate "ON" position accomplishes the reverse of the preceding motions so that the contact bar 34 is urged from the detent portions 42 and 43 down the "OFF" cam surfaces 40 and 41 to remake electrical contact across the stationary contacts 47 and 48 in the base of the molded switch cup 15. Thus in the intermediate "ON" position, the contact bar 34 returns to the inverted apexes 50 and 51 of the opposed cam surfaces.

When the position of the hour hand gear 2 is at some angular position other than that shown by FIG. 2, so that the cam projections 5 and 6 of the hour hand gear wheel 2 and the alarm set gear 4 are not in exact angular alignment, the selector shaft 11 when manually rotated counterclockwise will latch in the automatic "OFF" position by the engagement of latch lug 25 in the latch recess or catch 26 of the latch lever 20. The movement from the intermediate "ON" position to the automatic "OFF" position advances the switch contact bar 34 in an arcuate direction along the opposed automatic cam surfaces 44 and 45 to axially displace the selector shaft 11 against the spring bias of the latch spring 18. As the contact bar 34 is urged along the automatic cam surfaces, the latch lever 20, that is keyed to the selector shaft 11, describes an arcuate path in a counterclockwise direction to terminate in the position shown by the dashed lines of FIG. 3, as previously described. In such a position, the catch 26 of the latch lever 20 engages the latch lug 25 extending from the front plate 8 and restrains the selector shaft 11 in the automatic "OFF" position against the rotary bias of the latch spring 18. Thus, the switch contact bar 34 is maintained out of electrical contact with contacts 47 and 48 at some point on the automatic cam surfaces 44 and 45 by the catch 26 of the latch lever 20 restraining the selector shaft 11.

As the hour hand gear wheel 2 rotates, the cam projection 5 thereon describes an arc of 360° so that at the selected time the cam projection 5 will exactly coincide with the cam projection 6 of the alarm set gear 4. When the cam projections are in exact angular alignment at the desired letoff time, the hour hand gear wheel 2 is axially displaced to release the catch 26 of the latch lever 20 by arcuately displacing the latch lever 20 in an axial direction against the axial spring bias of the latch spring 18. Under the rotary spring bias of the latch spring 18, the selector shaft 11 is urged in a clockwise direction to the intermediate "ON" position. During this rotary clockwise motion, the switch contact bar 34 rides down the automatic cam surfaces 44 and 45 to the inverted apexes 50 and 51 between the opposed automatic cam and "OFF" cam surfaces to make electrical contact between the stationary contacts 47 and 48 in the base of the molded cup 15.

It should be noted that the free end of latch lug 25,

as seen in FIGS. 1 and 2, is tapered to form cam surfaces rather than having sharp corners. This arrangement permits the latch lever **20** to be manually moved by clockwise torque on the selector shaft **11** from the "AUTOMATIC-OFF" position at any time without having to wait for the timer mechanism to release the lever. In so moving the shaft **11**, the forward biasing force on latch lever **20** is overcome by superior manual force, whereas the torsional biasing force provided by the spring **18** is unable to overcome the latching force until the latch lug **25** is disengaged from the lever **20** by the axial motion of the hour gear **2**.

As will be evidenced from the foregoing description, certain aspects of the invention are not limited to the particular details of construction illustrated, and it is contemplated that other modifications and applications will occur to those skilled in the art. It is, therefore, intended that the appended claims shall cover such modifications and applications that do not depart from the true spirit and scope of the invention.

Having described the invention, what is claimed is:

1. A timer switch assembly comprising a clock mechanism, a three position switch including a switch contact, said contact being positionable in an on position, said contact being movable in one direction from said on position to an off position, said contact being movable in a direction opposite to said one direction from said on position to an automatic off position, means normally biasing said switch contact from the automatic off position to the on position, latch means to retain said switch contact in the automatic off position against movement by the biasing means, and means controlled by said clock mechanism to operate and release said latch means to enable the biasing means to move said switch contact from the automatic off position to the on position at a desired time.

2. A timer switch assembly comprising a clock mechanism, a three position switch including a selector shaft and a switch contact mounted on said shaft, said shaft and contact being positionable in an on position, said shaft and said contact being rotatable in one direction from said on position to an off position, said shaft and said contact being rotatable in a direction opposite to said one direction from said on position to an automatic off position, means normally biasing said shaft from the automatic off position to the on position, latch means to retain said shaft in the automatic off position against movement by the biasing means, and means controlled by said clock mechanism to operate and release said latch means to enable the biasing means to move said shaft from the automatic off position to the on position at a desired time.

3. A timer switch assembly comprising, a clock mechanism having a gear that describes continuous angular movement with intermittent axial displacement at a selected time, a rotary three position switch including a selector shaft and a switch contact carried by said shaft, said shaft having an on position, said shaft being rotatable in one direction from said on position to an off position, said shaft being rotatable in a direction opposite to said one direction from said on position to an automatic off position, a latch lever mounted on said shaft, means normally biasing said lever and said shaft from the automatic off position to the on position, means to retain said lever in the automatic off position against movement by the biasing means, said lever being engaged with said gear in a manner such that axial displacement of said gear at the selected time will move said lever to release said latching means to permit said shaft to rotate from the automatic off position to the on position in response to the urging of said biasing means at the desired time.

4. A timer switch assembly comprising, a clock mechanism, a pair of fixed switch contacts, a selector shaft, a contact bar mounted on said shaft and adapted to connect said contacts, said shaft having an on position wherein said contact bar connects said contacts, said shaft having an off position wherein said contact bar does not connect said contacts, said shaft having an automatic off position wherein said contact bar does not connect said contacts but is adapted to be automatically moved to said on position, spring means normally biasing said shaft to the on position, latch means to retain said shaft in the automatic off position against movement by the spring means, and means controlled by said clock mechanism to operate and release said latch means to enable the spring means to move said shaft from the automatic off to the on position to thus connect the contacts at a desired time.

5. A timer switch assembly comprising a clock mechanism, a switch selector shaft adapted to control the connecting and disconnecting of a plurality of switch contacts, said shaft being selectively rotatably and axially movable to an off position, an on position, and an automatic-off position, a latch lever adapted to rotate with the shaft and to pivot on an axis substantially perpendicular to the shaft rotational axis, means to bias said shaft from the automatic-off position to the on position, latch means to retain the lever and said shaft in the automatic-off position against movement by the biasing means, and means controlled by said clock mechanism to pivot said latch lever to release the lever from the latch means and enable the biasing means to move the shaft from the automatic-off position to the on position to thus connect the switch contacts at a desired time.

6. The switch assembly of claim 6 wherein the latch lever may be manually released from the latch means by rotation of the selector shaft.

7. A timer switch assembly comprising a clock mechanism, a molded cup base having a pair of diametrically spaced contacts and a plurality of internal cam tracks, a switch selector shaft carrying a switch contact bar adapted to be received within the cup base to co-act with the internal cam tracks to connect or disconnect the contacts, said shaft being selectively rotatably and axially movable to an off position wherein the contact bar does not connect the contacts, an on position wherein the contact bar connects the contacts, and an automatic off position wherein the contact bar does not connect the contacts but is in position to be automatically moved to the on position, means to bias said shaft rotatably and axially from the automatic-off position to the on position, latch means to retain said shaft in the automatic-off position against movement of said biasing means, and means controlled by said clock mechanism to release the latch means to enable the biasing means to move the shaft rotatably and axially from the automatic-off position to the on position to thus allow the contact bar to connect the contacts at a desired time.

8. A timer switch assembly comprising a clock mechanism, a switch selector shaft carrying a switch contact bar which extends transversely across one end of the shaft, said shaft having an enlarged portion intermediate the shaft ends, a molded cup base adapted to receive said one shaft end and one end of the enlarged portion, said cup base having a pair of diametrically spaced switch contacts and a plurality of internal cam tracks adapted to guide the contact bar into or out of engagement with the contacts, said shaft being selectively rotatably and axially movable to an off position wherein the contact bar does not engage the contacts, an on position wherein the contact bar engages the contacts, and an automatic-off position wherein the contact bar does not engage the contacts but is in position to be automatically moved to the on position, a latch lever mounted on said shaft to rotate with the shaft and mounted adjacent said enlarged portion to pivot against said portion on an axis substantially perpendicular to the shaft rotational axis, spring means to bias said shaft and said latch lever to move rotatably and axially from the automatic-off position to the on position, latch means to restrict rotary motion of said latch lever to retain the lever and said shaft in the

automatic-off position against movement of the spring means, and means controlled by said clock mechanism to pivot said latch lever to release the lever from the latch means to enable the spring means to move the shaft rotatably and axially from the automatic-off position to the on position to thus allow the contact bar to engage the contacts at a desired time.

9. A timer switch assembly comprising a clock mechanism, a switch selector shaft carrying a switch contact bar which extends transversely across one end of the shaft, a molded cup base adapted to receive said one end of the selector shaft and having a pair of diametrically spaced switch contacts to be connected by said contact bar, said cup base having a first pair of diametrically spaced internal cam tracks each of which extends from a respective one of the contacts and terminates in a detent and having a second pair of diametrically spaced internal cam tracks each of which leads to a respective one of the contacts and opposes a respective one of the first pair of cam tracks, said shaft being selectively rotatable to an off position wherein the contact bar is positioned by the detent of the first pair of cam tracks and does not connect the contacts, and an automatic-off position wherein the contact bar engages the second pair of cam tracks and does not connect the contacts but is in position to be automatically moved to an on position intermediate the off and automatic-off positions wherein the contact bar connects the contacts, means to bias the shaft from the automatic-off position to the on position, latch means to retain the shaft in the automatic-off position against movement of the biasing means, and means controlled by said clock mechanism to release said latch means and enable the biasing means to move the shaft from the automatic-off position to the on position to thus connect the contacts at a desired time.

10. A switch assembly comprising a switch selector

shaft carrying a switch contact bar which extends transversely across one end of the shaft, a molded cup base adapted to receive said one end of the selector shaft and having a pair of diametrically spaced switch contacts to be connected by said contact bar, said cup base having a first pair of diametrically spaced internal cam tracks each of which extends from a respective one of the contacts and terminates in a detent and having a second pair of diametrically spaced internal cam tracks each of which leads to a respective one of the contacts and opposes a respective one of the first pair of cam tracks, said shaft being selectively rotatable to an off position wherein the contact bar is positioned by the detent of the first pair of cam tracks and does not connect the contacts and an automatic-off position wherein the contact bar engages the second pair of cam tracks and does not connect the contacts but is in position to be automatically moved to an on position intermediate the off and automatic-off positions wherein the contact bar connects the contacts, means to bias the shaft from the automatic-off position to the on position, latch means to retain the shaft in the automatic-off position against movement by the biasing means, and signal means to release said latch means and enable the biasing means to move the shaft from the automatic-off position to the on position to thus connect the contacts.

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