July 28, 1970 E. D. BANATHY ET AL 3,522,393

TIME SWITCH

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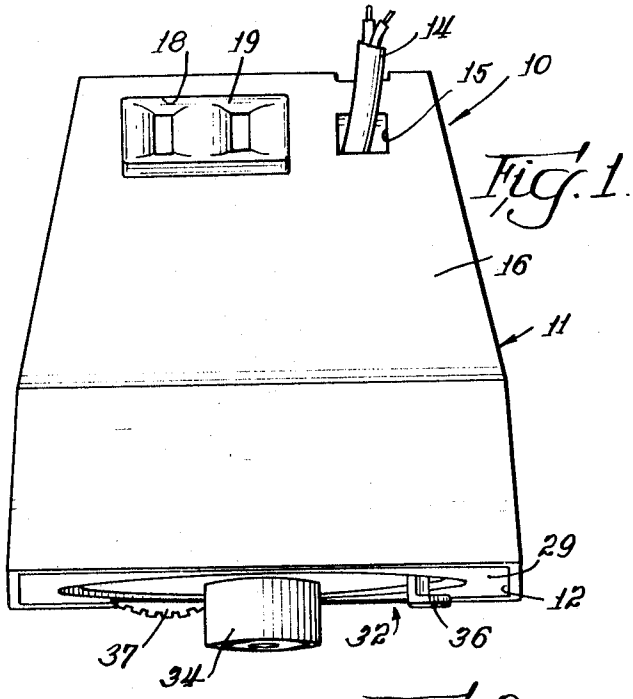

Fig. 1.

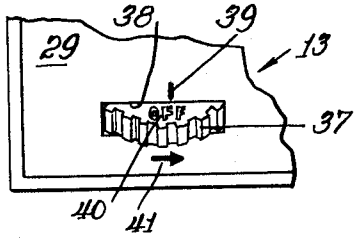

Fig. 4.

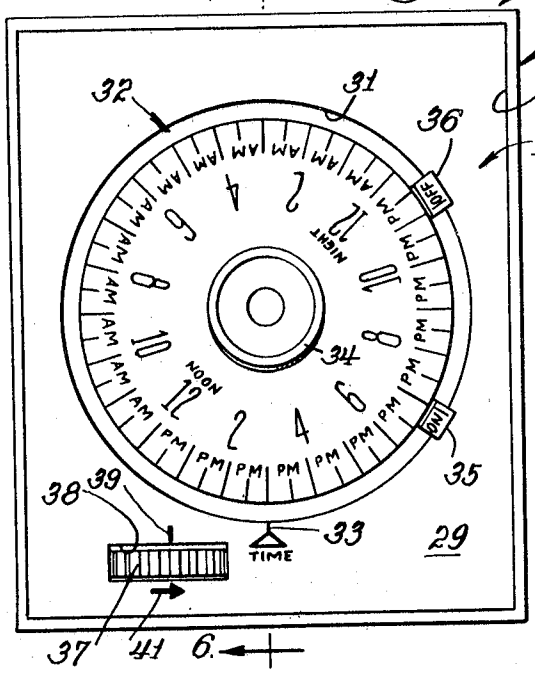

Fig. 2.

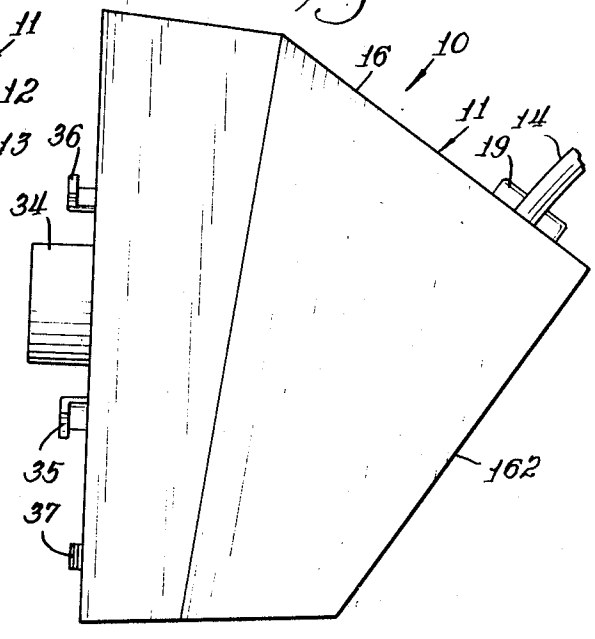

Fig. 3.

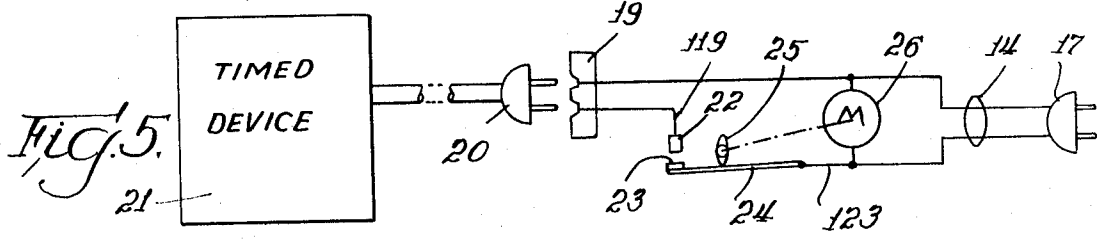

Fig. 5.

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Fig. 6.

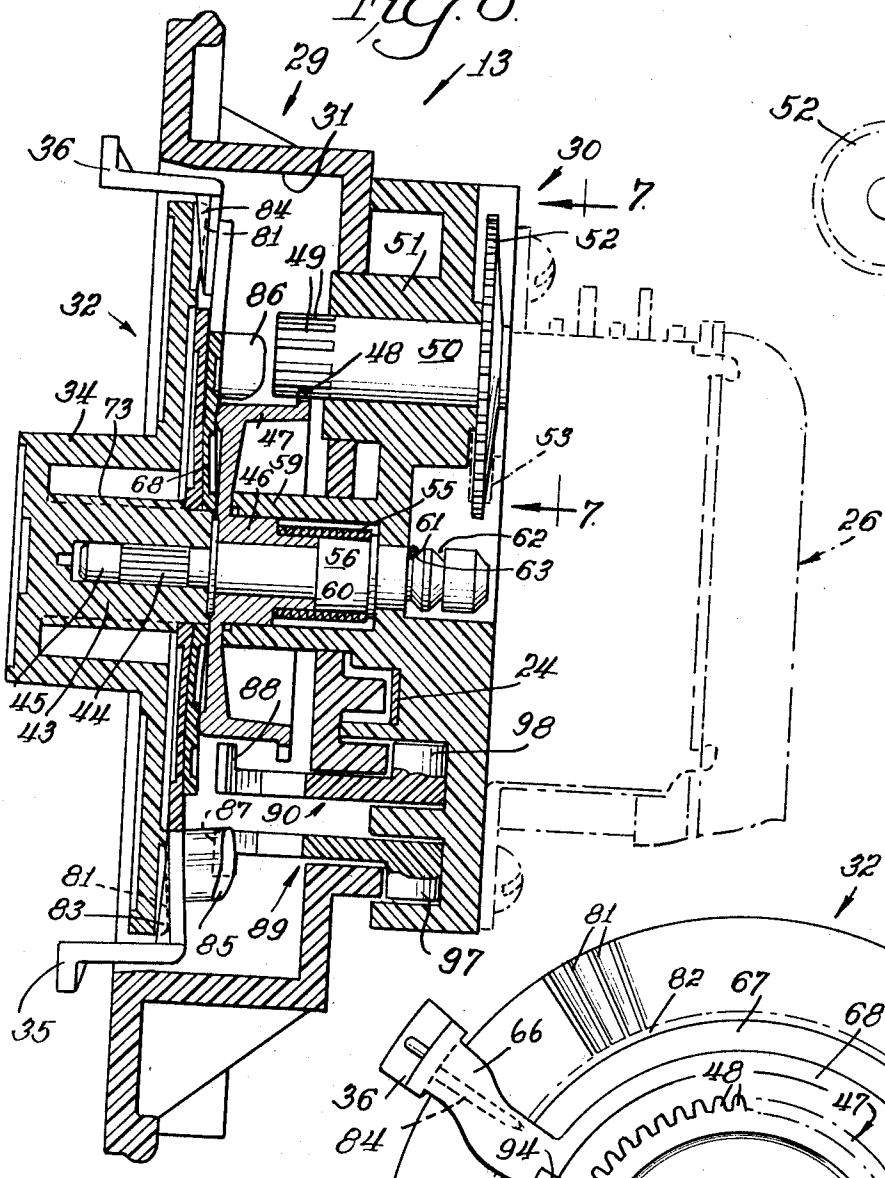

Fig. 7.

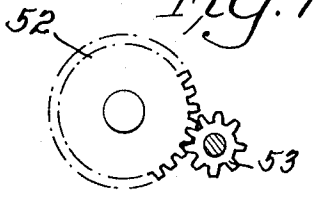

Fig. 8.

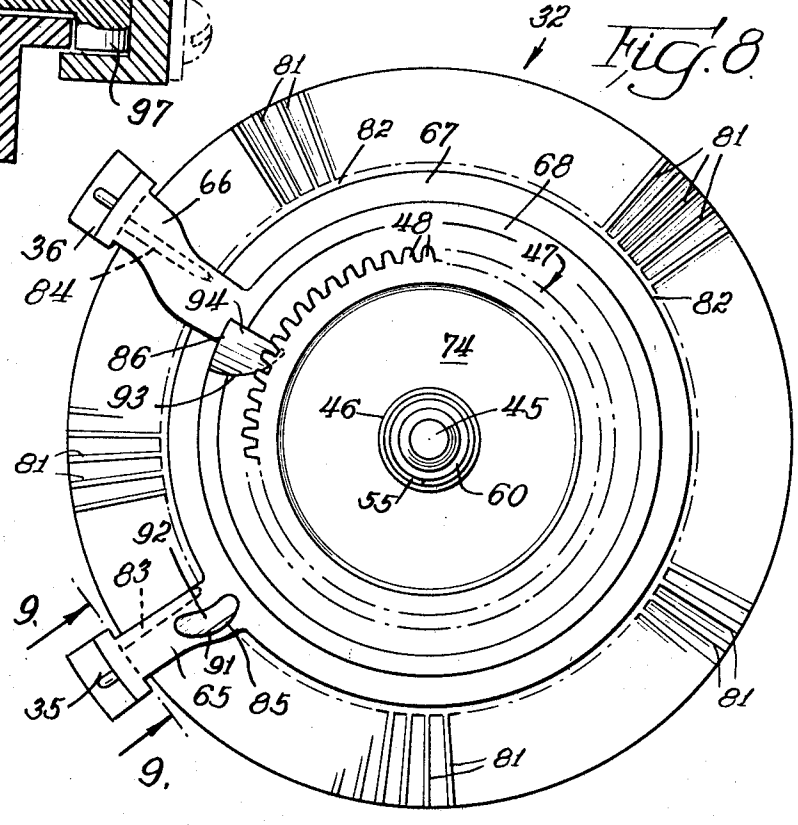

Fig. 9.

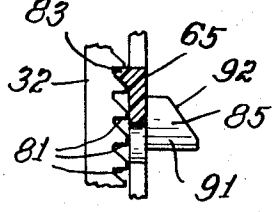

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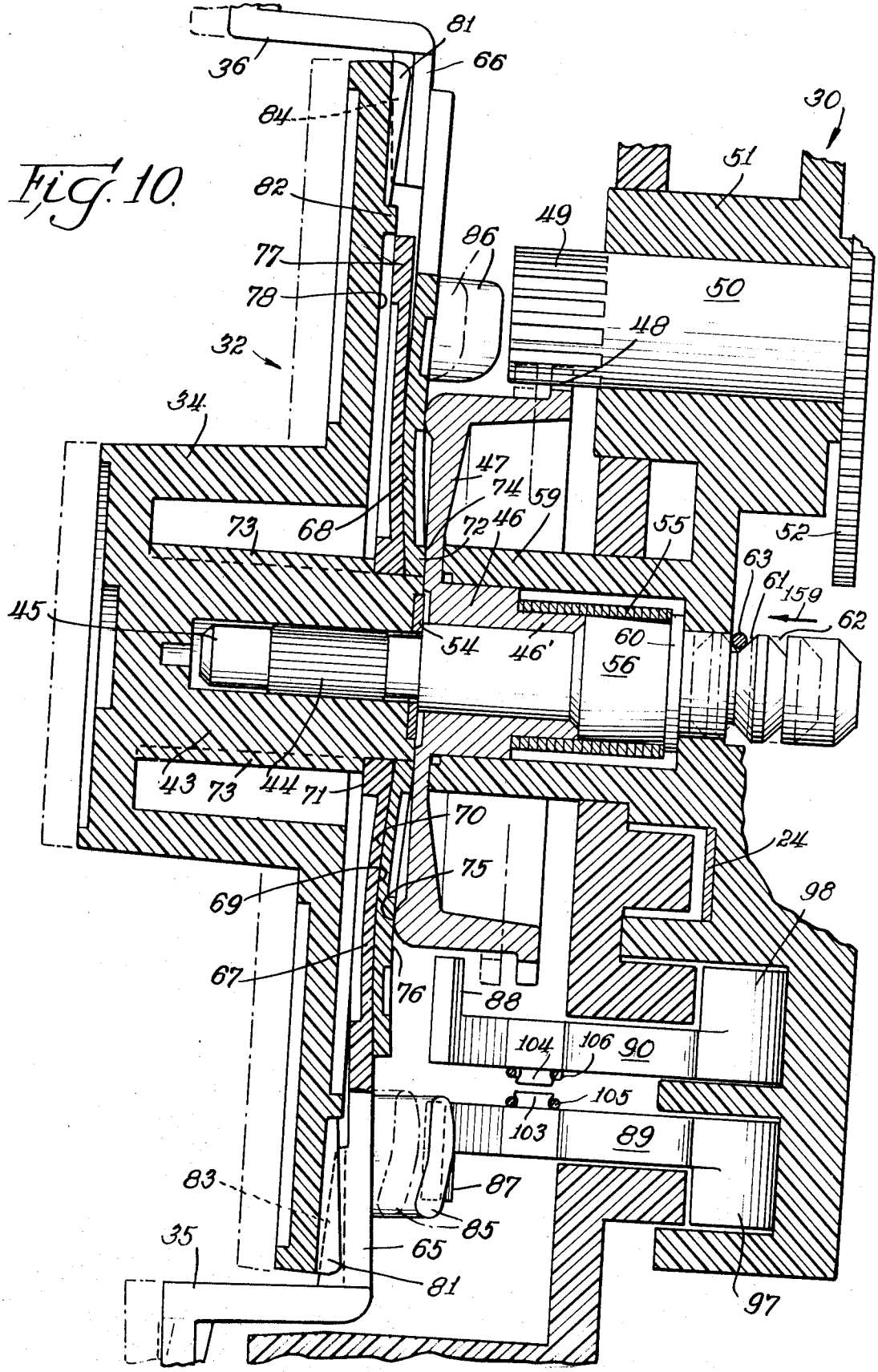
Fig. 10



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TIME SWITCH

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Fig. 11

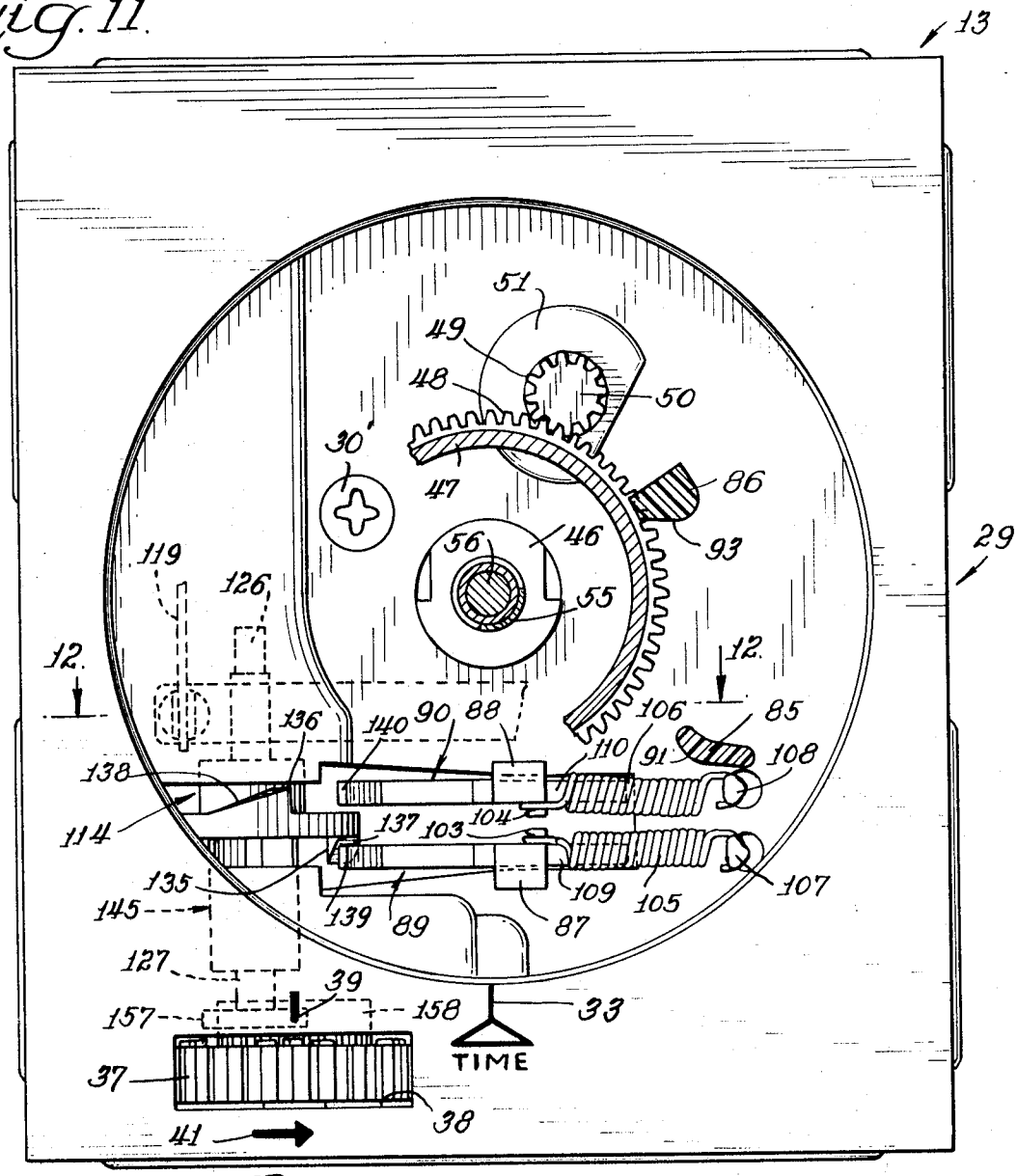
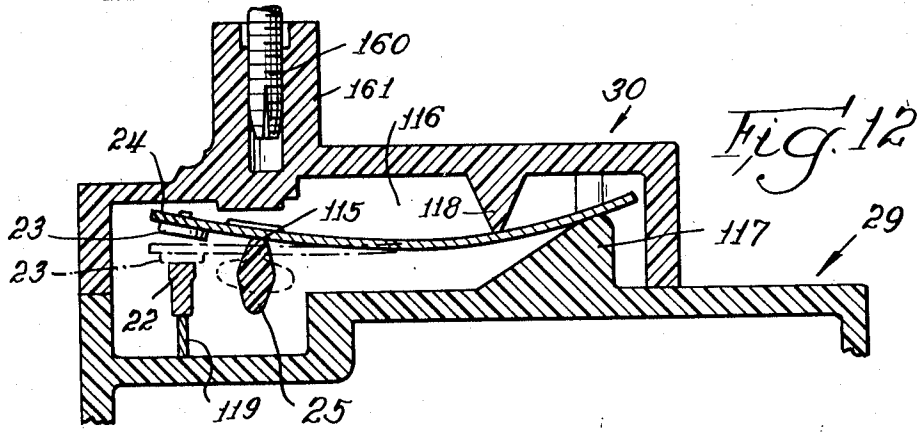


Fig. 12



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TIME SWITCH

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Fig. 17

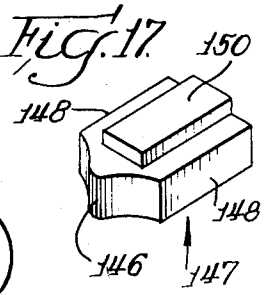


Fig. 13

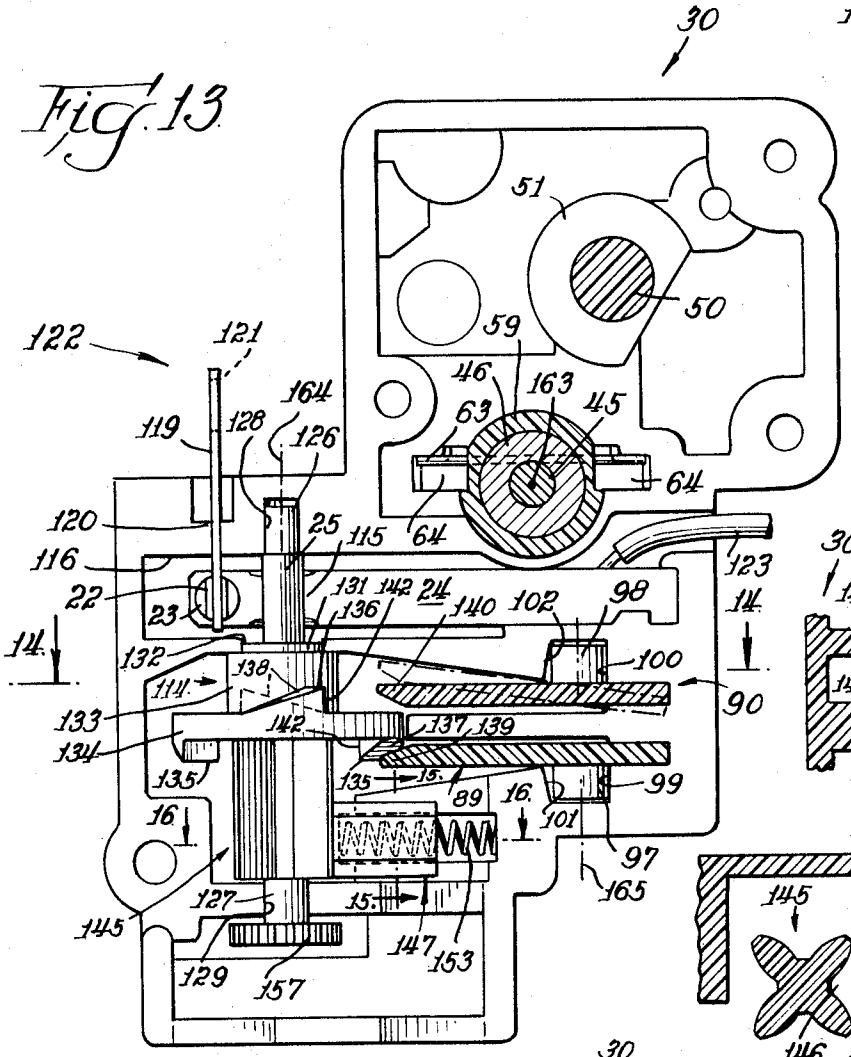
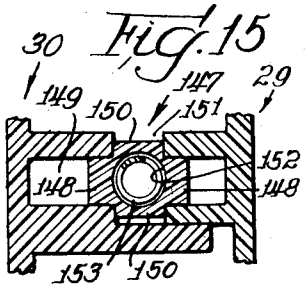


Fig. 15



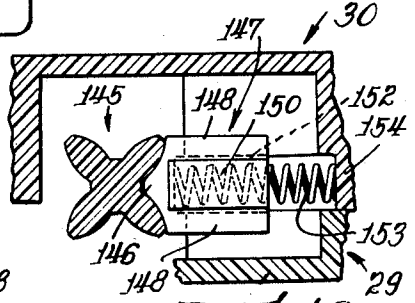


Fig. 16

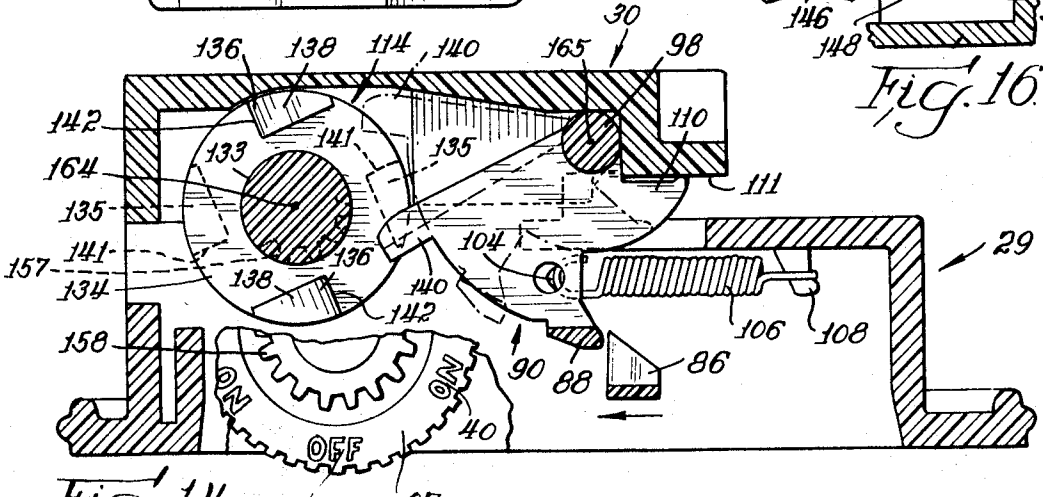


Fig. 14

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TIME SWITCH

Eugene D. Banathy, Skokie, Edward F. Condon, Jr., Oak Park, and Julius R. Rosenski, Chicago, Ill., and Robert K. Pfleger, Miami, Fla., assignors to International Register Company, Chicago, Ill., a corporation of Illinois

Filed July 26, 1968, Ser. No. 747,970
Int. Cl. H01h 43/10
U.S. Cl. 200—38 14 Claims

ABSTRACT OF THE DISCLOSURE

Switch contacts located between front and rear insulating frame sections are closed and opened by a rotatable switch operator that is driven in stepwise fashion by on and off trip levers that are alternately pivoted by switch on and off members adjustably mounted on and rotatable with a time driven dial that is located in a cavity in the front frame section. A manually rotatable dial is geared to the switch operator. The time dial and switch members can be moved axially outwardly to cause them to skip the trip levers. An insulating housing open on one side encloses the frame sections.

The time switch herein disclosed is an improvement over the time switch of Gallagher et al. U.S. Pat. 2,824,-181, issued Feb. 18, 1958.

Among the objects of this invention are: To provide a time switch for turning on and off lights, radios, small electric appliances and the like at preselected times in a 24 hour period in a new and improved manner; to locate the switch contacts within an insulating frame; to employ a rotatable switch operator for sequentially closing and opening the switch contacts; to rotate the switch operator in a stepwise fashion by a pair of trip levers pivotally mounted on the frame; to pivot the trip levers for independent action against the biasing action of springs by switch on and off members adjustably mounted on and rotatable with a time driven dial; to employ a spring pressed dog to complete each step of the rotation of the switch operator; to rotate the switch operator manually; and to enclose the frame in an insulating housing.

According to this invention an insulating frame comprising front and rear sections has mounted therebetween stationary and movable switch contacts, the latter being carried by a resilient switch blade. A two lobe cam on a switch operator rotatably mounted between the frame sections engages the switch blade to close and open the contacts twice for each revolution of the switch operator. Formed integrally with the switch operator is a disc section that carries a pair of diametrically opposed teeth on each side. The teeth are inclined on one side to permit detents of pivotally mounted trip levers to bypass them in one direction and to engage the other side in the opposite direction under the urging of coil tension springs. The trip levers are sequentially pivoted by switch on and off members adjustably monuted on and rotatable with a time driven dial. The time driven dial and the switch on and off members can be shifted axially to bypass the trip levers while the dial continues to rotate for time indicating and synchronous purposes. A spring pressed dog, slidable between the frame sections, cooperates with a four lobe cam on the switch operator to complete each step of its rotation. A manually operable dial is geared to the switch operator to close and open the switch contacts independently of and in accordance with operation thereof under the control of the time driven switch on and off members. An insulating housing having an open side encloses the frame which closes the open side.

In the drawings: FIG. 1 is a top plan view at full size of a time switch embodying this invention. FIG. 2 is a view, in front elevation, of the time switch shown in FIG. 1. FIG. 3 is a view, in side elevation, of the time switch as shown in FIG. 2. FIG. 4 is a view of a portion of the frame where the manually operable dial is located. FIG. 5 shows, diagrammatically, the circuit connections that can be employed in practicing this invention. FIG. 6 is a vertical sectional view taken generally along the line **6—6** of FIG. 2 and at an enlarged scale. FIG. 7 is an elevational view along the line **7—7** of FIG. 6 showing the relation between a motor driven pinion and the gear driven thereby. FIG. 8 is a view, in rear elevation, of the time driven dial shown in FIG. 6. FIG. 9 is vertical sectional view taken generally along the line **9—9** of FIG. 8. FIG. 10 is a view at an enlarged scale similar to FIG. 6 to show more clearly certain details of construction. FIG. 11 is an elevational view of the time switch, the time driven dial havng been removed. FIG. 12 is a horizontal sectional view taken generally along the line **12—12** of FIG. 11. FIG. 13 is a view, similar to FIG. 11, with the front frame section removed in order to show the details of construction underneath it. FIG. 14 is a horizontal sectional view taken generally along the line **14—14** of FIG. 13. FIG. 15 is a vertical sectional view taken generally along the line **15—15** of FIG. 13. FIG. 16 is a horizontal sectional view taken generally along the line **16—16** of FIG. 13. FIG. 17 is a perspective view of the spring pressed dog used for completing a step in the rotation of the switch operator.

In FIGS. 1, 2 and 3 reference character **10** designates, generally, a time switch in which this invention is embodied. It includes a housing **11** of suitable plastic material that is provided with an inclined rectangular opening **12** at one side which is closed by an inclined frame of plastic insulating material which is indicated, generally, at **13**. A two conductor cord **14** extends through an opening **15** in a top wall **16** of the housing **11** to permit connection to a suitable source of alternating current. As indicated in FIG. 5, a plug **17** is connected to the cord **14** for insertion in a conventional wall socket. The top wall **16** is provided with an opening **18** in which an outlet socket **19** is positioned. As shown in FIG. 5 the outlet socket **19** is arranged to receive a plug **20** that is connected to a timed device **21**, such as a lamp, radio, small electric appliance or the like. The circuit is completed from the two conductor cord **14** to the outlet socket **19** through a stationary switch contact **22** and a movable switch contact **23** carried by a resilient switch blade **24**. A two lobe cam **25**, driven by a synchronous motor **26**, is arranged to effect the closing and opening of the switch contacts **22** and **23** at certain preselected times as will be described hereinafter.

In FIG. 6 it will be noted that the inclined frame **13** of plastic insulating material is made up of a front frame section that is indicated, generally, at **29** and a rear frame section that is indicated, generally, at **30**. The frame sections **29** and **30** are held in juxtaposed relation by a screw **30'**, FIG. 11.

The front frame section **29** has a circular cavity **31** within which there is positioned a time driven dial that

is indicated, generally, at 32. The time driven dial 32 is divided, as shown in FIG. 2, into 24 hour divisions appropriately marked and is arranged to be rotated once each 24 hours. It is marked with the hours from noon to midnight and midnight to noon and is formed of suitable plastic. It is arranged to rotate relative to an index 33 on the face of front frame section 29 which indicates with respect to the time driven dial 32 the time of day or night. Molded integrally with the time driven dial 32 is a knob 34. Mounted on the rear side of the time driven dial 32, extending to the front over the periphery thereof and rotatable therewith, are an on switch member 35 and an off switch member 36 both formed of suitable plastic material.

As shown at the lower left corner of FIGS. 2 and 4 there is provided a manually operable dial 37 of suitable plastic a portion of which extends through an opening 38 in the front frame section 29. The dial 37 is arranged to be rotated with respect to an index 39 and carries indicia 40 to indicate the open or closed condition of the contacts 22 and 23. An arrow 41 on the face of the front frame section 29 below the dial 37 indicates the direction in which it should be rotated manually.

In FIGS. 6 and 10 it will be noted that a central hub 43 is formed integrally with the knob 34 and is non-rotatably mounted on a knurled section 44 of a shaft 45 that is journaled in a bearing hub 46 that is integral with a metallic cup shaped gear 47. Gear teeth 48 are formed along the periphery of the gear 47 for meshing engagement and endwise slidable movement with respect to pinion teeth 49 at one end of a shaft 50 of suitable plastic that is journaled in a bearing 51 in the rear frame section 30. At the other end of the shaft 50 a gear 52 is formed integrally therewith and it is arranged to be engaged by a pinion 53, FIG. 7, that is driven by the synchronous motor 26 which is suitably mounted on the rear side of the rear frame section 30. The gear 52 is arranged to be rotated at one revolution each 2½ hours by the pinion 53 which rotates one revolution each hour. It will be understood that other gear ratios can be employed so long as the arrangement is such that the time driven dial 32 rotates once each 24 hours. Interposed between the inner end of the central hub 43 and the juxtaposed portion of the bearing hub 46 of the metallic cup shaped gear 47 is a washer 54 which limits the extent to which the central hub 43 can be forced over the knurled section 44.

It is desirable to permit clockwise rotation of the time driven dial 32 manually for time setting purposes. Because of the high gear ratio from the synchronous motor 26, it is not feasible to provide for rotating the time driven dial 32 without taking this into account. For this purpose a wrap around spring 55 provides a one way clutch between the shaft 45 on which the time driven dial 32 is mounted and the bearing hub 46 that forms an integral part of the metallic cup shaped gear 47. As shown in FIG. 10 one end of the spring 55 overlies a reduced diameter section 46' of the hub 46 while the other end overlies a tapered hub section 56 of the shaft 45.

For a purpose that will be outlined in detail hereinafter the time driven dial 32 and shaft 45 are movable endwise from the position shown by full lines in FIG. 10 to the broken line position. To permit this endwise movement the bearing hub 46 is journaled in a bearing sleeve 59 that is formed integrally with the rear frame section 30. A flange 60 integral with the shaft 45 limits the inward movement of it relative to the rear frame section 30. Spaced grooves 61 and 62 are formed in the inner end of the shaft 45 for the purpose of positively positioning it as shown by full lines or in the alternate position as shown by broken lines. A spring wire 63, located behind ears 64, FIG. 13, is arranged to mesh with either the groove 61 or the groove 62 to permit endwise movement of the shaft 45. It will be understood that on application of sufficient endwise force to the shaft 45, the spring wire 63 is displaced from one or the other of the grooves 61 or 62 and seats itself in the other groove on completion of the endwise shifting in one direction or the other.

In FIGS. 8 and 10 it will be seen that the on and off switch members 35 and 36 include radial arms 65 and 66 which extend from annular flexible discs 67 and 68 having their flat sides 69 and 70 juxtaposed. Hub flanges 71 and 72 bear against ribs 73 on the central hub 43 and against the bottom wall 74 of the metallic cup shaped gear 47 respectively. An annular rib 75 on the metallic cup shaped gear 47 bears against an annular rib 76 on the flexible disc 68 with the arrangement being such that, as shown in FIG. 10, the discs 67 and 68 are flexed between their inner and outer peripheries and thus are placed somewhat under tension to act in a direction toward the rear side of the time driven dial 32. However, as shown, the front side of the annular disc 67 carries an annular rib 77 which is spaced from the rear surface 78 of the time driven dial 32. The arrangement is such that the on and off switch members 35 and 36 can be rotated relative to each other and relative to the time driven dial 32 to set with respect thereto the time at which the contacts 22 and 23 should be closed and subsequently the time at which they should be opened.

In FIG. 8 inclined ratchet teeth 81 are shown as being formed along the periphery of the rear side of the time driven dial 32. For illustrative purposes it is pointed out that there are ninety-six inclined ratchet teeth and that they extend radially from an annular rib 82 which surrounds the rear surface 78. Teeth 83 and 84 on the forward sides of the arms 65 and 66 are arranged to engage the inclined ratchet teeth 81 to the end that they are driven thereby on rotation of the time driven dial 32 by the synchronous motor 26. The radial arms 65 and 66 are sufficiently flexible to permit the teeth 83 and 84 to ratchet past the teeth 81 on the rear side of the time driven dial 32.

Extending rearwardly from the on and off switch members 35 and 36 are detents 85 and 86, the latter being radially inwardly further than the former for the purpose of engaging, respectively, arms 87 and 88, FIG. 11, of on and off trip levers 89 and 90 that are formed of suitable plastic. As shown in FIGS. 8 and 9 the detent 85 has a curved side 91 for engaging the arm 87 of the on trip lever 89 and an inclined side 92 for clearing it after it has moved past. Similarly, the detent 86, FIG. 8, has a curved side 93 to engage the arm 88 and an inclined side 94 to clear it after the same has been passed.

As shown in FIG. 13 hubs 97 and 98 are formed integrally with the trip levers 89 and 90 and they are located in slots 99 and 100, respectively, in the rear frame section 30 for pivotal movement under the control of the detents 85 and 86 as they rotate past the arms 87 and 88. The slots 99 and 100 have inclined sides 101 and 102 to permit shifting of the trip levers 89 and 90 sidewise, for example to the position shown by broken lines for the trip lever 90 for a purpose that presently will be apparent. Lugs 103 and 104, FIGS. 11 and 14, are formed integrally with the trip levers 89 and 90 for receiving one end of each of coil tension springs 105 and 106 the other ends of which are secured to lugs 107 and 108 that are molded integrally with the front frame section 29. Coil tension springs 105 and 106 bias the trip levers 89 and 90 to the position shown in FIGS. 11 and 14. Arms 109 and 110 limit the pivotal movement of the trip levers 89 and 90 under the influence of the springs 105 and 106 by engaging a surface 111 on the rear frame section 30 as shown more clearly in FIG. 14.

In FIG. 13 there is illustrated, generally, at 114 a switch operator which carries the two lobe cam 25 for engaging the resilient switch blade 24 to effect closing and opening of the contacts 22 and 23. The switch operator 114 is formed of plastic and is rotatably mounted between the front and rear frame sections 29 and 30. As shown in FIG. 12 the two lobe cam 25 is arranged to engage the resilient switch blade 24 at 115 adjacent the

movable contact **23**. The switch blade **24** is located in a slot **116** that is formed in the rear frame section **30**. The end of the switch blade **24** opposite the movable switch contact **23** is held captive between an extension **117** from the front frame section **29** and an extension **118** from the rear frame section **30** with the arrangement being such that the movable switch contact **23** normally is biased into contact engagement with the stationary contact **22** and to the position shown by broken lines in FIG. 12. The two lobe cam **25** engages the switch blade **24** at **115** twice during each revolution to lift the movable switch contact **23** out of engagement with the stationary switch contact **22**. The stationary switch contact **22** is carried by a contact support plate **119** which is located in a slot **120**, FIG. 13, in the rear frame section **30**. A terminal section **121** extends rearwardly through an opening **122** in the rear frame section **30** to permit connection to a conductor. A conductor **123** is connected to the switch blade **24** as shown here in FIG. 13.

Referring again to the switch operator **114** as shown in FIG. 13, it will be noted that it has journals **126** and **127** at its ends which are located in bearing slots **128** and **129** that are molded in the rear frame section **30**. Just below the two lobe cam **25** there is located an integrally formed relatively narrow journal **131** that is positioned in a bearing slot **132** which is molded in the rear frame section **30**. A hub **133**, larger in diameter than the journal **131**, extends there below and to the disc section **134** which is positioned between the distal ends of the on and off trip levers **89** and **90**. As shown more clearly in FIG. 14 pairs of diametrically opposite teeth **135** and **136** are provided on the under and upper sides, respectively of the disc section **134**. The pairs of teeth **135** and **136** are inclined on one side as indicated at **137** and **138** to permit detents **139** and **140** at the distal ends of the trip levers **89** and **90** to bypass them. The leading edges **141** and **142** of the teeth **135** and **136** are arranged to be engaged by the detents **139** and **140**, as the case may be, under the influence of the respective spring **105** or **106**, FIG. 11, to rotate the disc section **134** and thereby the switch operator **114** through one step of its four step operation in rotating through a complete revolution.

Below the disc section **134** and formed integrally with the switch operator **114** is a four lobe cam **145** that is illustrated more clearly in FIG. 16. In order to complete each step for the one fourth revolution of the switch operator **114** for each pivotal movement of one or the other of the trip levers **89** or **90** a nose portion **146** of a spring pressed dog **147** of plastic is arranged to engage between adjacent lobes. The dog **147** has side flanges **148**, FIGS. 15 and 17, that are slidable in slot **149** that is formed jointly by the front and rear frame sections **29** and **30**. Top and bottom flanges **150** of the dog **147** are slidable in a slot **151** that also is formed jointly by the front and rear frame sections **29** and **30**. The dog **147** has a central bore **152** for receiving a coil compression spring **153** that extends outwardly and reacts against a wall **154** of the rear frame section **30**.

In order to provide for manual closing and opening of the switch contacts **22** and **23** a pinion **157** is formed integrally with the journal **127** at the lower end of the switch operator **114**. It will be understood that the journal **127** and the pinion **157** are molded separately from the remaining portion of the switch operator **114** and then are suitably joined thereto to provide a unitary construction. Thus the journal **127** and pinion **157** constitute a separate plastic part. The pinion **157** is arranged to mesh with a gear **158**, FIG. 14, that is formed integrally with the manually operable dial **37**. Thus, when the dial **37** is rotated, it rotates the switch operator **114** independently of its operation by the trip levers **89** and **90** and to the next position of the switch contacts **22** and **23**.

Referring to FIG. 10, the full line showing of the time driven dial **32** corresponds to the operative positioning of the detents **85** and **86** for engaging and operating the trip levers **89** and **90**. When it is desired that no operation of the switch contacts **22** and **23** take place, the knob **34** is grasped and is pulled outwardly to the broken line position in the direction indicated by arrow **159**. This shifts the shaft **45** outwardly and displaces the spring wire **63** from the annular groove **61** and it then engages groove **62** to hold the detents **85** and **86** out of operative engagement with the arms **87** and **88** of the trip levers **89** and **90**. When the detents **85** and **86** pass the ends of the arms **87** and **88** in the withdrawn position shown by broken lines in FIG. 10, only a slight engagement with the arms **87** and **88** takes place but, due to the flexibility of the detents **85** and **86** and the tension applied by the springs **105** and **106**, no pivotal movement of the trip levers **89** and **90** takes place. When the automatic operation of the switch contacts **22** and **23** is to be resumed, the knob **34** and time driven dial **32** are moved inwardly to displace the spring wire **63** from the groove **62** and arrange for its reception in the groove **61**.

Any suitable means can be employed for securing the housing **11** to frame **13**. As shown in FIG. 12 mounting screw **160**, which may be one of two mounting screws, extends into a boss **161** that is formed integrally with the rear frame section **30**. It will be understood that the mounting screw **160** has a headed end and extends through a rear wall **162**, FIG. 3, of the housing **11**.

Referring to FIGS. 13 and 14, the relationship between certain axes of operation is illustrated. The axis of rotation of shaft **45** is indicated at **163** in FIG. 13. This axis is transverse to the front and rear frame sections **29** and **30**. The axis of rotation of the switch operator **114** is indicated at **164** in FIGS. 13 and 16. It will be noted that the axis **164** is in a plane that the perpendicular to the axis **163** of the shaft **45**. The axis **165** of pivoting movement of the hubs **97** and **98** of the trip levers **89** and **90** is parallel to the axis **164** of rotation of the switch operator **114**.

In describing the operation of the time switch **10**, it will be assumed that plug **17**, FIG. 5, is inserted in a socket that is energized with alternating current at suitable voltage and frequency. For example, the voltage may be 115 volts and the frequency 60 Hz. The plug **20** is inserted in the outlet socket **19** and the time device **21** is prepared for energization or deenergization, depending upon whether the switch contacts **22** and **23** are opened or closed or are in the off or on position. The time driven dial **32** is rotated in a clockwise direction to position it with respect to the index **33** to show the time of day or night that the time switch **10** is set so that from then on the actual time will be indicated. The knob **34** then is briefly held against rotation and the on and off switch members **35** and **36** are shifted in clockwise directions to the desired times at which the switch contacts **22** and **23** are to be closed and to be opened. Assuming that the first operation is closure of the contacts **22** and **23**, the synchronous motor **26** continues to drive the dial **32** and therewith the on and off switch members **35** and **36** until the detent **85**, FIG. 11, which is radially outwardly further than the detent **86**, engages the arm **87** of the trip lever **89**. Continued movement of the detent **85** carries with it the trip lever **89** and the detent **139** rides up the inclined side **137** of the adjacent tooth **135** while the spring **105** is tensioned. The movement continues until the detent **139** passes beyond the opposite side **141** of the tooth **135** and then the trip lever **89** shifts from the previously sidewise displaced position to a position registering with the side **141**. At this time the detent **85** has bypassed the arm **87**. There is no longer any restraint on the trip lever **89** and the spring **105** then acts to return it to the non operated position or to the position shown for the trip lever **90** in FIG. 14. This is accompanied by rotation of the switch operator **114** together with rotation of the four lobe cam **145** which moves the spring pressed dog **147** out of its position between adjacent lobes and causes it to enter between the next pair under the influence of the coil compression

spring **153** which has sufficient force to complete the quarter revolution of the switch operator **114** and to rotate the two lobe cam **25**, FIG. 12, to the broken line position where the contact **23** is permitted to move into engagement with the stationary contact **22** and complete the circuit for the timed device **21**. No further action takes place automatically until the detent **86** engages the arm **88** of the off trip lever **90** as the result of which the foregoing sequence of operations is repeated and the switch operator **114** is rotated through another quarter revolution accompanied by rotation of the two lobe cam **25** to the position shown by full lines in FIG. 12 and separation of the movable contact **23** from the stationary contact **22**. Thereupon the timed device **21** is deenergized.

For manual operation the dial **37**, FIG. 14, is rotated in the direction of the arrow **41**, FIG. 2, to rotate the switch operator **114** independently of its rotation under the control of the detents **85** and **86** as previously described. It will be understood that, if the contacts **22** and **23** are engaged at the time that the manually operable dial **37** is rotated to the off position, the next automatic operation normally would be by the detent **86**. However, when it pivots the off trip lever **90** in the manner described, its detent **140** will not have for operation one or the other of the teeth **136**. Thus, only the off trip lever **90** will be operated but there will be no corresponding rotation of the switch operator **114**.

What is claimed as new is:

1. A time switch comprising
a frame,
a time driven dial rotatably mounted on said frame,
switch on and switch off members rotatable with said dial,
a switch operator rotatably mounted on said frame,
switch contacts operated by said switch operator,
an on trip lever pivotally mounted on said frame and operable by said switch on member to close said switch contacts,
an off trip lever pivotally mounted on said frame and operable by said switch off member to open said switch contacts,
said switch operator including a disc section located between said trip levers and having teeth on opposite sides,
said teeth being inclined on one side to permit detents on said levers to bypass said teeth when said levers are pivoted by said on and off switch members and then to engage the opposite sides of said teeth, and
a spring individual to each lever tensioned as it is pivoted by the switch member individual thereto for rotating said switch operator to its next position after disengagement by the respective switch member.

2. A time switch according to claim **1** wherein said switch on and switch off members are individually adjustable about said dial to close and open said contacts at various times.

3. A time switch according to claim **1** wherein said dial is shiftable axially to move said switch on and switch off members to inoperative positions with respect to said on and off trip levers.

4. A time switch according to claim **1** wherein there are two diametrically located teeth on each side of said disc section.

5. A time switch according to claim **4** wherein said switch operator includes a symmetrical two lobe cam for closing and opening said switch contacts twice during each revolution.

6. A time switch according to claim **5** wherein
said switch operator includes a symmetrical four lobe cam, and
a spring biased dog slidable on said frame is arranged to enter the space between adjacent lobes to complete rotation of said switch operator to its next position.

7. A time switch comprising

an insulating frame including front and rear frame sections,
a time driven dial rotatably mounted on said frame,
switch on and switch off members rotatable with said dial,
a switch operator rotatably mounted on said frame,
switch contacts located between said frame sections and operated by said switch operator,
an on trip lever pivotally mounted on said frame and operable by said switch on member to close said switch contacts,
an off trip lever pivotally mounted on said frame and operable by said switch off member to open said switch contacts,
said switch contacts including a stationary contact and a movable contact carried by a resilient blade, and
extensions from said front and rear frame section engaging said blade at spaced locations therealong and biasing said movable contact into engagement with said stationary contact.

8. A time switch according to claim **7** wherein
said trip levers are mounted on said rear frame section, and
a spring connected to said front frame section is connected to each trip lever for biasing it to operate said switch contacts.

9. A time switch according to claim **7** wherein
said front frame section has a cavity within which said time dial is located, and
a housing open at one side encloses said front and rear frame sections.

10. A time switch according to claim **1** wherein a manual operator on said frame is connected to said switch operator for manually closing and opening said switch contacts.

11. A time switch according to claim **10** wherein
said switch operator includes a pinion, and
said manual operator is a dial rotatably mounted on said frame and includes a gear meshing with said pinion.

12. A time switch comprising
a frame,
a time driven dial rotatably mounted on said frame,
switch on and switch off members rotatable with said dial,
a switch operator rotatably mounted on said frame,
switch contacts operated by said switch operator,
an on trip lever pivotally mounted on said frame and operable by said switch on member to close said switch contacts,
an off trip lever pivotally mounted on said frame and operable by said switch off member to open said switch contacts,
means mount said switch operator to rotate about an axis in a plane that is perpendicular to the axis of rotation of said time dial, and
means mount said trip levers to rotate about an axis parallel to said axis of said switch operator.

13. A time switch comprising
a frame,
a time driven dial rotatably mounted on said frame,
switch on and switch off members rotatable with said dial,
a switch operator rotatably mounted on said frame,
switch contacts operated by said switch operator,
an on trip lever pivotally mounted on said frame and operable by said switch on member to close said switch contacts,
an off trip lever pivotally mounted on said frame and operable by said switch off member to open said switch contacts,
said switch on member including an annular flexible disc spaced from said time driven dial,
said switch off member including an annular flexible

disc juxtaposed to said annular flexible disc of said switch on member, and

a member rotatable with said time driven dial including an annular rib bearing against said annular flexible disc of said switch off member and holding both annular flexible discs in flexed condition toward said time driven dial.

14. A time switch according to claim **13** wherein said time driven dial, said switch on and off members and said member including said annular rib are shiftable unitarily and axially to move said switch on and off members to inoperative positions with respect to said on and off trip levers.

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