United States Patent

[11] 3,588,391

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Chicago, Ill.

[54] PLUG-IN TWENTY-FOUR HOUR TIME SWITCH

14 Claims, 20 Drawing Figs.

[52] **U.S. Cl.** **200/6BB,** 74/568T, 200/38A, 200/38B, 200/38D, 200/153L

[51] **Int. Cl.** **H01h 19/00,** H01h 7/08, H01b 43/10

[50] **Field of Search** ..... 200/38 (A-D), (Inquired), 6. 153.11. 166.1; 74/568 (Timer)

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Primary Examiner—Milton O. Hirshfield
Assistant Examiner—Mark O. Budd
Attorney—Robert R. Lockwood

ABSTRACT: A two part insulating housing has a 24 hour time dial rotatably mounted thereon and driven by a synchronous motor within the housing. Adjustable time-on and time-off members on the dial operate radial arms from a square cam which rotates about an axis transverse to the axis of the dial to open and close switch contacts at the preset times. Leaf springs react against opposite sides of the square cam to operate the contacts with a snap action and to floatingly support the cam and contact operating shaft connected thereto. Spring contacts of an outlet socket are energized on closure of the switch contacts. Plug-in contact terminals are energized from a conventional wall socket. The mechanism in the housing is assembled on the rear side of the front housing and is held in place principally by bosses extending from the front side of the rear housing.

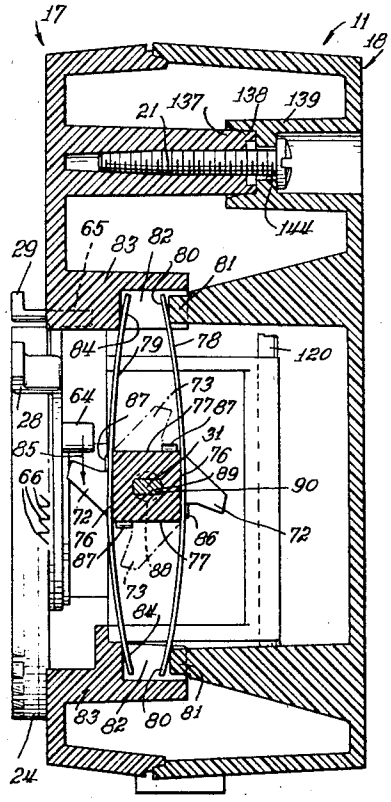


Fig. 1

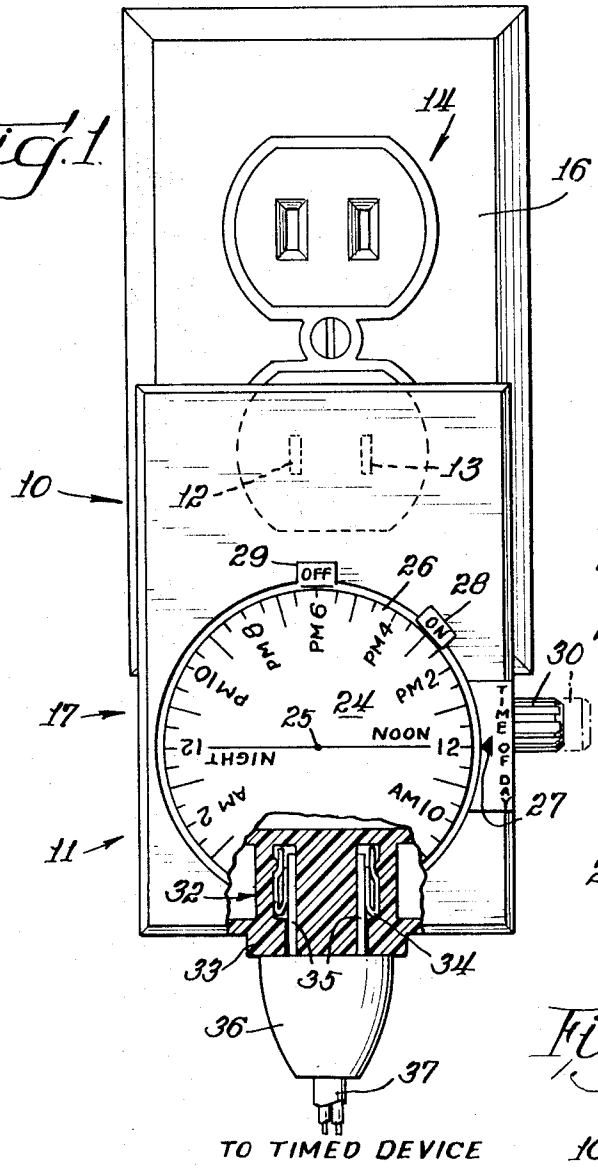


Fig. 2

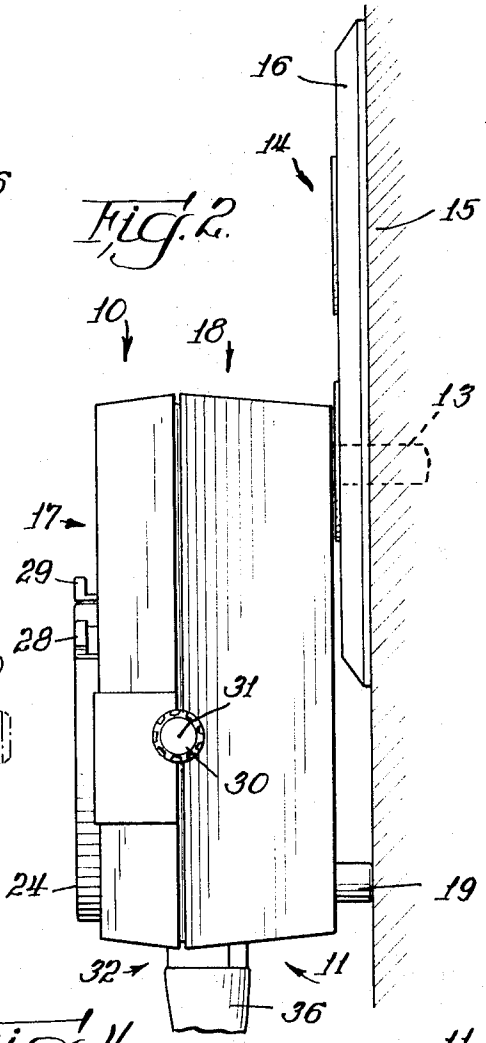


Fig. 3

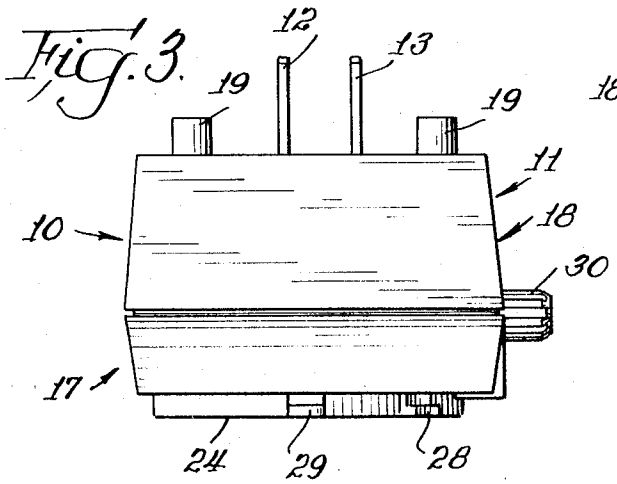
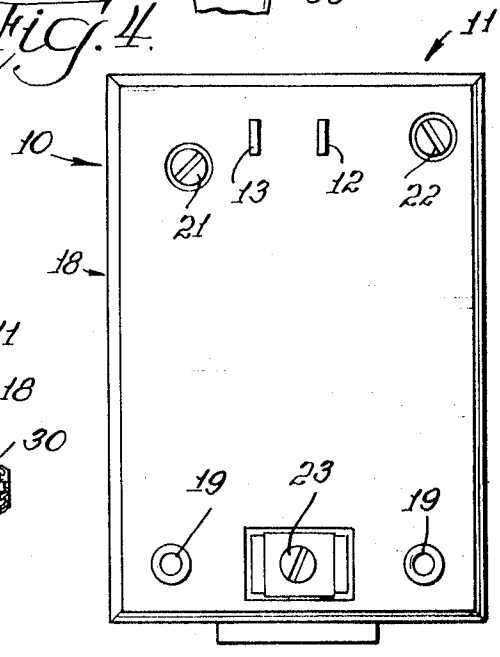


Fig. 4



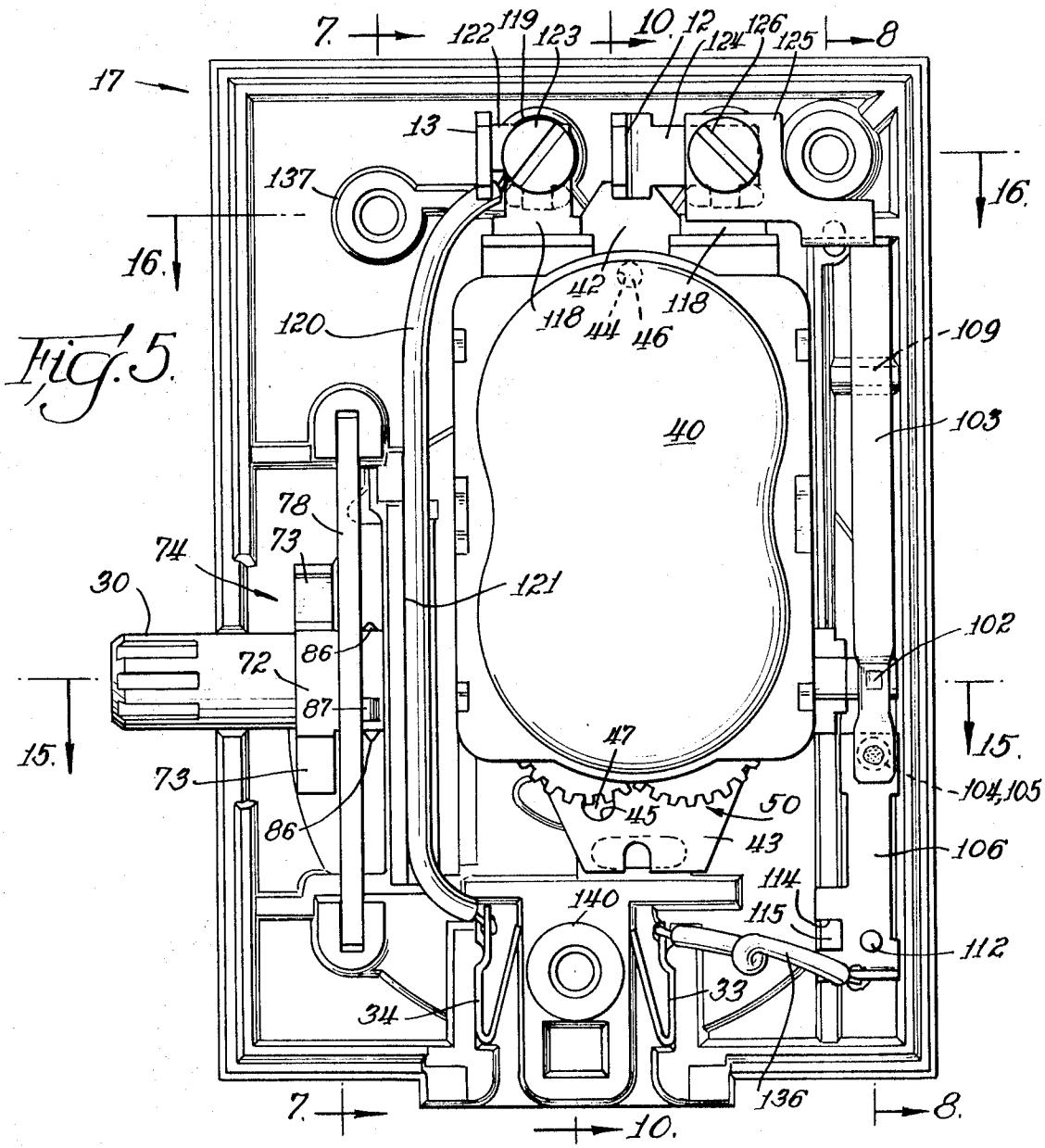

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Fig. 5.

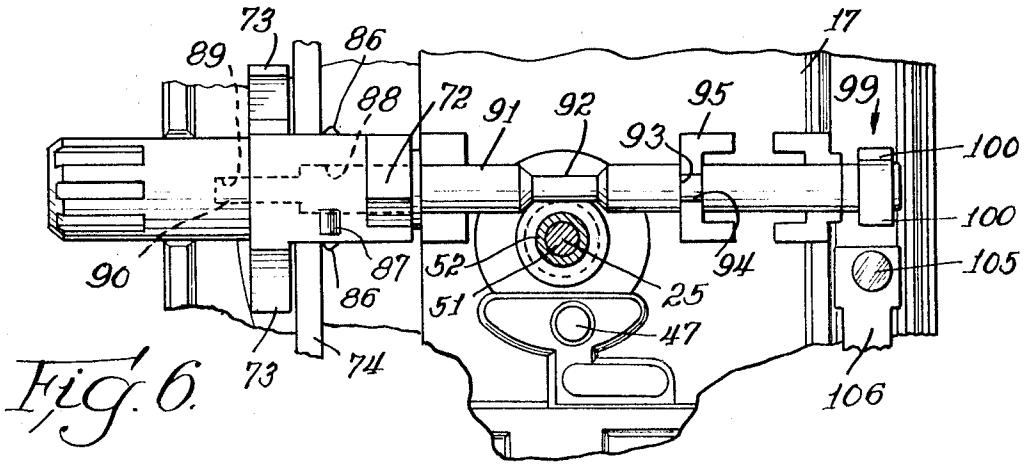

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Fig. 6.

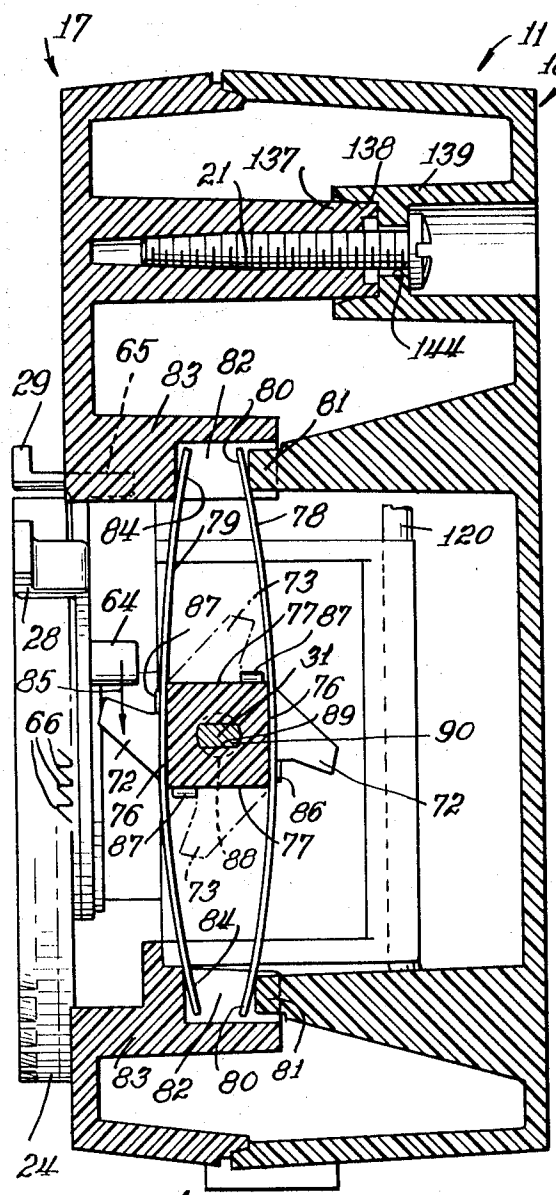


Fig. 7.

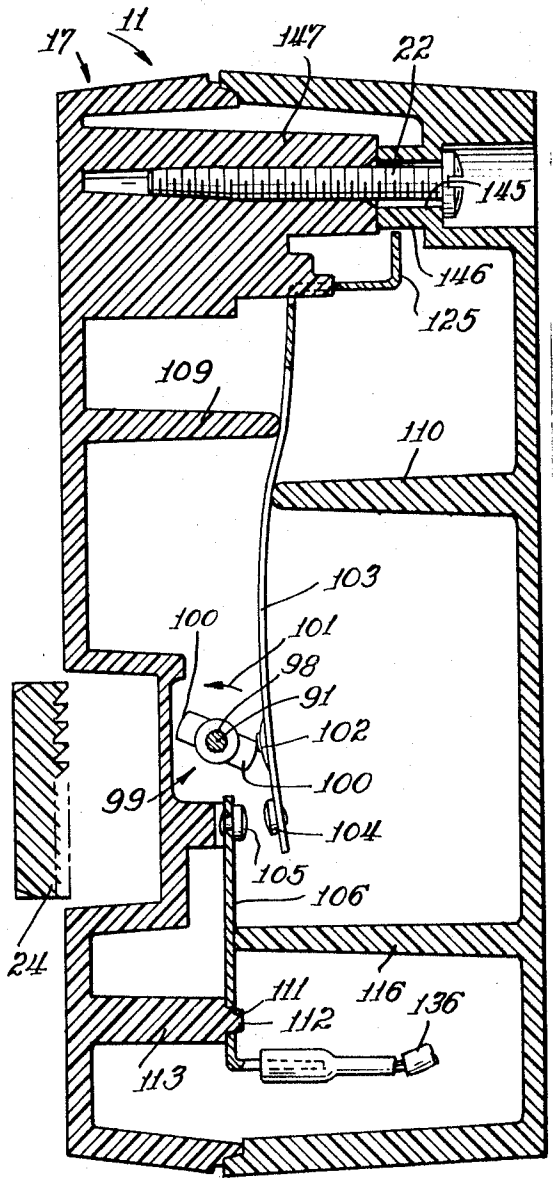


Fig. 8.

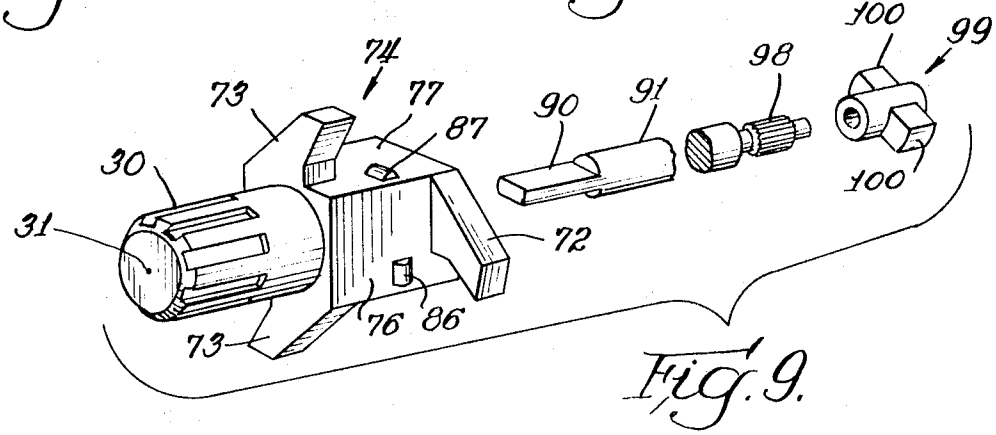


Fig. 9.

Fig. 10

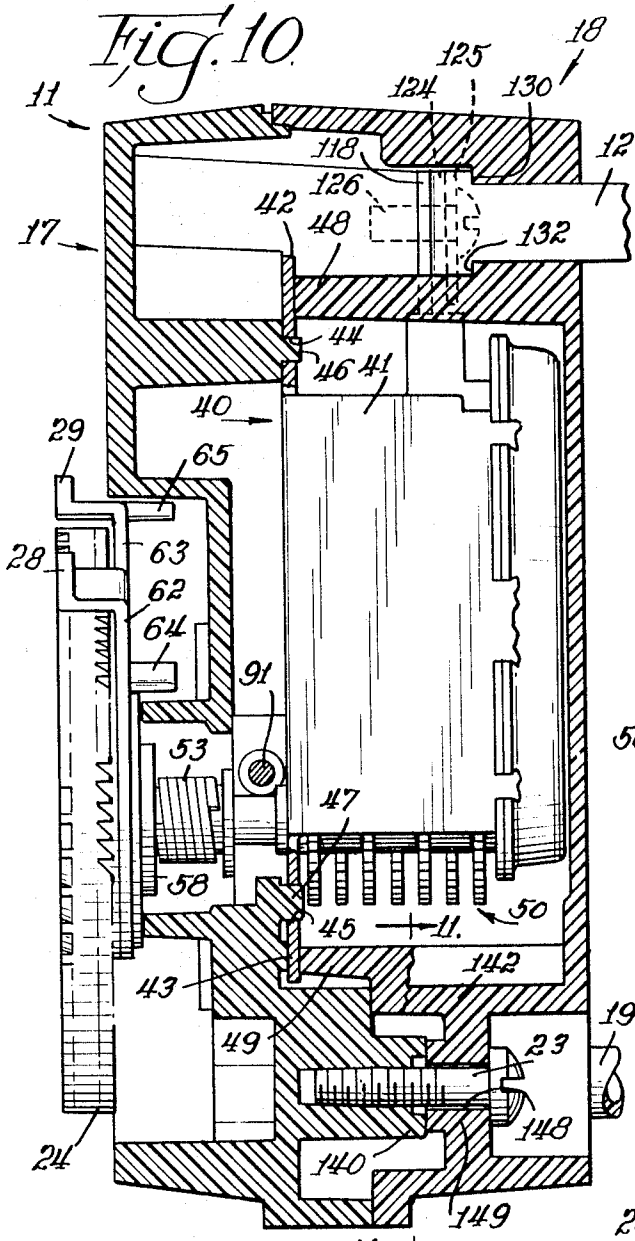


Fig. 12.

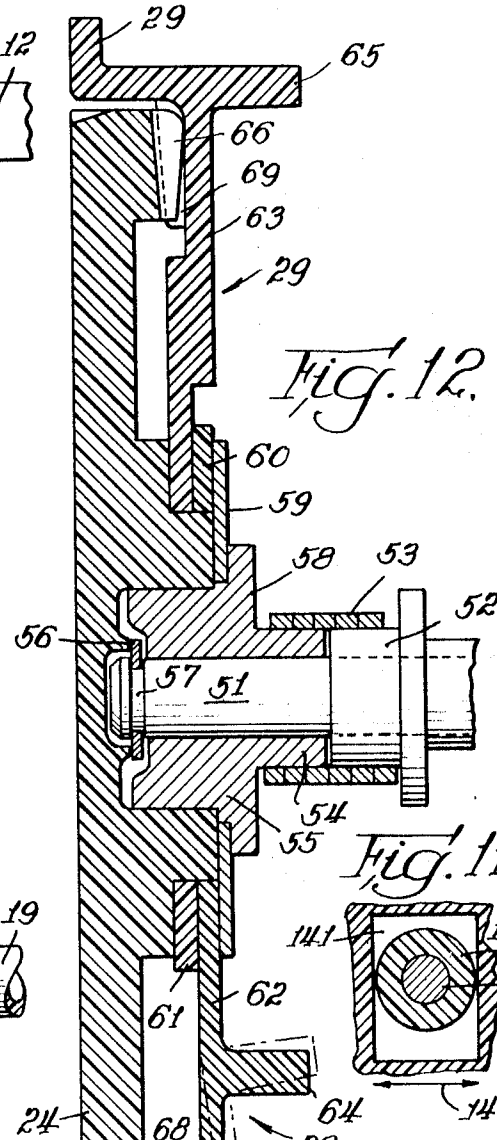


Fig. 11

Fig. 14

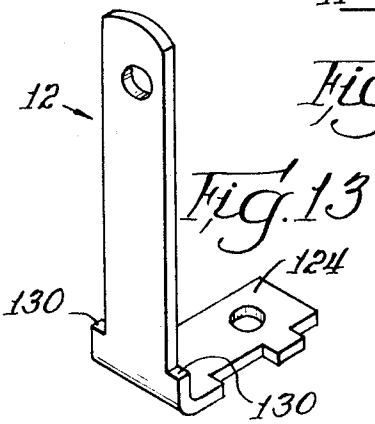


Fig. 13

Fig. 19

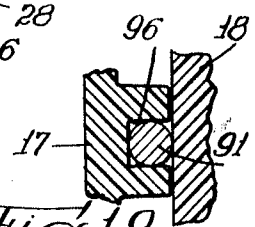
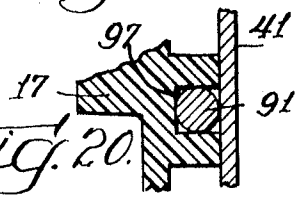


Fig. 20.



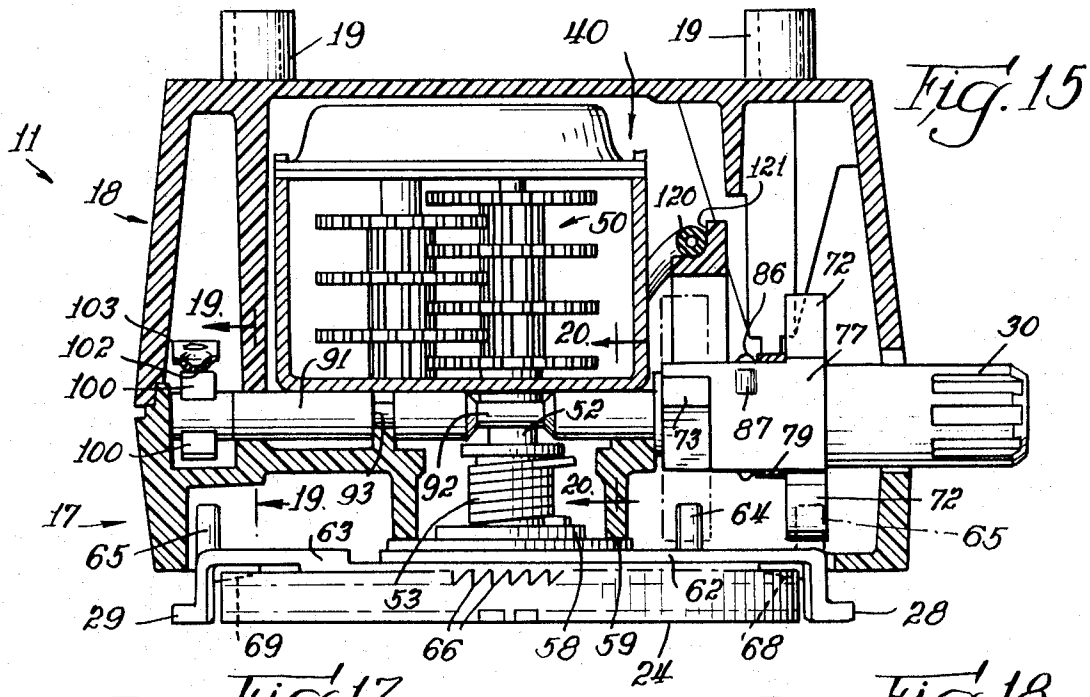


Fig. 15

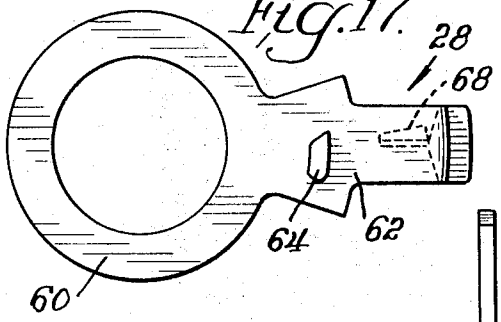


Fig. 17.

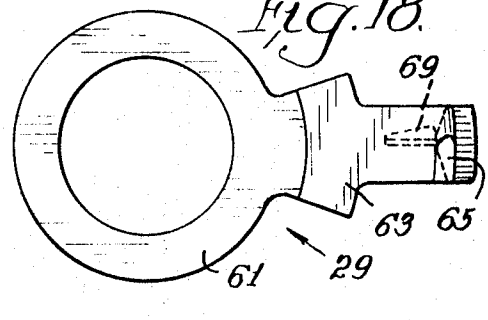


Fig. 18.

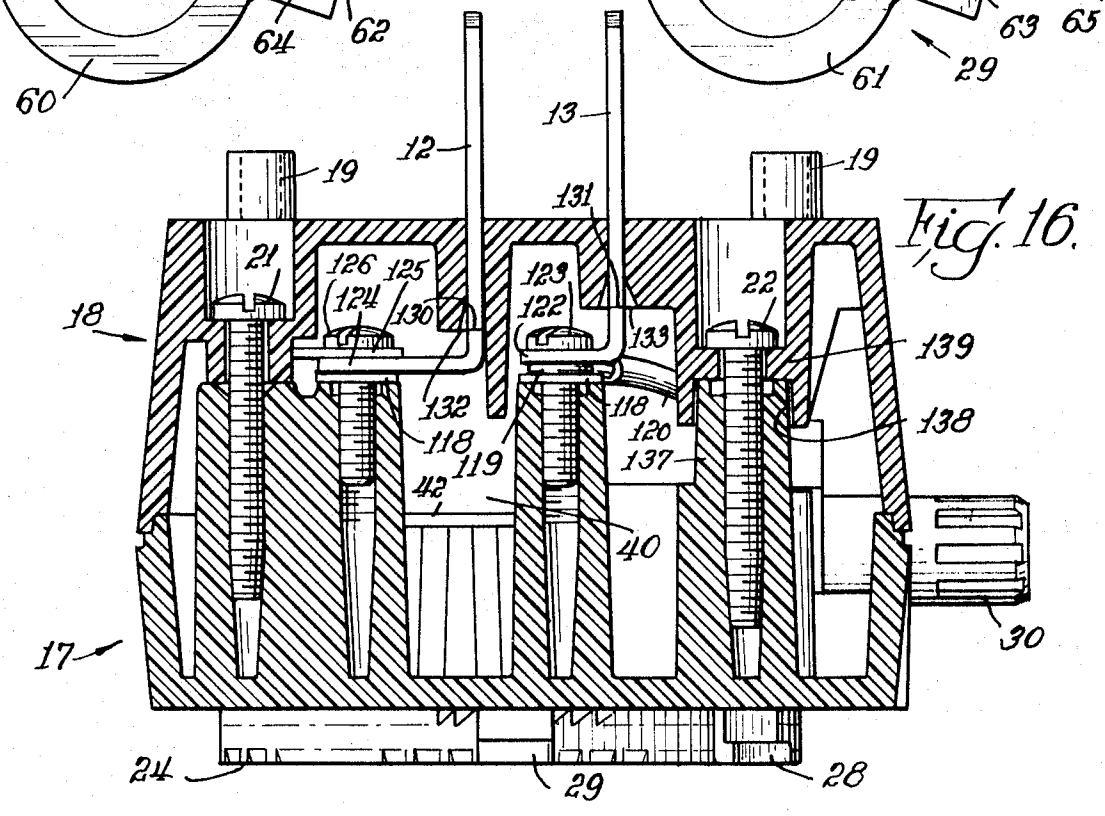


Fig. 16.

PLUG-IN TWENTY-FOUR HOUR TIME SWITCH

This invention is an improvement over the disclosure in Banathy and Rosenski application Ser. No. 780,054, filed Nov. 29, 1968.

Among the objects of this invention are: To provide in a new and improved manner for closing and opening switch contacts with a snap action under the control of adjustable time-on and time-off members on a time driven dial; to obtain the snap action by a pair of leaf springs reacting against opposite sides of a square cam driven by the members on the dial; to support the cam and a switch contact operating shaft by a balancing action of the leaf springs; to provide for manually closing and opening the switch contacts; to disengage manually the connection between the time driven dial and the square cam; to mount the square cam for endwise movement relative to the switch contact operating shaft; to employ a two part insulating housing for mounting the time driven dial on the outside and the associated mechanism therefor on the inside; to assemble the mechanism on one housing part and to hold it in place on application of the other housing part; and to facilitate assembly of the housing parts by means of interfitting cylindrical dowels at one end and a cylindrical dowel on the other end of one housing part fitting into a rectangular opening in the other housing part at the other end.

According to this invention a 24 hour time driven dial has adjustable time-on and time-off members for engaging radial on and off arms on a cam member to close and open switch contacts at preset times during one rotation of the dial. A synchronous motor drives the dial about an axis that is transverse to the axis of the cam member which is square. Opposite sides of the cam member are engaged by leaf springs which support it with a balancing action and a shaft driven thereby carrying a switch contact operator. The cam member is manually operable for closing and opening the switch contacts and is movable endwise to shift the radial arms out of the paths of the time-on and time-off members. Plug-in contact terminals are arranged to engage socket terminals of a conventional wall-type outlet. The switch contacts, when closed, complete a circuit to receptacle contacts which receive the prongs of a conventional plug connected to a timed device, such as a lamp. The time switch mechanism is enclosed in an insulating housing comprising a front housing and a rear housing. The time driven dial is mounted on the front side of the front housing. The mechanism within the housing is assembled on the rear side of the front housing. Bosses molded integrally with the front side of the rear housing bear against the plug-in terminals, the motor housing ears and the switch contacts to hold them in place. Screws extend through the rear housing into bosses molded integrally with the front housing to hold the housings together. Interfitting cylindrical dowels at one end of the housing facilitate final assembly thereof. At the other end of the housing a cylindrical dowel on the front housing fits into a rectangular opening in the rear housing.

In the drawings:

FIG. 1 is a view, in front elevation and at full scale, of a time switch embodying this invention and shows how it is mounted on a conventional wall-type outlet receptacle.

FIG. 2 is a view, in side elevation, of the construction shown in FIG. 1.

FIG. 3 is a top plan view of the time switch shown in FIG. 1.

FIG. 4 is a view, in rear elevation, of the time switch shown in FIG. 1.

FIG. 5 is a plan view at double scale, of the time switch shown in the preceding FIGS., the rear housing having been removed to show the underlying parts.

FIG. 6 is a view, similar to FIG. 5, showing only a portion of the mechanism, the motor having been removed in order to show the arrangement of the underlying contact operating shaft and parts associated therewith.

FIG. 7 is a vertical sectional view taken generally along line 7–7 of FIG. 5, the rear housing also being shown.

FIG. 8 is a view, similar to FIG. 7, taken generally along line 8–8 of FIG. 5.

FIG. 9 is a perspective view, in disassembled relation, of the four-sided cam member, the shaft operated thereby and the switch operator.

FIG. 10 is a view, similar to FIG. 7 taken generally along line 10–10 of FIG. 5.

FIG. 11 is a vertical sectional view taken generally along line 11–11 of FIG. 10.

FIG. 12 is a vertical sectional view, at an enlarged scale, of the time driven dial 24 and certain of the parts assembled therewith.

FIG. 13 is a perspective view of one of the plug-in contact terminals.

FIG. 14 is a perspective view of the other plug-in terminal.

FIG. 15 is a horizontal sectional view taken generally along line 15–15 of FIG. 5 with the rear housing also being shown.

FIG. 16 is a vertical sectional view, similar to FIG. 15, taken generally along line 16–16 of FIG. 5.

FIG. 17 is a plan view of the switch-on member.

FIG. 18 is a plan view of the switch-off member.

FIG. 19, sheet 4, is a vertical sectional view taken generally along line 19–19 of FIG. 15.

FIG. 20, sheet 4, is a vertical sectional view taken generally along line 20–20 of FIG. 15.

In FIGS. 1—4 a time switch embodying this invention is indicated, generally, at 10. The time switch 10 has an insulating housing that is indicated, generally, at 11 and is formed of a suitable self-extinguishing molded plastic material. From the rear side of the insulating housing 11 plug-in contact terminals 12 and 13 extend for insertion in a conventional outlet socket such as one of a pair of outlet sockets indicated generally at 14. The outlet sockets 14 are conventionally located in an outlet box in a wall 15, for example, and are energized from a suitable 60 Hz., 115 volt source. A conventional cover plate 16 overlies the outlet sockets 14. The insulating housing 11 comprises a front housing, indicated generally at 17, and a rear housing, indicated generally at 18, the latter is provided with integrally molded spacing lugs 19 on its rear side to space the time switch 10 from the surface of the wall 15 and maintain general alignment with the front side of the cover plate 16. Mounting screws 21, 22 and 23 extend through suitable openings in the rear housing 18 for securing it to the front housing 17.

Centrally located near the lower end of the front side of the front housing 17 is a time driven dial that is indicated, generally, at 24. It is arranged to rotate about an axis 25 at a speed of 1 revolution in 24 hours. Time markings 26 are located along the periphery of the time driven dial 24. An index 27 on the front housing 17 indicates the time of day. Mounted on the time driven dial 24 are a switch-on member 28 and a switch-off member 29. They can be adjusted to the desired positions with respect to the time markings 26 for closing and opening a circuit that will be described in detail hereinafter. A manually operable knob 30 extends from one side of the housing 11 at the junction between the front and rear housings 17 and 18 and is rotatable about an axis 31 which is transverse to the axis 25 about which the time driven dial 24 rotates.

At the lower end of the rear housing 18 there is provided a timed outlet socket that is indicated, generally, at 32. It includes contact springs 33 and 34 which are arranged to be engaged by contact prongs 35 of a plug 36 which is connected to a conventional two conductor cord 37 that is arranged to energize a timed device, such as a lamp. Other devices can be energized on energization of the timed outlet socket 32.

FIGS. 5 and 10 show certain details of construction of the mechanism within the insulating housing 11. For driving the time dial 24 a synchronous motor, indicated generally at 40, is employed. It includes a frame 41 which has integral endwise extending motor mounting members or ears 42 and 43. They have openings 44 and 45 for receiving bosses 46 and 47 which extend inwardly from the rear side of the front housing 17 and serve to locate the motor 40 properly in position. When the rear housing 18 is assembled, as shown in FIG. 10, bosses 48

and 49, molded integrally with and extending from the front side of the rear housing 18, bear against the motor mounting members or ears 42 and 43 and serve to firmly hold the motor 40 in place.

The motor 40 is intended to operate at a relatively high speed. In order to reduce the speed to 1 revolution each 24 hours, a reduction gear train, indicated generally at 50, is mounted principally within the frame 41. It is shown in more detail in FIG. 15. The output shaft from the reduction gear train 50 is indicated at 51 in FIG. 12 and, as pointed out, it is rotated at a speed of 1 revolution each 24 hours. Secured to the shaft 51 is a clutch collar 52 around which a portion of a clutch spring 53 is wrapped. The other portion of the clutch spring surrounds a clutch sleeve 54 which constitutes an integral extension of a metallic insert 55 which has a press fit with the time driven dial 24 and thus rotates it. The clutch spring 53 is arranged to permit relative rotation in one direction of the time driven dial 24 with respect to the shaft 51 for the purpose of setting the time driven dial 24 to the correct time as indicated by index 27. The shaft 51 extends through the metallic insert 55 and is rotatable with respect thereto. A snap washer 56, in an annular groove 57 near the end of the shaft 51, secures the time driven dial 24 against separation from the shaft 51 while permitting relative rotation.

The switch-on and switch-off members 28 and 29 are mounted on the rear side of the time driven dial 24 as shown in FIG. 12. Their individual construction is shown more clearly in FIGS. 17 and 18. It will be noted that the metallic insert 55 has a radially extending flange 58 which overlies a flat washer 59 that, in turn, overlies circular sections 60 and 61 of the members 28 and 29. In this manner the members 28 and 29 are maintained inseparable from the time driven dial 24 while being adjustable with respect thereto for different time settings. Arms 62 and 63 extend radially from the circular sections 60 and 61 and they carry detents 64 and 65 the function of which will be set forth presently. A number of closely spaced teeth 66 are molded integrally with the rear side of the time driven dial 24 for cooperation with teeth 68 and 69 on the front sides of the arms 62 and 63 of the switch-on and switch-off members 28 and 29. It is through the teeth 66 on the time driven dial 24 and the teeth 68 and 69 on the switch-on and the switch-off members 28 and 29 that operating torque is applied to the detents 64 and 65.

In FIGS. 6, 7 and 9 it will be observed that diametrically opposite radial on and off arms 72 and 73 are molded integrally with a cam member that is indicated, generally, at 74. The knob 30 is molded integrally with the cam member 74. Preferably the knob 30 and the cam member 74 are molded of suitable plastic material. For normal operation the on and off arms 72 and 73 are located in the paths of the detents 64 and 65 that extend from the arms 62 and 63 of the switch-on and switch-off members 28 and 29. Once each 24 hours the detent 64 engages one of the radial on-arms 72 to shift the cam member 74 through 90°. Also once each 24 hours the detent 65 on the switch-off member 29 engages one of the off-arms 73 likewise to effect rotation of the cam member 74 through 90°.

The construction of the cam member 74 is important. It will be noted that it has a square cross section with diametrically opposite parallel sides 76 and 77. The cam member 74 is located between an inner leaf spring 78 and an outer leaf spring 79 with the cam member 74 being located midway the ends thereof and the leaf springs 78 and 79 bearing against either the parallel side 76 or the parallel side 77 depending upon the last position to which the cam member 74 has been rotated. During the initial part of each cycle of operation or quarter turn of the cam member 74 when the detent 64 or 65 engages the arm 72 or 73, the cam member 74 is rotated slowly as the corners of the rectangular cross sections spread the leaf spring 78 and 79 apart. After the corners of the square cross section of the cam 74 have passed a center position with respect the leaf spring 78 and 79, the cam member 74 moves with a snap action to the next position where the leaf springs 78 and 79 bear flatwise against the next pair of parallel sides, for example, the parallel sides 77.

It will be observed that the inner leaf spring 78 is bowed between its ends 80 which bear against bosses 81 which are molded integrally with and extend from the front side of the rear housing 18. The ends 80 of the inner leaf spring 78 are trapped in slots 82 that are formed in bosses 83 which are molded integrally with and extend from the rear side of the front housing 17. The ends 84 of the outer leaf spring 79 also are trapped in the slots 82 and, as shown, they bear against the bosses 83 at the bottoms of the slots 82. As the detent 64 moves downwardly in the direction indicated by arrow 85, it engages the on-arm 72 and gradually rotates the cam member 74 in a counterclockwise direction in the manner described until the corners of the square cross section pass a central position with respect to the leaf springs 78 and 79 whereupon the cam member 74 is rotated with a snap action to the next position.

The leaf springs 78 and 79 provide a floating bearing support for the cam member 74. Since the leaf springs 78 and 79 react in opposite directions against the square cross section of the cam member 74, it is held centrally therebetween with no resultant force acting on it tending to move it horizontally from the position shown in FIG. 7. Other guide means, to be described, confine the cam member 74 so that it cannot move in a vertical direction.

The cam member 74 is movable endwise by the knob 30 for the purpose of shifting the arms 73 and 74 out of the paths of the detents 64 and 65 to prevent operation of switch contacts to be described. In order to hold the cam member 74 in either of its alternate positions, detents 86 and 87 are formed integrally with and extend from the sides 76 and 77 respectively. The leaf springs 78 and 79 are arranged to engage the sides 76 or 77 of the cam member 74 on one side or the other side of the detents 86 and 87 as the case may be.

As shown in FIG. 7 the cam member 74 has a central circular opening 88 that terminates at the inner end in a slot 89 which is shown in broken line outline in FIG. 6. The slot 89 is arranged to receive a flat end 90 of a contact operating shaft 91 which is arranged to rotate with the cam member 74 when it is rotated by one or the other of the detents 64 or 65 as described. The slot 89 and the flat end 90 of the shaft 91 permit the endwise movement of the cam member 74 for the purpose set forth above, the shaft 91 being held captive against endwise movement. Attention here is directed to the fact that the shaft 91 rotates about the axis 31 since it is located endwise of the knob 30 and that this axis is transverse to the axis 25 about which the time driven dial 24 rotates as driven by the motor 40.

As shown in FIG. 6 the shaft 91 has a reduced diameter section 92 intermediate its ends to clear the motor driven shaft 51 and parts associated therewith. Also the shaft 91 has an annular groove 93 which interfits with a slot 94 that is formed in a boss 95 that is molded integrally with the rear side of the front housing 17. In this manner the shaft 91 is held captive against endwise movement. The shaft 91, as shown in FIG. 19, extends through a slot 91 in the front housing 17 and is held captive therein by a wall of the rear housing 18. The shaft 91 also extends through a slot 97 in the front housing 17 where it is held captive by the bottom of the frame 41 for the motor 40 when it is placed in the housing. This is shown in FIG. 20.

As shown in FIG. 9 the end of the shaft 91 opposite the flat end 90 has a knurled section 98 onto which a switch operator 99 is pressed. The switch operator 99 is formed of molded plastic material and has radially extending arms 100. As shown in FIG. 8, when the shaft 91 and the switch operator 99 are rotated in a counterclockwise direction indicated by arrow 101, one or the other of the arms 100 engages a raised section 102 near the distal end of a movable switchblade 103. A contact 104 at the distal end of the switch blade 103 is arranged to be moved into and out of contact engagement with a contact 105 that is carried by a stationary switch terminal plate 106.

The mounting of the switchblade 103 and of the terminal plate 106 is important. As shown in FIG. 8 a boss 109 extends from the rear side of the front housing 17 and engages one side of the switchblade 103. In spaced relation thereto and offset therefrom a boss 110, molded integrally with the front side of the rear housing 18, bears against the opposite side of the switchblade 103 which is inherently resilient. This construction then acts to bias the distal end of the switchblade 103 and the contact 104 carried thereby toward the stationary contact 105. The biasing action is overcome by one or the other of the radial arms 100 on rotation of the switch operator 99. Since the contact 104 does not separate from the contact 105 until after the cam member 74 has been rotated past the center position, the contacts 104 and 105 are separated with a snap action which is desirable in order to minimize arcing and the consequent erosion of the contact surfaces. The switch terminal plate 106 has an opening 111, FIG. 8 through which a circular boss 112 projects. The circular boss 112 is molded integrally with a boss 113 that is molded integrally with and extends from the rear side of the front housing 17. This construction serves to locate the switch terminal plate 106. It is further centered by the provision of a slot 114, FIG. 5, which interfits with a rectangular boss 115 that extends rearwardly from the boss 113 which forms a part of a front housing 17. The terminal plate 106 is firmly held in place by a boss 116 which extends forwardly from the front side of the rear housing 18 as shown in FIG. 8.

As shown in FIG. 5 motor terminals 118 extend upwardly from the motor 40 and are arranged to be connected directly to the plug-in contact terminals 12 and 13. The motor 40 is intended to be energized continuously as long as the time switch 10 is in the plugged-in position shown in FIG. 1. Other connections are made to the contact terminals 12 and 13. One of these comprises a conductor terminal 119 which extends from an insulated conductor 120 that lies in a groove 121, FIG. 15, in the front housing 17. The other end of the insulated conductor 120 is connected to the contact spring 34 for engagement by one of the prongs 35 of the plug 36. The contact terminal 13, FIG. 14, has a terminal section 122 extending at right angles and it is arranged to overlie the conductor terminal 119 which overlies one of the motor terminals 118 as shown in FIG. 16. A screw 123 serves to hold the assembly together on the front housing 17. In a similar manner the switchblade 103 is connected to the contact terminal 12. As shown in FIGS. 5 and 16 a terminal section 124, FIG. 13, of the contact terminal 12 overlies the other motor terminal 118 and underlies a switchblade terminal 125 which is connected to the switchblade 103. As shown in FIG. 16 a screw 126 serves to clamp the switchblade terminal 125, terminal section 124 of the contact terminal 12 and the motor terminal 118 in good contact engagement.

The screws 123 and 126 are employed during assembly for clamping the contact terminals 12 and 13 to the motor terminals 118, conductor terminal 119 and the switchblade terminal 125. Further contact pressure is applied to the contact terminals 12 and 13 when the rear housing 18 is placed in assembled position as shown in FIG. 16. In FIGS. 13 and 14 it will be observed that shoulders 130 and 131 are provided on the contact terminals 12 and 13. They are arranged to be engaged by bosses 132 and 133 on the front side of the rear housing 18. The arrangement is such that, when the rear housing 18 is in its final assembled position substantial pressure is applied thereby against the shoulders 130 and 131.

Energization of the timed outlet socket 32 is completed when the contact 104, FIG. 8, engages the contact 105. The circuit extends from the stationary switch terminal plate 106, FIG. 5, through an insulated conductor 136 to the other contact spring 33.

In view of the fact that reliance is placed on various bosses extending from the front and rear housings 17 and 18 for holding various parts of the mechanism properly in place, it is desirable that the rear housing 18 be assembled accurately with respect to the front housing 17. Since the time switch 10 is produced on a mass production basis the possibility of error in the assembly is reduced to a minimum. In FIGS. 5, 7 and 16 it will be observed that a cylindrical boss 137 is molded integrally with the rear side of the front housing 17. The diameter of the distal end of the boss 137 is maintained within a close tolerance. The cylindrical boss 137 is arranged to telescope or interfit with a cylindrical socket 138 that is formed in a boss 139 which extends forwardly from the inside of the rear housing 18. Likewise the internal diameter of the cylindrical socket 138 is held to a close tolerance so that an accurate fit is established between the external surface of the boss 137 and the internal surface of the socket 138. It will be apparent that the rear housing 18 can be pivoted slightly on the boss 137 during the final assembly. At the other end of the housing 11, as shown in FIGS. 10 and 11, the front housing is provided with a cylindrical boss 140 that is molded integrally therewith. The diameter of its distal end is held at a close tolerance for interfitting with a rectangular opening 141 which is formed in a boss 142 that is molded integrally with the front side of the rear housing 18. The width indicated at 143, FIG. 11, of the rectangular opening 141 is held within a close tolerance for the purpose of accurately locating the distal end of the boss 140 therein. Since the rear housing 18 is pivoted accurately on the boss 137 at the other end of the housing 11, it is unnecessary to hold the length of the rectangular opening 141 within any accuracy limits.

A final step in the assembly is the application of the screws 21, 22 and 23. As shown in FIG. 7 the screw 21 is inserted through an opening 144 in the boss 139 and is screwed into the cylindrical boss 137. As shown in FIG. 8 the screw 22 is inserted through an opening 145 in a boss 146 that is molded integrally with the front side of the rear housing 18. The screw 22 is threaded into a boss 147 that is molded integrally with the rear side of the front housing 17. In FIG. 10 it will be noted that the screw 23 is inserted through an opening 148 in a boss 149 that is molded integrally with the front side of the rear housing 18. It is threaded into the cylindrical boss 140.

The assembly procedure preferably followed is to employ the front housing 17 as a base. It is turned upside down so that it lies on its front side as viewed in FIG. 5. The outer leaf spring 79 FIG. 7, is placed in the front housing 17 with its ends 84 at the bottoms of the slots 82. Next the cam 74 assembled with the shaft 91 and the switch operator 99 in place is applied with the knob extending to the left as seen in FIG. 5 and one of the flat sides, for example, the side 76 lying on the leaf spring 79. The motor 40 is next placed in the front housing 17 with the mounting members or ears 42 and 43 located as shown in FIG. 10 and the shaft 51 projecting through the wall of the front housing 17. The conductor terminal 119 and insulated conductor 120 are applied, the latter in the groove 121 and the former in overlying relation to the left motor terminal 118 as viewed in FIG. 5. Then the contact terminal 13 is applied over this assembly and the self-tapping screw 123 is inserted in order to hold the assembly in place. The contact spring 34 at the other end of the insulated conductor 120 is properly located in the timed outlet socket 32. Next the contact terminal 12 is placed over the right motor terminal 118, as viewed in FIG. 5. The switchblade terminal is applied with the switchblade 103 attached thereto. The switchblade 103 is placed in the front housing 17 in overlying relation to the boss 109, FIG. 8. Then the assembly is secured in place by the self-tapping screw 126. Another part to be assembled on the front housing 17 is the stationary switch terminal plate 106 which is located as shown in FIG. 8. Attached to it is the insulated conductor 136 which connects it to the other contact spring 33 which is placed on the other side of the timed outlet socket 32. The assembly is completed by applying the inner leaf spring 78 with its ends 80 in the slots 82, FIG. 7. It will be observed that the foregoing steps place all of the parts on the front housing 17 and thereby facilitate assembly without requiring the presence of the rear housing 18.

After the parts are assembled properly on the front housing 17, the rear housing 18 is applied by first lowering it onto the

front housing 17 with the cylindrical boss 137, FIG. 7, lining up and entering the cylindrical socket 138. The rear housing 18 is positioned fairly accurately when initially applied and then is swung to bring the rectangular opening 141, FIG. 11, into alignment with the cylindrical boss 140. Finally the screws 21, 22 and 23 are applied to complete the assembly with the various parts being held properly in operative position by the cooperating bosses extending from the front and rear housings 17 and 18 in the manners previously outlined. Next the assembly is turned upside down with the contact terminals 12 and 13 extending through the bottom wall of the rear housing 18 as shown in FIGS. 3 and 4. The last step in the assembly is the application of the time driven dial 24 to the projecting end of the motor driven shaft 51. The insert 55, which is inseparably secured to the time driven dial 24, is telescoped over the protruding end of the shaft 51 until the washer 56 snaps into place in the groove 57.

In operation the time switch 10 is positioned as seen in FIG. 1 with the contact terminals 12 and 13 plugged in to one of the outlet sockets 14. The motor 40 is energized and rotates the time dial 24 at a speed of 1 revolution in 24 hours. The time dial 24 is advanced in a clockwise direction as permitted by clutch spring 53 to indicate with respect to the index 27 the correct time of day. The switch off and on members are set to the desired times that the timed outlet 32 is to be energized and deenergized and the plug 36 is inserted. Assuming that the knob 30 is pushed in to the full line position shown in FIG. 1, the timed outlet 32 will be energized and deenergized once each 24 hours for an indefinite period. Should it be desired to change the position of the switch blade 103, the knob 30 can be rotated through 90° to the next position. Thus the contacts 104 and 105 can be closed or opened at will with corresponding energization or deenergization of the timed outlet 32. By pulling the knob 30 out to the broken line position shown in FIG. 1, the cam member 74 is shifted axially along the shaft 91 and the on and off arms 72 and 73 are moved out of the paths of the detents 64 and 65 on the switch-on and switch-off members 28 and 29. The time dial 24 continues to rotate and indicate time of day but no rotation of the cam member 74 and parts associated therewith takes place. When the cam member 74 is moved to its outermost position, it can be rotated to provide a permanent on or permanent off position of the contacts 104 and 105.

We claim:

1. A time switch comprising:
an insulating housing;
a time driven dial rotatably mounted on said housing;
switch-on and switch-off members rotatable with said dial;
a switch operator mounted on said housing for rotation continuously in one direction;
switch contacts operated by said switch operator;
a cam member having driving connection with said switch operator and rotatable therewith;
radial arms on said cam member in the paths of said switch-on and switch-off members to rotate said cam member continuously in one direction to close and open said switch contacts; and
spring means reacting against said cam member and biasing it toward either switch contact operated position.

2. A time switch according to claim 1 wherein:
said switch operator includes a shaft;
said cam member has angularly related contiguous flat sides; and
said spring means reacts against at least one of said flat sides.

3. A time switch according to claim 2 wherein:
pairs of said flat sides are diametrically opposite each other; and
said spring means includes a pair of springs each reacting against one side of each pair of sides.

4. A time switch comprising:
an insulating housing;
a time driven dial rotatably mounted on said housing;
switch-on and switch-off members rotatable with said dial;
a switch operator including a shaft rotatably mounted on said housing;
switch contacts operated by said switch operator;
a cam member having driving connection with said switch operator and rotatable therewith and having angularly related contiguous flat sides therewith;
radial arms on said cam member in the paths of said switch-on and switch-off members to close and open said switch contacts;
spring means reacting against at least one of said flat sides of said cam member and biasing it toward switch contact operated position;
said cam member being nonrotatably mounted on said shaft and movable endwise thereof to shift said radial arms out of the paths of said switch-on and switch-off members; and
means on said cam member extending outwardly of said housing for manual operation of said cam member.

5. A time switch according to claim 4 wherein:
said cam member has a square cross section;
said spring means comprises a pair of leaf springs on opposite sides of said cam members to engage flatwise the sides of said cam members therebetween and provide a floating bearing support therefor; and
means in said housing supporting each end of each of said leaf springs.

6. A time switch according to claim 5 wherein detent means on each side of said cam member engageable by one side or the other of each of said leaf springs hold said cam member in either of its operated positions.

7. A time switch according to claim 1 wherein:
said housing comprises a front housing and a rear housing;
said housings at one end have cylindrical interfitting dowel means; and
said housings at the other end have a dowel on one housing interfitting with a rectangular opening in the other housing.

8. A time switch according to claim 1 wherein:
said housing comprises a front housing and a rear housing;
said switch contacts are carried by switchblades mounted on said front housing one of which is moved near its distal end by said switch operator; and
boss means on said rear housing hold said switchblades in place on said front housing.

9. A time switch according to claim 1 wherein:
means on said housing support said dial to rotate about an axis; and
means on said housing support said switch operator to rotate about an axis transverse to said axis about which said dial rotates.

10. A time switch according to claim 9 wherein:
motor means in said housing have driving connection to said dial;
said housing comprises a front housing and a rear housing; and
boss means on said rear housing hold said motor means in place on said front housing.

11. A time switch comprising:
an insulating housing;
a time driven dial rotatably mounted on said housing;
switch-on and switch-off members rotatable with said dial;
a switch operator including a shaft rotatably mounted on said housing;
switch contacts operated by said switch operator;
a cam member having driving connection with said switch operator and rotatable therewith and having a square cross section;
radial arms on said cam member in the paths of said switch-on and switch-off members to close and open said switch contacts;
spring means reacting against said cam member and biasing it toward switch contact operated position; and
said spring means comprising a pair of generally parallel leaf springs on opposite sides of said cam member to engage flatwise the sides of said cam member therebetween.

12. A time switch comprising:
an insulating housing;
a time driven dial rotatably mounted on said housing;
switch-on and switch-off members rotatable with said dial;
a switch operator rotatably mounted on said housing;
switch contacts operated by said switch operator;
a cam member having driving connection with said switch operator and rotatable therewith;
radial arms on said cam member in the paths of said switch-on and switch-off members to close and open said switch contacts;
spring means reacting against said cam member and biasing it toward switch contact operated position;
said housing comprising a front housing and a rear housing;
said spring means comprising a pair of leaf springs reacting against opposite sides of said cam member and mounted at their ends on said front housing; and
boss means on said rear housing trapping the ends of said leaf springs in operative position.

13. A time switch comprising:
an insulating housing;
a time driven dial rotatably mounted on said housing;
switch-on and switch-off members rotatable with said dial;
a switch operator rotatably mounted on said housing;
switch contacts operated by said switch operator;
a cam member having driving connection with said switch operator and rotatable therewith;
radial arms on said cam member in the paths of said switch-on and switch-off members to close and open said switch contacts;
spring means reacting against said cam member and biasing it toward switch contact operated position;
said housing comprising a front housing and a rear housing;
a pair of shouldered contact terminals mounted on said front housing and extending through said rear housing; and
boss means on said rear housing engaging the shoulders on said contact terminals and holding the same in place.

14. A time switch comprising:
an insulating housing;
a time driven dial on said housing;
switch-on and switch-off members rotatable with said dial;
switch contacts in said insulating housing operated by said members;
motor driven shaft means in said housing rotatable at a predetermined speed, extending at one end into said time driven dial, and having an annular groove at said one end;
a metallic insert having a press fit with said time driven dial and rotatable on said one end of said shaft means;
snap washer means in said annular groove and overlying said metallic insert; and
connecting means between said shaft means and said metallic insert including:
a clutch collar secured to and rotatable with said shaft means,
a clutch sleeve secured to and rotatable with said metallic insert, and
a clutch spring wrapped around said clutch collar and said clutch sleeve.