March 9, 1954 W. P. GALLAGHER ET AL 2,671,830

TIMING MECHANISM

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Fig. 1

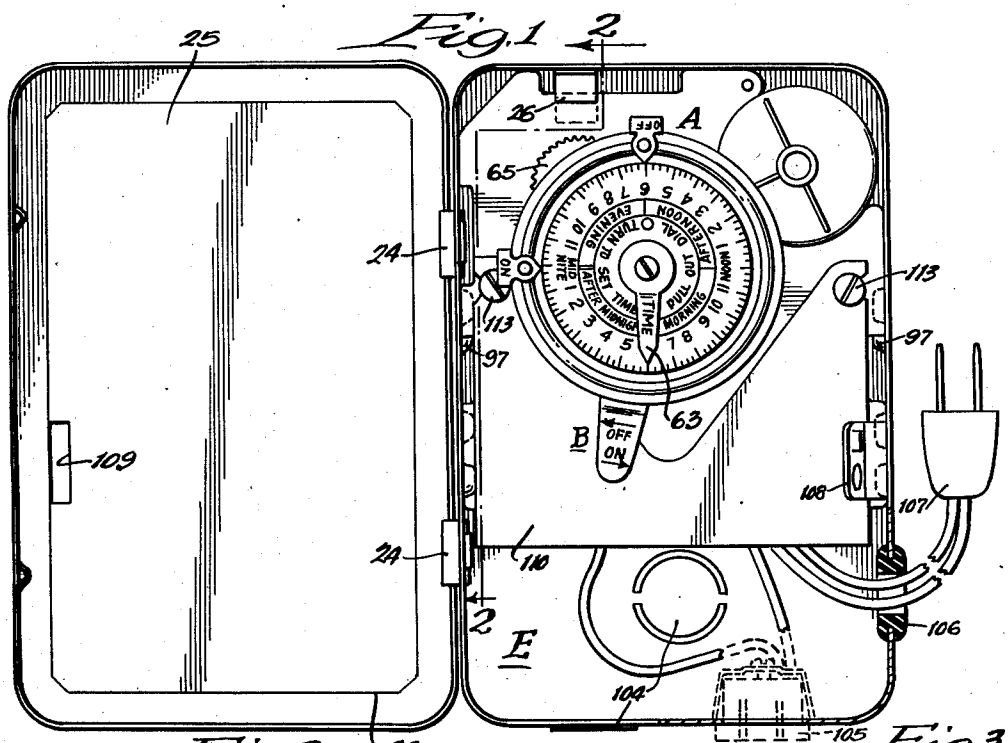


Fig. 2

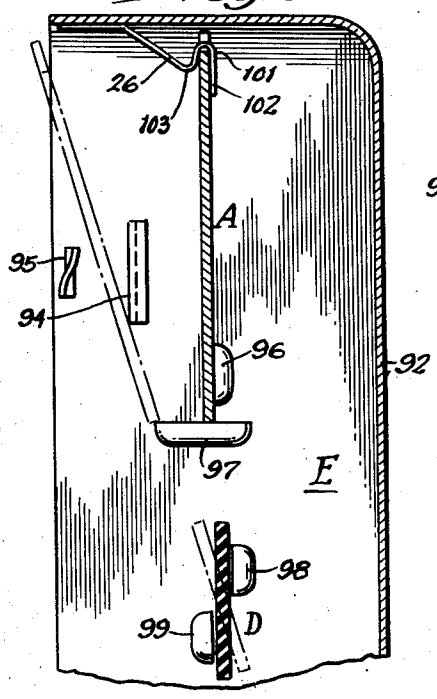
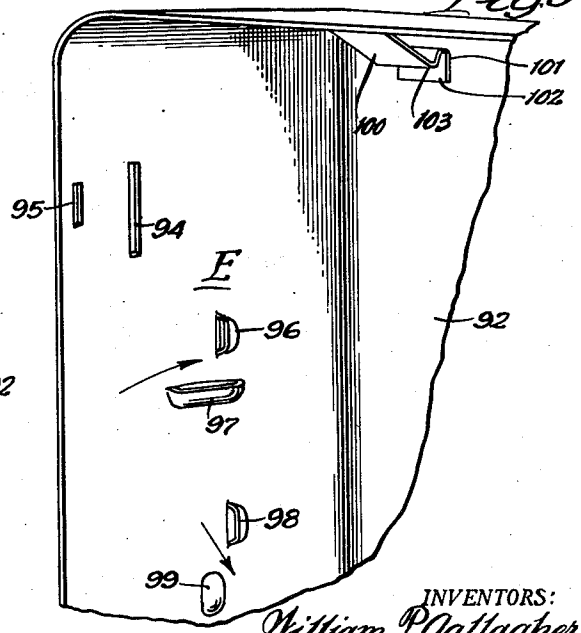


Fig. 3



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TIMING MECHANISM

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Fig. 4

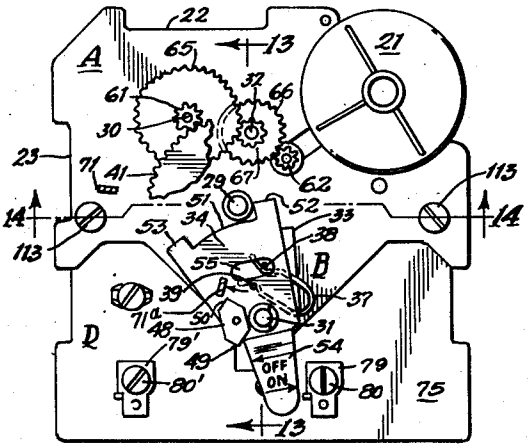


Fig. 5

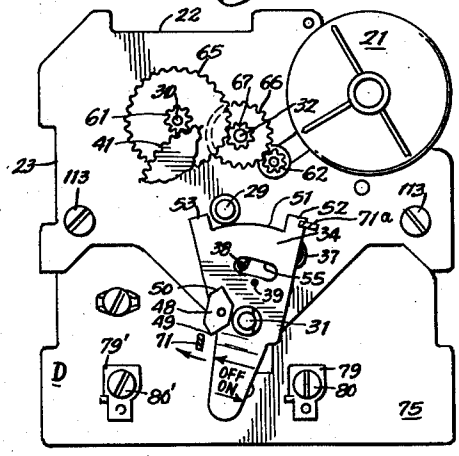


Fig. 8

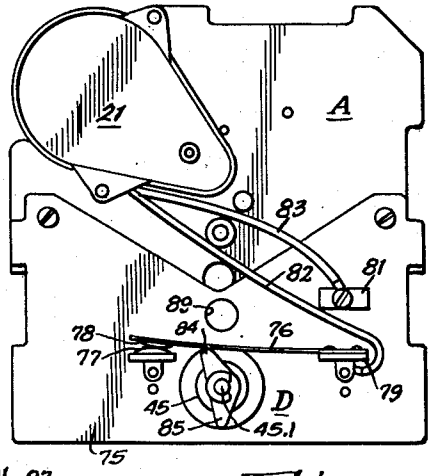


Fig. 6

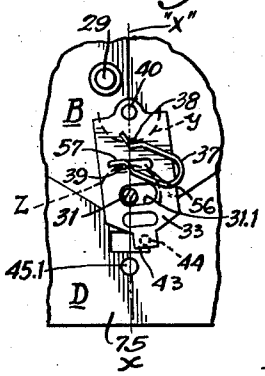


Fig. 7

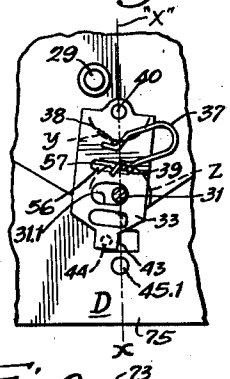


Fig. 9

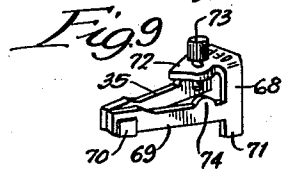


Fig. 11

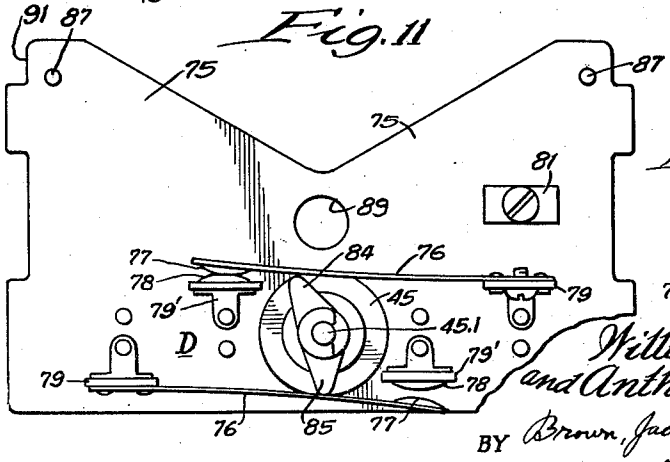
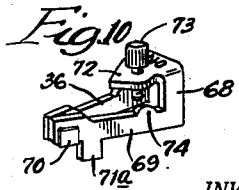


Fig. 10



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Fig. 12

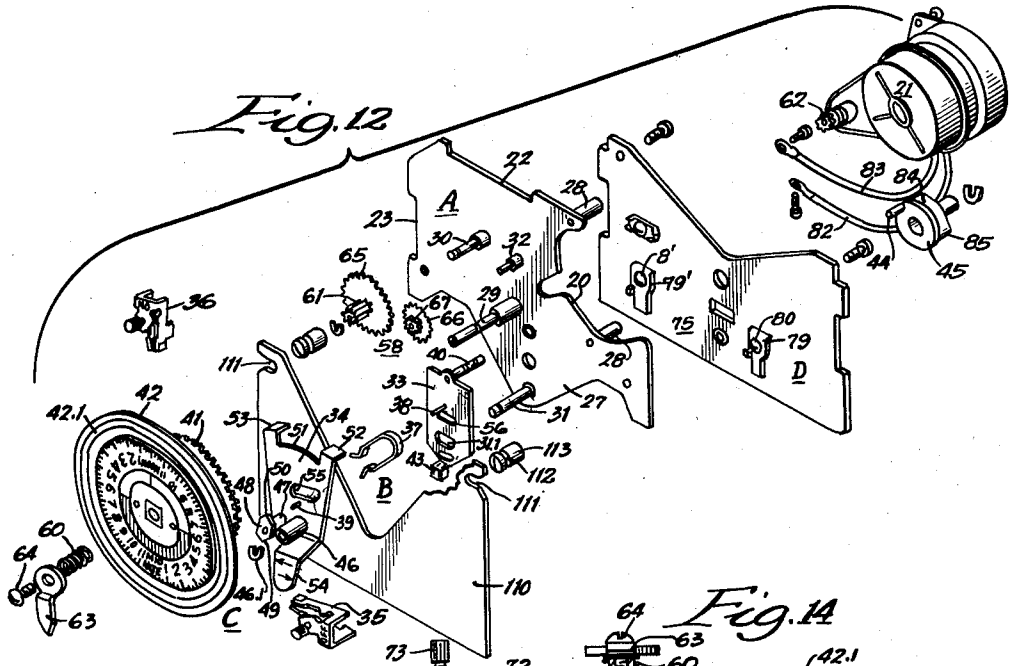


Fig. 14

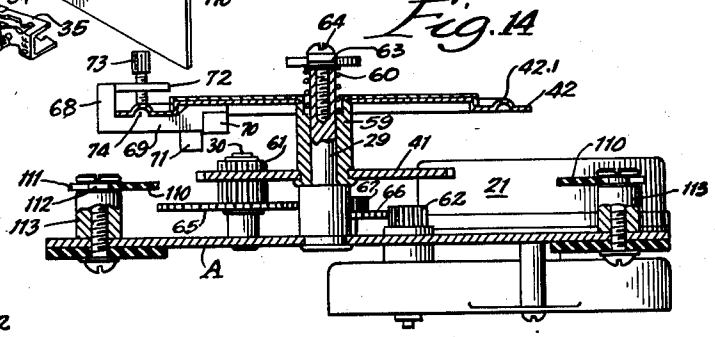


Fig. 13

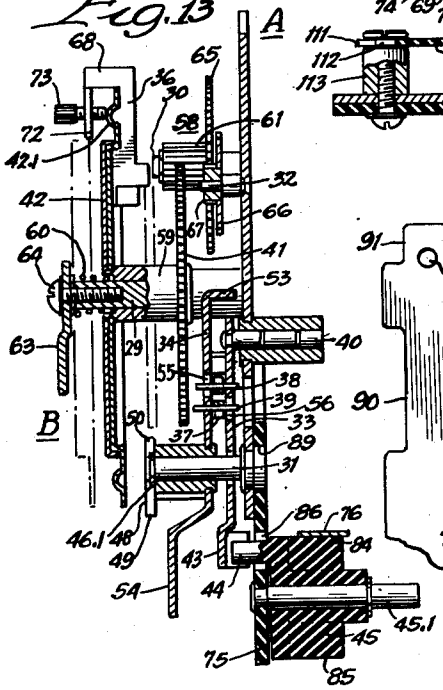
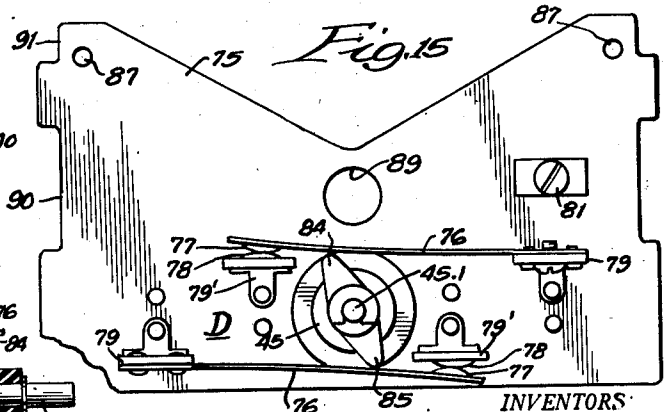


Fig. 15



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UNITED STATES PATENT OFFICE

2,671,830

TIMING MECHANISM

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Application July 7, 1950, Serial No. 172,586

19 Claims. (Cl. 200—38)

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This invention relates to time switches of the type used for opening and closing electrical circuits at predetermined times during a twenty-four hour period. Switches of this type are used extensively for controlling electric lights for the illumination of signs, windows, streets, etc., and for numerous other uses where it is desired to have circuit opening and closing operations occur automatically at preset times of the day or night in repeating succession without having to perform any resetting operations. Heretofore these switch mechanisms have involved a rather intricate arrangement of parts, which not only made manufacture expensive but made the manual setting and operation rather inconvenient. Moreover, where different types of circuits had to be controlled involving different combinations or arrangements of switching contacts, a complete time switch had to be provided for each different arrangement of contacts. Certain of these situations involving a particular arrangement of contacts are more infrequently encountered than are others. Nevertheless, the manufacturer and supplier of this type of equipment had to stock a full line of switches in order to be prepared for all demands, the infrequent as well as for the more frequent. This has often meant much idle inventory over a long period of time.

Furthermore, the connection of this type of switch to devices which they are designed to control generally has involved special wiring and necessitated the employment of expert help for that purpose.

The main objects of this invention, therefore, are to provide a time switch of this kind having improved switch operating mechanism capable of either automatic or manual operation; to provide a switch operating mechanism of this kind having improved means for effecting the quick make and break of the switch contacts; to provide improved means for effecting an adjustment of the time dial with respect to the motor driven timing means and the switch operating mechanism so as to set the dial to confrom to the time of day; to provide an improved switch operating mechanism for timing switches of this kind which permits any one of a plurality of panels mounting different types of switches to be interchangeably associated with the switch operating mechanism; to provide an improved form and arrangement of tripper means on the time dial for predetermining the times for effecting the actuation of the switch operating mechanism; to provide an improved form and mounting of tripper devices on the time dial so that the user

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can quickly add or remove tripping devices at will, whereby to obtain any desired combinations of on and off times up to approximately twelve each for a twenty-four hour period; to provide improved means for releasably holding a time switch of this kind in a housing; to provide a time switch of this kind with improved means for interposing it between the equipment to be controlled and a receptacle in an existing electrical circuit; and to provide an improved time switch of this kind having a small number of parts of simplified construction and assembly which makes for economical manufacture, permits easy adjustment, and insures accurate operation. In the embodiment of this invention shown in the accompanying drawings:

Fig. 1 is a front elevation of a time switch constructed in accordance with this invention arranged in a housing, the door of the housing being open to more clearly illustrate the manner in which the time switch is removably held in place in the housing;

Fig. 2 is an enlarged fragmentary sectional detail of the same, taken on the line 2—2 of Fig. 1, showing in full outline the manner in which the switch mounting is releasably held in position in the housing and showing in dotted outline the angular position which the mounting assumes when inserted or removed from the housing;

Fig. 3 is an enlarged, fragmentary, perspective of the interior of the upper left hand corner of the housing showing the lugs and the spring which coact to releasably hold the time switch mounting in place in the housing;

Fig. 4 is a plan view of the improved switch operating mechanism constructed in accordance with this invention, the parts being shown in their "on" position;

Fig. 5 is a similar view showing the switch operating mechanism in its "off" position;

Figs. 6 and 7 are fragmentary details showing the spring whereby the switch operating mechanism effects a quick make and break of the switch contacts;

Fig. 8 is a rear view of the improved switch operating mechanism as shown in Fig. 4;

Figs. 9 and 10 are perspective views of the slightly modified forms of tripper means which effect the automatic shifting of the switch operating mechanism;

Fig. 11 is a rear view similar to Fig. 8 but showing a switch panel having a form of switch different from that shown in Fig. 8;

Fig. 12 is an exploded view of this improved time switch;

Fig. 13 is a vertical, sectional, elevation of

this improved time switch, taken on the plane of the line 13—13 of Fig. 4, showing in dotted outline the axially adjustable position of the time gear and time dial which permits a rotation of the time dial independent of the motor driven time gearing;

Fig. 14 is a horizontal sectional view of the same taken on the plane of the line 14—14 of Fig. 4; and

Fig. 15 is a rear view of a panel, with another switch arrangement, which may be attached to the time switch mounting plate to be actuated by the switch operating mechanism.

An improved time switch constructed in accordance with this invention comprises a plate "A" mounting a switch operating mechanism "B" actuated by a motor driven control mechanism "C" for opening and closing any one of a plurality of switch means "D," interchangeably mountable on the mounting plate "A," all of which is supported in a housing "E" so formed as to permit easy placing and removal thereof.

The mounting plate "A" is a flat piece of metal recessed at 20, to permit the convenient attachment of a motor 21, and at 22 and 23, to respectively span a hinge 24 for the housing cover 25 and receive the free end of a housing retaining spring 26. A V-shaped extension 27 provides for a mounting of the switch operating mechanism "B". On the back of the plate "A" are posts 28 to which the motor 21 is attached and on the front are stud shafts 29, 30, and 31, and a pin 32, which provide for the appropriate journalling of the motor driven time control mechanism "C" and the switch operating mechanism "B" will be described presently.

The motor 21 herein shown, is of the synchronous type conventionally used with this type of switch mechanism.

The switch operating mechanism "B" comprises a pair of switch actuating arms 33 and 34 swingably mounted on the plate 27 and whose relative swinging is controlled by the trippers 35 or 36, on the time control mechanism "C," and a U-shaped spring 37, interposed between stake pins 38 and 39 on the respective arms 33 and 34.

These two switch actuating arms 33 and 34 are swingably mounted, in superimposed relationship, by a stud shaft 40 and the stud shaft 31 on the V-shaped plate extension 27. These stud shafts 40 and 31 are located intermediate the stud shaft 29, which mounts a time gear 41 and dial 42 of the motor operated control mechanism "C," and the apex of the V-shaped plate extension 27, with the spring 37 interposed between said arms 33 and 34.

The arm 33 is formed with a socket 43 at its outer end, to receive a pin 44 on a switch cam 45 for any one of the switches "D," and is slotted at 31.1, to receive the stud shaft 31 so as to permit the swinging of the arm 33 sufficient to effect the desired opposite shifting of the switch cam 45.

The arm 34 mounts a pair of hubs 46 and 47 press fitted or otherwise secured in holes in the arm 34, the former 46 serving as a bearing for the arm 34 on the stud shaft 31 and the latter 47 mounting a plate 48 providing shoulders 49 and 50 positioned to be engaged by the respective trippers 35 and 36 for shifting the switch actuating arm 33. At its inner end the arm 34 is recessed at 51 to form a fork the ends of which are bent down to provide shoulders 52 and 53 which strike the stud shaft 29 and limit the swinging movement of the arm 34. At its lower end the arm 34 is formed with an offset extension 54, beyond the periphery of the time dial 42, whereby the arm 33 may be manually shifted. The face of the extension 54 is scored with the words "on" and "off" and arrows indicating the direction of throw.

The arm 34 is removably secured on the stud shaft 31 by a "C" washer 46.1 seated in annular recess in the end of said shaft.

As will be most apparent from Fig. 12, the stake pin 38 is mounted on the arm 33 and extends through a slot 55 in the arm 34, whereas the stake pin 39 is mounted on the arm 34 and extends through a slot 56 in the arm 33. The U-shaped spring 37 has the ends of the parallel parts thereof crimped as shown at 57, in which crimps the pins 38 and 39 are received to secure the spring 37 in operative relationship with the arms 33 and 34. These two pins 38 and 39, against which the ends of the U-shaped compression spring 37 react, swing in non-concentric, non-intersecting arcs indicated in dotted lines at y and z in Figures 6 and 7. The compression spring 37 exerts a constant spreading force tending to separate the spring reaction pins 38 and 39. The positioning and spacing pins 38 and 39 on the members 33 and 34 are such that in the opposite swinging of the actuating arm 34 the pin 39 is oppositely moved across the line x—x through the axes of the stud shafts 31 and 40, of the respective arm members 34 and 33, (see Figs. 6 and 7). This results in the other or second spring reaction pin 38 being snapped across the line x—x to the opposite side, thus effecting a snap throw of the actuated arm 33, which in turn is transmitted to the switch cam 45 for effecting a quick make and break of the contacts of any one of the different types of switches "D."

The motor-driven control mechanism "C," for the switch operating mechanism "B," comprises the interconnected time wheel 41 and dial 42, the gearing 58, and the trippers 35 and 36.

The time gear 41 and dial 42 are secured in fixed axial relationship by a collar 59 slidably mounted on the stud shaft 29. The gear 41 is normally urged by a spring 60 into mesh with a pinion 61 forming a part of the motor driven gearing 58.

The dial 42 has the face thereof suitably marked and imprinted (see Fig. 1) with arabic figures and words to represent the two twelve-hour periods of time between noon and midnight, the "morning," "afternoon," "evening," and "aftermidnight" divisions, and instructions for operating the dial to alter the setting thereof with respect to a pointer 63. Adjacent its outer periphery the dial is embossed to form an arcuate shaped circumferential bead 42.1 which provides support for the trippers 35 and 36.

The gearing 58 is of conventional form comprising gears 65 and 66. The gear 65 mounts the pinion 61 and meshes with a pinion 67 on the gear 66 which in turn meshes with a pinion 62 driven by the motor 21. This gearing is sized and arranged so as to revolve the dial 42 once in twenty-four hours.

The trippers 35 and 36 as herein shown are metal stampings bent to form a U-shaped base 68 having converging legs extending transversely from the ends of the parallel parts of the U-shaped base 68. The legs are secured together at their outer ends by a clip 70 and one of which legs 69 mounts a shoulder 71 or 71a. From the

transverse part of the U-shaped base 68 extends a pointer-shaped ear 72, parallel to the legs 69. The ear 72 mounts a threaded pin 73 whereby the tripper 35 or 36 is secured in place on the time dial 42. Arcuate shaped shoulders 74 are formed on the legs 69 directly under the pin 73, which shoulders 74 fit in the time dial bead 42.1 to coact with the pin 73 to insure a more rigid support of the trippers 35 and 36 on the time dial 42.

As will be noted from Figs. 9 and 10, the only difference between the trippers 35 and 36 is that the shoulder 71 for the tripper 35 is at the outer end of one of the legs 69, whereas for the tripper 36 the shoulder 71*a* is near the inner end of the leg 69. Thus, when in place on the time dial 42 the shoulder 71 on the tripper 35 is located in the path of the shoulder 49 on the arm 34, whereas the shoulder 71*a* on the tripper 36 is located in the path of the shoulder 50 on the arm 34. Hence, the shoulders 71 and 71*a* on the respective trippers 35 and 36 effect the opposite shifting of the arm 34, as these shoulders contact and pass the respective shoulders 49 and 50 on the arm 34.

The trippers 35 and 36 may be further distinguished from each other in not only marking them respectively "off" and "on" but also forming them of different colored metals or with other color distinctions.

One or more pairs of the trippers 35 and 36 may be mounted on the dial 42 so as to obtain several opposite shiftings of the switch operating mechanism "B" during a period of twenty-four hours.

The spring 60 embraces the outer end of the stud shaft 29 and is interposed between the end of the collar 59 and the pointer 63 secured to the end of the stud shaft 29 by a screw 64. The spring 60 thus permits an axial shifting of the interconnected time gear 41 and dial 42 so as to disengage the time gear 41 from engagement with the pinion 61 and allow the interconnected time gear and dial to be rotated for the purpose of setting the dial 42 in any desired position with respect to the pointer 63. This outward axial shifting of the interconnected time gear 41 and dial 42 also shifts the tripper shoulders 71 and 71*a* out of the paths of the shoulders 49 and 50 on the arm 34 to permit the rotation of the dial 42, when the time gear 41 is disengaged from the pinion 61.

Hence, the dial 42 can be unmeshed and rotated to a new position in the setting of the device even after the time cycle established by the positions of the trippers 35 and 36 has been set up on the dial 42.

As hereinbefore noted, time switches of this kind are used for controlling circuits for various kinds of equipment. More generally, these switches which control these circuits are referred to as "single pole, single throw," "double pole, double throw," "double pole, single throw," etc. The main difference between these switches is the number of switch arms (see Figs. 8, 11 and 15), whether they have single contacts or both front and back contacts, and the form of the switch cam used for operating these switch arms.

The herein-shown form and arrangement of the switch operating mechanism "B" and the time-actuated control mechanism "C" makes possible the use of these mechanisms with any one of these three different types of switches "D" which may be interchangeably connected to the mounting plate "A."

Each of these switches "D" comprises a panel of insulating material 75 on the back of which is mounted one or more spring contact arms 76 positioned so as to be actuated by the switch cam 45 for shifting the arm or arms 76 to make and break contact between contacts 77 and 78.

The arm or arms 76 and the contacts 78 are generally supported on angle blocks 79 and 79', respectively, one leg of each of which is secured to the front of the panel 75 and provided with the usual binding post 80 and 80'. Each panel is also provided with a "neutral" binding post 81. Suitable wires 82 and 83 lead from one of the angle blocks 79 and from the "neutral" binding post 80 to the motor 21. The other wires are adapted to be attached to the binding posts 80 and 80' for connecting the switch "D" in circuit with the device, the operation of which is to be controlled by this mechanism.

The switch cam 45 for any of these switches "D" is swiveled on the panel 75, on a pin 45.1, so that the opposite wings 84 and 85 contact one or two spring arms 76, for the purpose of shifting it or them to make and break engagement between the contact 77 and 78. The pin 44 on the switch cam 45 extends through a slot 86 in the panel 75 and into the socket 43 on the arm 33 of the switch operating mechanism "B."

The panel 75 for each of the switches "D" is apertured at 87 to receive a pilot post on the mounting plate "A" to insure a proper positioning of the panel to locate the switch cam pin 44 in the socket 43 of the arm 33. Along its sides, the panel is recessed at 90 and 91 so that it will pass certain lugs on the housing to permit the ready insertion of the plate "A" and panel 75 into the housing "E," and the removal therefrom, as will be explained presently.

The housing "E," as herein shown, is in the form of a metal box 92 with a cover 93. The box is formed with slots 94 and 95 to support the cover hinges 24. Both sides of the box also have shoulders 96, 97, 98, and 99, struck inwardly therefrom to provide support for the mounting plate "A" and the switch panel 75. At the top of the box is a spring 100 which releasably retains the mounting plate "A" in position on and in contact with the shoulders 96 and 97 respectively.

As will be most apparent from Figs. 1 and 2, the hinges 24 are formed from strips of metal which extend through slots in the cover 25 and have their ends inserted through the slots 94 and 95. The end of the hinge extending through the slot 94 is bent downwardly, as shown in Fig. 2, and the end extending through the slot 95 is twisted so as to prevent the removal of the cover 25 from the box 92 until and unless the twist is taken out of that end of the hinge strip.

As will be most apparent from Fig. 3, the shoulders 96 and 98 provide support for the mounting plate "A" and switch panel 75, respectively, holding them in spaced relationship to the back of the box so that the parts on the underside of the plate and panel are out of contact with the box. The shoulders 97 serve as abutments for the mounting plate "A" against which the plate is held by the spring 100 to prevent any longitudinal movement in the box 92. The shoulders 99 engage the upper face of the panel 75 and prevent it from being accidentally elevated, particularly when the interconnected time wheel 41 and dial 42 are being shifted axially on the stud shaft 29

for adjusting the time dial with respect to the pointer 63.

The spring 100 is formed with a hook 101 providing a ledge 102 disposed in the plane of the shoulders 96 and 98 and serving to hold the upper end of the mounting plate "A" against depression in the box 92. The hook 101 presents a shoulder 103 which prevents the removal of the mounting plate "A" unless and until the spring 100 is retracted so as to move the shoulder 103 outwardly of the upper edge of the mounting plate "A" at the point of the recess 22. The spring 100 is welded to the inner face of the top of the box 92 near the lefthand corner at a point conveniently accessible for depression by a finger on one hand while the other hand grips the time dial 42 to permit the removal of the mounting plate "A" and its mechanism from the housing "E."

A shouldered and apertured spring tongue 108, welded to the inner face of one side of the housing 92, extends through a slot 109 in the cover 25 whereby the cover 25 is releasably held in closed position. The aperture in the tongue 108 permits the insertion of a lock to secure the cover against unauthorized opening.

The box 92 of the housing "E" is also provided with the usual knockout disks 104 whereby wires or conduits may be inserted for connecting a switch "D" with a source of power and with a circuit to be controlled by the operation of this device.

With devices of this type heretofore provided, it has generally been necessary to employ a licensed electrician to connect up the switch with the circuits. In order to obviate that necessity for many situations, this improved switch mechanism mounts an electrical receptacle 105 (see Fig. 1) in one of the openings formed by knocking out a disk 104 and which receptacle is suitably connected to the appropriate switch "D." A grommet 106, preferably of rubber, is inserted in one of the other openings formed by knocking out a disk 104 through which wires from a plug 107 lead to a switch "D."

In order to protect one from accidentally touching the contact bars 79 and 79', exposed on the front of the switch panel "D," a mask 110 is removably arranged over the switch panel 75. The mask 110 is a piece of insulating material and, as most clearly shown in Figs. 1 and 11, comprises a pair of substantially V-shaped parts which are recessed at 111 to be seated in notches 112 on the post 113 by means of which a switch panel 75 is secured to the mounting plate "A."

The operation of this improved time switch is substantially as follows:

Obviously, in putting this time switch into use, it would first have to be set to correctly correspond with the time of day. This is very readily effected by gripping with one hand the periphery of the time dial 42 and pulling it axially against the action of the spring 60 so as to disengage the time gear 41 from the pinion 61. Thereupon, the time dial 42 may be turned in either direction to bring the proper markings on the dial 42 into alinement with the time pointer 63. Upon being thus set and released, the spring 60 will automatically re-engage the time gear 41 with the pinion 61.

The desired number of trippers 35 and 36 are positioned on the time dial 42 opposite the markings indicative of the times at which the switch operating means "B" is to be actuated for the opening and closing of one of the switch means "D." It will be noted that several pairs of the trippers 35 and 36 may be placed on the dial 42 and each firmly held in position by the turning of the threaded pin 73 so as to draw the shoulders 74 on the tripper into the time dial bead 42.1.

As the time dial 42 rotates, the shoulders 71 and 71a on the trippers 35 and 36 are successively brought into engagement with the respective shoulders 49 and 50 on the plate 48 mounted on the arm 34 eccentrically of its stud shaft pivot 46. As the respective shoulders 71 and 71a contact the shoulders 49 and 50, the arm 34 is alternately shifted in opposite directions. Such opposite shifting of the arm 34 moves the pin 39 thereon back and forth across a line "X" through the axis of the stud shaft 31 on which the arm 34 is pivoted and the axis of the stud shaft 40 on which the arm 33 is pivoted, and may include the axis of the switch cam swivel pin 45.1. Each time this pin 39 crosses the line "X" through these pivots, the spring 37 comes into action to snap the connection of the arm 33 and the switch cam pin 44 across said line and thereby effect a quick make and break of the contact buttons 77 and 78 on a switch "D." The character of this action is most clearly indicated in Figs. 6 and 7.

The action of the spring 37, in swinging the arm 33, is limited by the contact of the shoulders 52 and 53 against the stud shaft 29 upon which are mounted the interconnected time gear 41 and dial 42.

If at any time during the use of this improved time switch, it becomes necessary to re-set the time dial 42 so as to properly correspond with the time of day, it is only necessary to shift the time dial 42 axially and disengage the time gear 41 from the pinion 61. The dial then can be rotated to bring the proper figure into alinement with the pointer 63. If, when this adjustment is made and the time dial 42 is released, a shoulder 71 on one of the trippers 35 should happen to come to rest on top of the shoulder plate 48, there is no likelihood of the mechanism thereby being rendered inoperative. This is for the reason that the pinion 61 is made of such a length that it will be engaged by the time gear 41 even when such a tripper shoulder 71 comes to rest on the shoulder plate 48. Accordingly, the continued operation of the pinion 61 will cause a rotation of the dial 41 and very shortly shift the shoulder 71 off from the shoulder plate 48, thus restoring all of the tripper shoulders 71 in the paths of their respective plate shoulders 49 and 50.

If, at any time, it is desired to manually change the position of a switch "D," it is only necessary to press the extension 54 on the arm 34 in the opposite direction from that in which it is set, which will reverse the position of the switch cam 45.

For example, if a switch "D" has been shifted by a dial tripper 36 to close a circuit, and the lights controlled thereby are "on," and one desires to have the lights "off," one may shift the extension 54 of the arm 34 in the direction indicated by the "off" arrow. This will shift the switch "D" to open the circuit and the lights will be "off." The circuit will remain open, with the lights "off," until the next time a shoulder 71 on an "on" tripper 36 contacts the shoulder 50 on the arm 34 which will effect a shift of the switch to "on" position and the mechanism will thus be restored to its automatic cycle.

The form of the switch "D" which would be used with this mechanism is, of course, deter-

mined by the character of the equipment and the circuit which is to be controlled. Three types of switches are indicated in the accompanying drawings and their functions hereinbefore indicated. Regardless of which one of the three panels herein shown is attached to the mounting plate "A," the pin **44** on the switch cam **45** is received in the socket **43** on the arm **34**. Such an arrangement of interchangeable switch panels makes it possible for the manufacturer to provide the dealer with a number of the switch operating mechanisms "B," and control mechanisms "C" on mounting plates "A," and varying quantities of the several types of switches "D," thus the dealer may assemble a switch "D" of the desired type with the other operating mechanisms, as the purchaser may require This avoids the necessity for the dealer having to stock a complete time switch for each of the several types of circuits for which he may anticipate customers' requests.

The switch operating mechanism "B" and its control mechanism "C" on the mounting plate "A," with or without a switch "D" secured in place on the mounting plate "A," is easily inserted in or removed from the housing "E."

As most clearly indicated in dotted outline in Fig. 2, the mounting plate "A," with or without a switch panel **72** attached thereto, is disposed at an angle so that the lower outside corners of the mounting plate "A" are positioned to be inwardly of and eventually to abut the shoulders **97**, whereupon the mounting plate may be dropped onto the spring **26** and pressed against it so as to retract it and allow the hook **101** to embrace the upper edge of the plate "A" at the recess **22**. The ledge **102** on the spring **100** provides a support for the upper end of the mounting plate "A," and the spring holds the plate in contact with the shoulder **97**. The spring shoulder **103** prevents the mounting plate "A" from being accidentally dislodged.

When it is desired to remove the mechanism from the housing "E," the spring **28**, being so readily accessible, is easily depressed by a thumb or finger and, with the other hand grasping the dial **42**, the plate "A" can be shifted to the incline position, shown in dotted outline in Fig. 2, whereupon the mechanism may be completely removed from the housing "E."

Variations and modifications in the details of structure and arrangement of the parts may be resorted to within the spirit and coverage of the appended claims.

We claim:

1. In an adjustable time switch, the combination of a time driven wheel, switch closing and switch opening trippers adjustably mounted on said time wheel, switch contacts, contact actuating means for effecting the closing and opening of said switch contacts, a first pivoted arm mounted on a first pivot axis and arranged to be oscillated first in one direction by one tripper on said wheel and then oscillated in the other direction by the other tripper on said wheel, a second pivoted arm mounted on a second pivot axis spaced from the first pivot axis of said first pivoted arm and operatively connected to transmit operating motion to said switch actuating means, first and second spring reaction shoulders on said first and second pivoted arms moving through the space between said first and second pivot axes on non-concentric, non-intersecting arcs, and compression spring means tending constantly to exert a separating force between said first and second spring reaction shoulders for imparting a snap motion to said contact actuating means and switch contacts.

2. In a time switch, the combination of switch contact means, switch actuating means for actuating said switch contact means, a time driven wheel, switch opening and switch closing trippers mounted on said time driven wheel, and snap actuating mechanism for transmitting a snap actuating motion from said trippers to said switch actuating means comprising a first pivoted arm pivotally mounted on a first pivot axis and arranged to be oscillated in one direction by one of said trippers and to be oscillated in the other direction by the other of said trippers, a second pivoted arm pivotally mounted on a second pivot axis which is spaced a substantial distance from said first pivot axis, said second pivoted arm being operatively connected to transmit motion to said switch actuating means, spring reaction shoulders on said two arms swinging in the space between said first and second pivot axes from one side to the other side of a straight line drawn between said first and second pivot axes and moving in separate non-intersecting, non-concentric arcs, and a compression spring operating in the space between said first and second pivot axes and exerting a constant separating force between said shoulders.

3. In a time switch of the class described, the combination of switch contact means, switch actuating means for actuating said switch contact means, a time driven wheel adapted to revolve through a complete revolution in a predetermined interval of time, switch opening and switch closing trippers adjustably mounted on said time driven wheel, and snap actuating mechanism for transmitting a snap actuating motion from said trippers to said switch actuating means at the preselected times established by the settings of said trippers on said time driven wheel comprising a first pivoted arm pivotally mounted on a first pivot axis and arranged to be oscillated in one direction by one of said trippers and to be oscillated in the other direction by the other of said trippers, a second pivoted arm pivotally mounted on a second pivot axis which is parallel with said first pivot axis but is spaced a substantial distance from said first pivot axis said second pivoted arm being operatively connected to transmit motion to said switch actuating means, spring reaction shoulders on said two arms swinging with said arms in the space between said first and second pivot axes from one side to the other side of a straight line drawn between said first and second pivot axes and moving in non-intersecting, non-concentric arcs, and a U-shaped leaf type of compression spring having its end portions operating in the space between said first and second pivot axes bearing against said spring reaction shoulders and exerting a constant separating force outwardly against said shoulders for producing a quick over-center snap action in the transmission of motion from said first pivoted arm to said second pivoted arm.

4. In a time switch, the combination of a continuously rotating time indicating dial, a relatively stationary marker cooperating with the time indications on said dial, a dial driving gear connected to said dial, a motor driven gear with which said dial driving gear normally meshes, an electric motor connected to continuously rotate said motor driven gear, said dial driving gear normally remaining in mesh with said motor driven gear for continuously rotating said dial

throughout the entire time that said electric motor is operating, switch closing and switch opening trippers mounted on said dial and rotating continuously therewith, a pivoted member arranged to be oscillated in one direction by one of said rotating trippers and in the other direction by the other of said rotating trippers, switch contacts, contact actuating means responsive to said pivoted member for closing and opening said switch contacts, and means enabling said time indicating dial and said dial driving gear to be shifted axially to a setting position wherein said dial driving gear is unmeshed from said motor driven gear and said trippers are clear of said pivoted member, in which position said dial can be rotatably adjusted relatively to said marker for giving the proper time setting to said dial.

5. An adjustable time switch comprising a mounting plate, a motor driven pinion journaled on said mounting plate, interconnected time gear and dial journaled on said mounting plate with said gear normally in mesh with said pinion, a thrusting spring normally urging said gear and dial to maintain said gear in mesh with said pinion, a switch cam having pivotal mounting on said plate, first and second switch actuating arms pivoted on said plate, radially and circumferentially spaced shoulders on said dial positioned to contact said first switch actuating arm on respectively opposite sides of its pivot for oppositely shifting said arm, said second arm being operatively connected with said switch cam and compression spring means connected to create a constant separating force between said first and second arms and adapted to oppositely snap the connection of said second arm and said switch cam across a line through the axis of the pivot mounting of said second switch actuating arm and through the axis of the pivot mounting of said switch cam when said first arm is shifted on its pivot by the respective shoulders, said gear and dial being axially shiftable against the action of said thrusting spring to disengage said gear from said pinion to retract said dial shoulders from the path of said arm and permit rotative movement of said dial.

6. In a time switch, the combination of a continuously rotating time indicating dial, a relatively stationary marker cooperating with the time indications on said dial, a dial driving gear connected to said dial, a motor driven gear with which said dial driving gear normally meshes, an electric motor connected to continuously rotate said motor driven gear, said dial driving gear normally remaining in mesh with said motor driven gear for continuously rotating said dial throughout the entire time that said electric motor is operating, switch closing and switch opening trippers mounted on said dial and rotating continuously therewith, a first pivoted arm mounted on a first pivot axis and arranged to be oscillated first in one direction by one of said trippers and then oscillated in the other direction by the other of said trippers, means enabling said time indicating dial and said dial driving gear to be shifted axially to a setting position wherein said dial driving gear is unmeshed from said motor driven gear and said trippers are clear of said first pivoted arm, in which position said dial can be rotatively adjusted relatively to said marker for giving the proper time setting to said dial, a second pivoted arm mounted on a second pivot axis spaced from the first pivot axis of said first pivoted arm, switch contacts and contact actuating means responsive to said second pivoted arm, first and second spring reaction shoulders on said first and second pivoted arms moving through the space between said first and second pivot axes on non-concentric, non-intersecting, arcs, and compression spring means tending constantly to exert a separating force between said first and second spring reaction shoulders.

7. In a time switch, the combination of a mounting plate, a pivot support secured to said mounting plate, an interconnected time indicating dial and driving gear rotatably and shiftably supported by said pivot support, an electric motor, a pinion driven thereby, thrusting spring means thrusting said dial and driving gear to an axial position on said pivot support where said gear is in mesh with said motor driven pinion for normally rotating said dial continuously throughout the entire time that said electric motor is operating, said thrusting spring means enabling said driving gear to be shifted axially to a setting position wherein it is unmeshed from said motor driven pinion, switch closing and switch opening trippers mounted on said time indicating dial, a first pivoted arm mounted on a first pivot axis and arranged to be oscillated in one direction by one of said trippers and to be oscillated in the other direction by the other of said trippers, a second pivoted arm mounted on a second pivot axis spaced from the first pivot axis of said first pivoted arm, a switch actuator responsive to said second pivoted arm, switch contacts responsive to said switch actuator, spring reaction shoulders on said first and second pivoted arms moving therewith through the space between said first and second pivot axes on non-intersecting arcs, and spring means tending constantly to exert a separating force between said spring reaction shoulders.

8. An adjustable time switch comprising, a mounting plate, an interconnected motor driven time wheel and dial rotatably journaled on said plate, first and second switch actuating arms mounted on said plate for independent swinging movement on laterally spaced pivot axes, said second switch actuating arm having a switch cam pin socket formed therein, a switch panel detachably mounted on said plate and mounting one or more switch contact members on the under side of said panel, a switch cam having pivot pin mounting on the under side of said panel for actuating said contact members, a pin on said switch cam extending up through a slot in said panel and seated in the switch cam pin socket formed in said second switch actuating arm, radially and circumferentially spaced shoulders on said dial positioned to contact said first switch actuating arm on respectively opposite sides of its pivot for oppositely shifting said latter arm, and compression spring means adapted to oppositely snap the connection of said second switch actuating arm and said switch cam across a line through the axis of the pivot pin mounting of said second switch actuating arm and through the axis of the pivot pin mounting of said switch cam when said first switch actuating arm is shifted on its pivot by the respective shoulders.

9. An adjustable time switch comprising, a mounting plate, an interconnected motor driven time wheel and dial rotatably journaled on said plate, first and second switch actuating arms pivotally mounted on said plate and said second arm having a switch cam pin socket formed therein, a switch panel detachably mounted on said plate and provided with a particular arrangement of switch contact members, a switch cam swiveled

on said switch panel and formed to actuate the respective contact members, a pin on said switch cam adapted to be seated in the pin socket of said second switch actuating arm, said switch panel having interchangeable mounting on said mounting plate for ready substitution by another switch panel having a different arrangement of switch contact members thereon, means for attaching either one of said switch panels on said plate with the respective switch cam pin of that panel seated in the pin socket of said second switch actuating arm, radially and circumferentially spaced shoulders on said dial positioned to contact said first switch actuating arm on respectively opposite sides of its pivot for oppositely shifting said latter arm, and a U-shaped compression spring connected to create a constant separating force between said first and second switch actuating arms and adapted to oppositely snap the connection of said second arm and switch cam across a line through the pivot axis of said second arm and the pivot axis of said switch cam swivel when said first arm is shifted on its pivot by the respective shoulders.

10. In a time switch, the combination of a mounting plate, a pivot support secured to said mounting plate, an interconnected time indicating dial and driving gear rotatably supported by said pivot support, an electric motor, a pinion driven thereby meshing with said driving gear for normally rotating said time indicating dial throughout the entire time that said electric motor is operating, switch closing and switch opening trippers mounted on said dial and rotating continuously therewith, a first pivoted arm arranged to be oscillated first in one direction by one of said trippers and oscillated in the other direction by the other of said trippers, a second pivoted arm mounted on a pivot axis spaced from the pivot axis of said first pivoted arm, spring reaction shoulders on said first and second pivoted arms moving therewith through the space between the pivot axes of said first and second pivoted arms on non-intersecting arcs, compression spring means connected with said reaction shoulders and tending constantly to exert a separating force between said sholders, said first and second pivoted arms being pivotally supported upon said mounting plate between said dial and said mounting plate and swinging in a plane substantially parallel to the plane of said dial, a switch cam responsive to the motion of said second pivoted arm, and switch contacts controlled by said switch cam.

11. An adjustable time switch comprising, a mounting plate, an interconnected motor driven time wheel and dial rotatably journaled on said plate, a switch cam swiveled on said plate, first and second superimposed switch actuating arms spaced apart axially of said gear and dial, spaced pivot pins for pivoting said arms to said plate adjacent their respective opposite ends intermediate the axis and periphery of said dial for swinging movement in spaced parallel planes at right angles to the axes of said pivot pins, radially and circumferentially spaced shoulders on said dial positioned to contact said first arm on respectively opposite sides of its pivot for oppositely shifting said first arm, means on the second of said arms connecting it to said switch cam, shoulders formed on the opposed faces of said arms and spaced apart radially of said dial, and a U-shaped compression spring interposed between and contacting said arm shoulders and adapted to oppositely snap the connection of said second arm and said switch cam across a line through the pivot axes of said pair of arms when said first arm is shifted on its pivot by the respective dial shoulders, said U-shaped compression spring resiliently maintaining said first arm in each of its oppositely snapped positions independently of contact with said dial or dial shoulders.

12. An adjustable time switch comprising, a mounting plate, an interconnected motor driven time wheel and dial rotatably journaled on said plate, a switch cam swiveled on said plate, first and second arms pivotally mounted on said plate on spaced parallel pivot axes permitting said two arms to swing in spaced parallel planes at right angles to said pivot axes, a pair of shoulders on said first arm arranged eccentrically of the pivot of said first arm and spaced at opposite sides of said first arm pivot radially of said dial, radially and circumferentially spaced shoulders on said dial positioned to respectively contact said first arm shoulders for oppositely shifting said first arm between switch opening and switch closing positions, said second arm being operatively connected with said switch arm, and a compression spring interposed between said arms and actuated by the swinging of said first arm to oppositely snap the connection of said second arm and said compression spring across a line through the pivot axes of said first and second arms when said first arm is shifted on its pivot by the engagement of said dial shoulders with the respective first arm shoulders, said compression spring resiliently maintaining said first arm in its switch opening and in its switch closing positions independently of contact with said dial or dial shoulders.

13. An adjustable time switch comprising, a mounting plate, an interconnected motor driven time wheel and dial rotatably journaled on said plate, a switch cam swiveled on said plate, first and second switch actuating arms pivotally mounted on said plate on spaced parallel pivot axes permitting said two arms to swing in spaced parallel planes at right angles to said pivot axes, a pair of shoulders on said first arm arranged eccentrically of the pivot of said first arm and spaced at opposite sides of said first arm pivot radially of said dial, a pair of trippers circumferentially shiftable on said dial, said trippers each having a shoulder formed thereon for contacting said arm shoulders to shift said first arm on its pivot, the shoulder on one of said trippers being spaced axially from the shoulder on the other said tripper whereby the contact of said tripper shoulders with the respective first arm shoulders effects an opposite shifting of said first arm on its pivot alternately into a switch opening position and a switch closing position, said second arm being operatively connected with said switch cam, and a compression spring interposed between said arms and actuated by the swinging of said first arm to oppositely snap the connection of said second arm and said compression spring across a line through the pivot axes of said first and second arms when said first arm is shifted on its pivot by the engagement of said tripper shoulders with the respective first arm shoulders, said compression spring resiliently maintaining said first arm in its switch opening and switch closing positions independently of contact with said trippers.

14. An adjustable time switch comprising, a mounting plate, a motor driven pinion journaled on said mounting plate, interconnected time gear and dial journaled on said mounting plate with

said gear normally in mesh with said pinion to be continuously driven thereby, a switch cam, an arm swingably mounted on said plate and operatively connected to said switch cam to actuate the latter alternately into switch opening and switch closing positions, a pair of shoulders on said arm arranged eccentrically of the pivot of said arm to said plate and spaced on opposite sides of said pivot radially of said dial, radially and circumferentially spaced shoulders on said dial positioned to respectively contact said arm shoulders for oppositely shifting said arm, and mechanism including compression spring means adapted to transmit a snap motion from said arm to said switch cam when said arm is shifted on its pivot by the contact of said dial shoulders with said respective arm shoulders, said compression spring means resiliently holding said switch cam in its switch opening position and in its switch closing position independently of contact of said arm shoulders with said dial or dial shoulders said gear and dial being axially shiftable to disengage said gear from said pinion to retract said dial shoulders from the path of said arm shoulders.

15. In apparatus of the class described including a unit assembly comprising a mounting plate having switch actuating means and motor driven control mechanism mounted on said plate for operating said switch actuating means, the combination therewith of a housing for receiving said unit assembly, horizontally and vertically disposed lugs punched from the sides of said housing to support said plate in spaced relationship to the back of said housing and to secure said plate against shifting, and a leaf spring anchored to the inside of the top end of said housing above the plane of said plate when resting on said housing lugs, said spring having the part inwardly of the anchoring thereof to said housing inclined inwardly to said housing top with the free end of said spring bent to form an offset in the plane of said plate to coact with said lugs to support said plate, said spring being automatically retractable to permit the ready insertion of said unit assembly into said housing or being manually retractable to permit the removal of said unit assembly.

16. In an adjustable time switch, the combination of a time driven wheel, switch actuating tripping means mounted on said wheel, switch contacts, contact actuating means for effecting the operation of said switch contacts, a first pivoted arm arranged to be oscillated by said switch actuating tripping means, a second pivoted arm mounted on a pivot axis spaced from the pivot axis of said first pivoted arm and operatively connected to transmit operative motion to said contact actuating means, and compression spring means acting on said first and second pivoted arms in the space between the pivot axes of said arms and tending to exert a separating force between said arms.

17. In a time switch, the combination of a continuously rotating time indicating dial, a dial driving gear connected thereto, a motor driven gear with which said dial driving gear normally

meshes, an electric motor connected to continuously rotate said motor driven gear, said dial driving gear normally remaining in mesh with said motor driven gear for continuously rotating said dial throughout the entire time that said electric motor is operating, switch actuating tripping means mounted on said dial, a pivoted member arranged to be oscillated by said tripping means, contact actuating means responsive to said pivoted member, switch contacts responsive to said contact actuating means, and means enabling said dial driving gear to be shifted axially out of mesh with said motor driven gear to permit said dial to be rotatively adjusted for giving the proper time setting to said dial either before or after said switch actuating tripping means has been secured in set position on said dial.

18. The combination of mounting means, a pair of spaced superimposed arms swingably mounted on said mounting means on parallel pivot pins spaced sufficiently far apart to permit portions of said arms to swing in the space between the axes of said pivot pins, shoulders on said arms positioned adjacent to but on opposite sides of a line through the axes of said pivot pins for shifting back and forth across said line, and a compression spring operatively disposed in the space between said pivot pin axes and arranged in contact with said shoulders for oppositely snapping said arms when one of said arms is oppositely shifted to move its shoulder across said line.

19. The combination of mounting means, an oscillating actuating member, a pair of spaced superimposed arms, spaced parallel pivot pins pivotally mounting said pair of arms on said mounting means on pivot axes spaced sufficiently far apart to permit portions of said arms to swing in the space between the axes of said pivot pins, one of said arms being connected to oscillate said member, shoulders on said arms normally positioned adjacent to but on opposite sides of a line through the axis of the swingable connections of said arms to said mounting means for shifting back and forth across said line, a compression spring arranged to operate in the space between said pivot pin axes and connected between said shoulders for oppositely snapping said arms when said other arm is oppositely shifted to move its shoulder across said line, and means for effecting the opposite shifting of said other arm.

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