

Dec. 18, 1951

W. F. HORGAN

2,579,260

TIME SWITCH

Filed Dec. 27, 1945

4 Sheets-Sheet 1

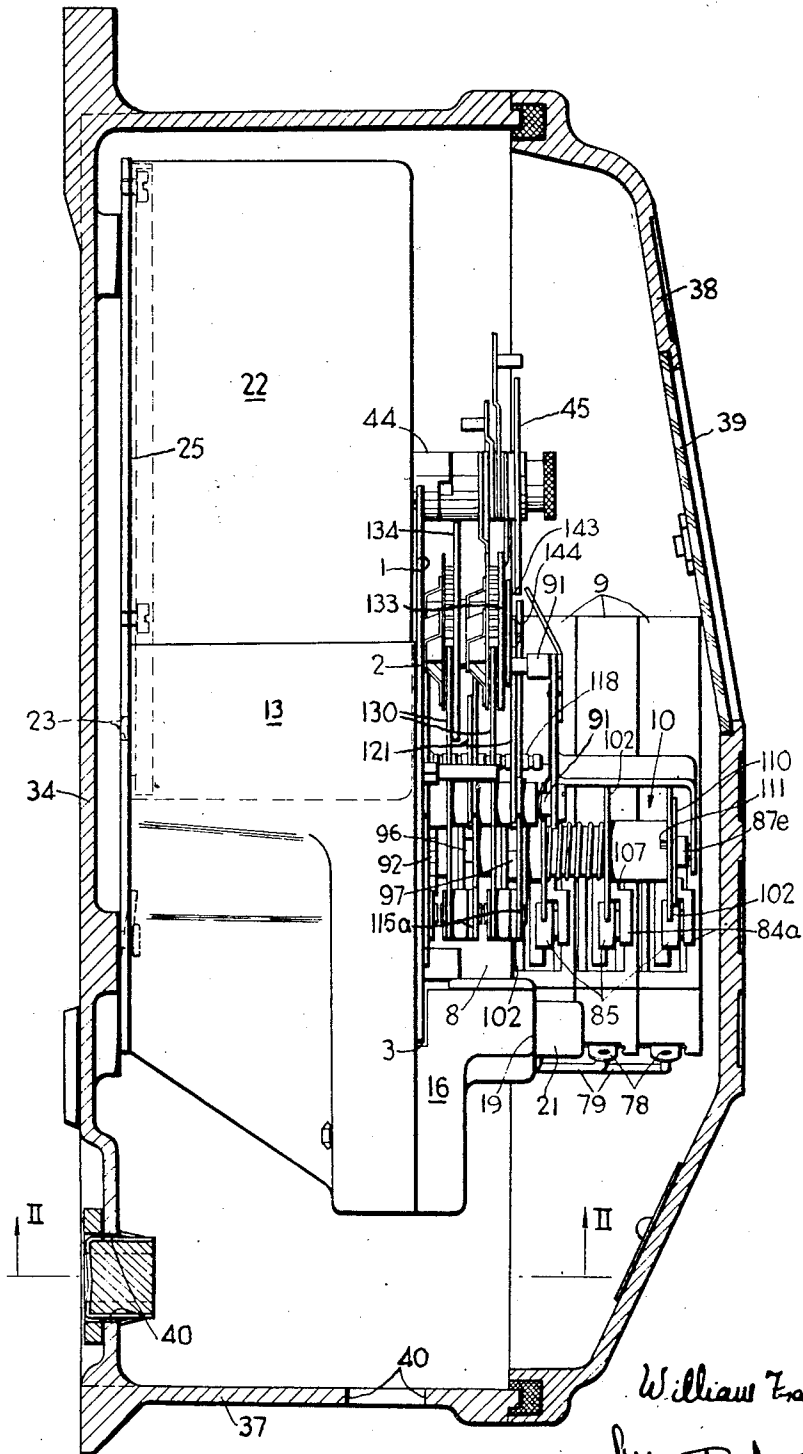


FIG. 1

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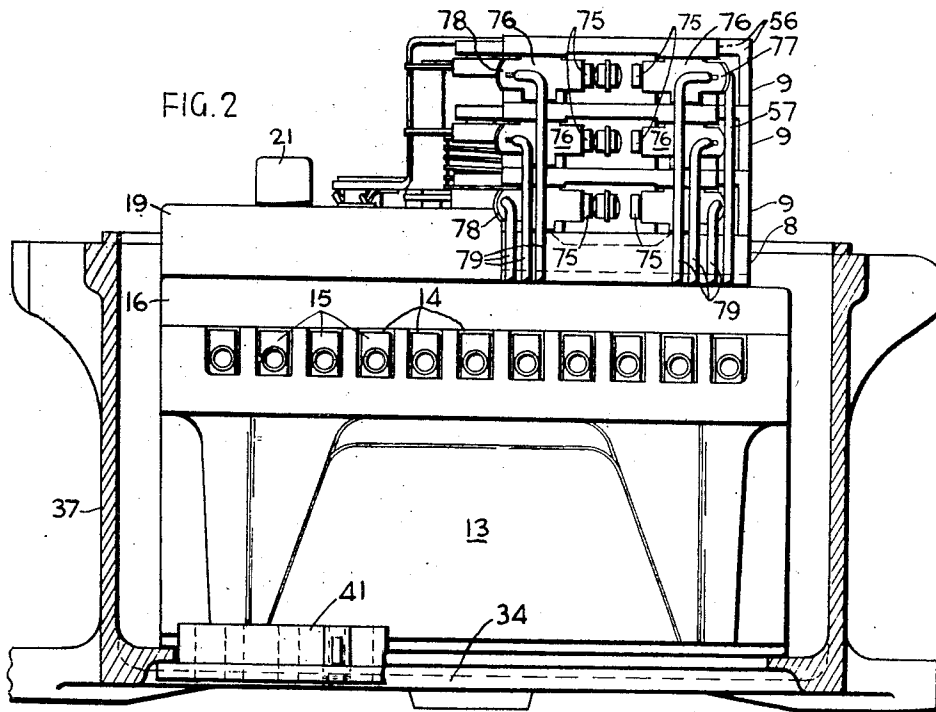
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4 Sheets-Sheet 2



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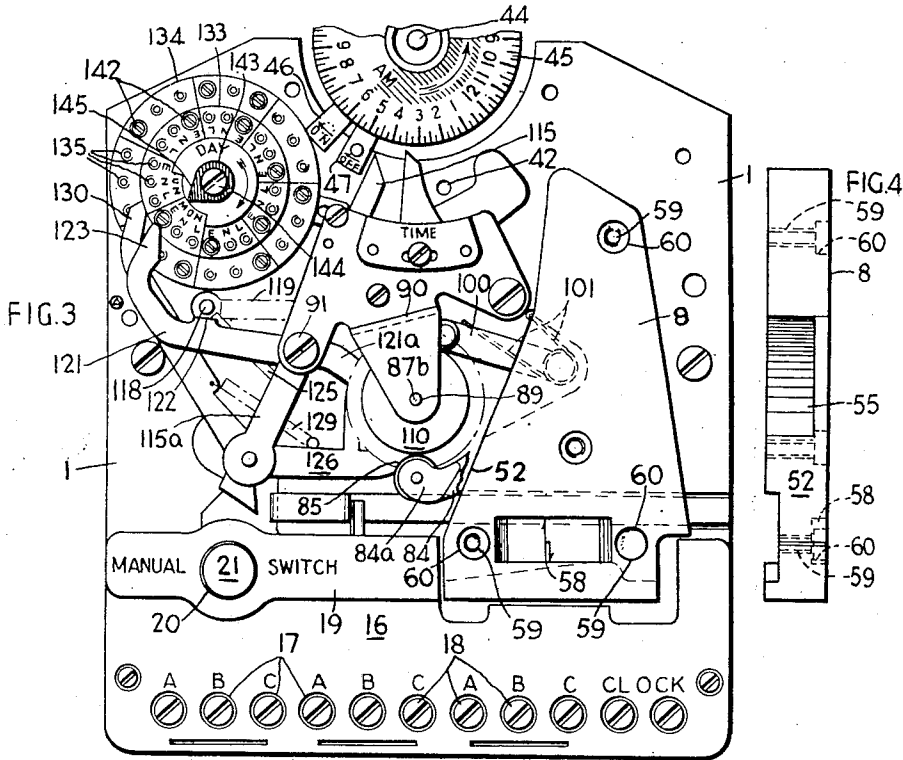
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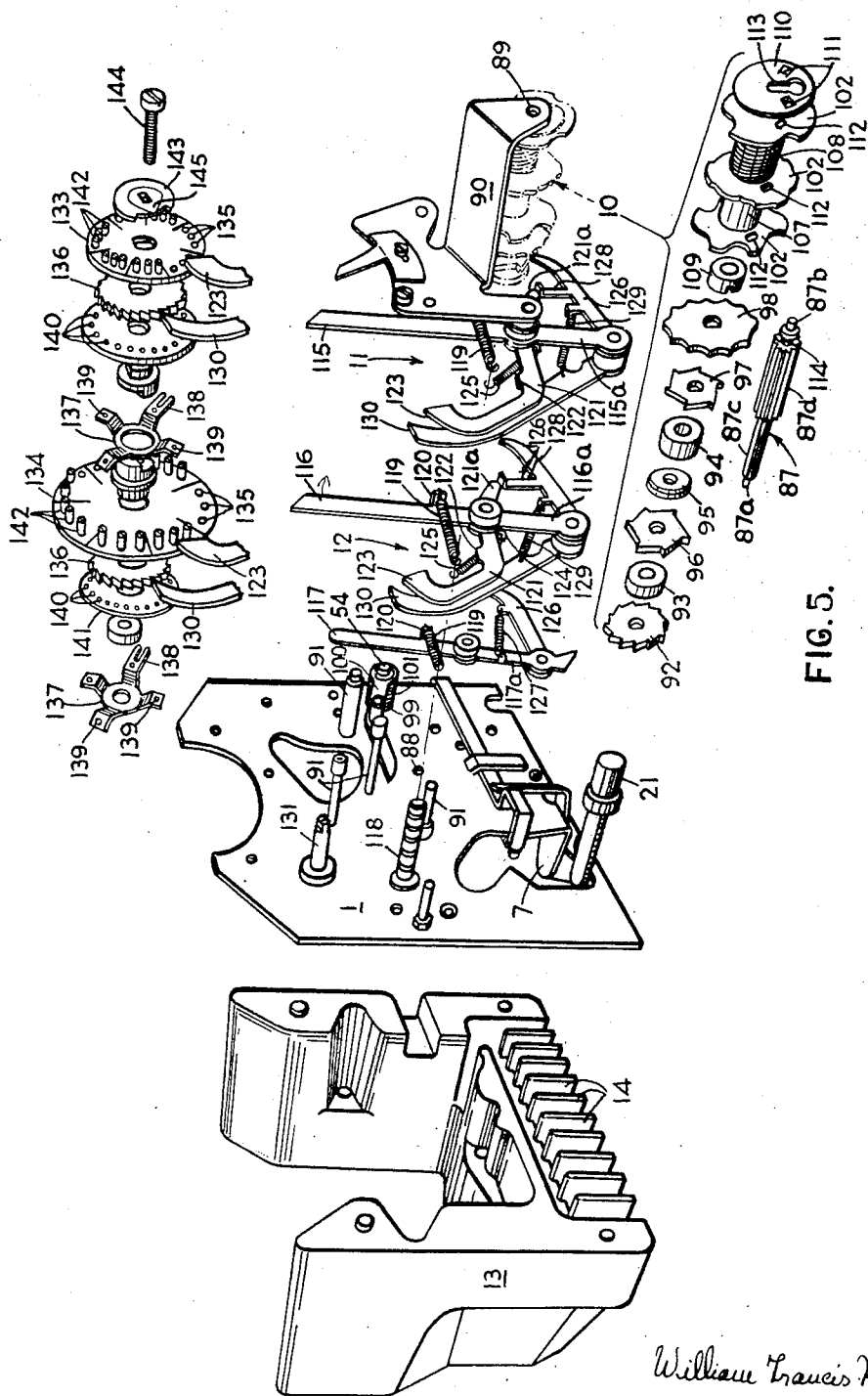


FIG. 5.

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UNITED STATES PATENT OFFICE

2,579,260

TIME SWITCH

William Francis Horgan, New Malden, England

Application December 27, 1945, Serial No. 637,419
In Great Britain January 9, 1945

5 Claims. (Cl. 200—38)

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This invention relates to time switches and is concerned more particularly with time switches of the kind comprising means capable of imparting a plurality of impulses to actuating mechanism at predetermined intervals within each of a number of sequential like periods of time and selector means capable of being pre-set to render such actuating mechanism effective for the impulses imparted during any desired number of such periods of time or none of them, as may be required. In such time switches the actuating mechanism, when effective, usually brings about for each impulse a change in the position of an element or device that is arranged to control the setting of a control element, such as an electric switch, a valve for a hydraulic or fluid-pressure system, a trip mechanism or other means for initiating or performing desired operations.

As heretofore proposed, time switches of the kind indicated can only be employed for the timed control of relatively simple operations according to a very limited range of programs since each impulse usually corresponds to one step of the operation and the variations possible are restricted to the mere omission or inclusion of steps in one period of time as compared with another such period. As an example of the type of program that is possible, there may be instanced the control of shop lighting where switching on at a predetermined time and switching off at another predetermined time is effected, by means of the time switch, automatically every day of the week with the exception of Sunday. Changes could be made in this program, by resetting the selector means, but only to cause the omission of one or both switchings on any one or more of the week-days or the inclusion of one or both switchings on the Sundays.

Now it is the main object of the present invention to provide a construction of time switch which shall be capable of adaptation to the timed control of very varied operations of widely differing degrees of complexity according to any one of an extensive range of programs and, particularly, which shall make it possible to vary the timing of a step in one period of time as compared with another such period in a predetermined manner. Another object is the provision of an improved construction and arrangement of the parts in such a time switch which shall make it possible to utilise the same actuating mechanism for effecting many and varied control operations without it being necessary to manufacture and stock large numbers of different parts.

Yet another object is to provide a range of two or more alternative timings for a step in an operation and to select any desired timing from

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this range or none of them in any one of the sequential time periods. Similarly, any two or more of the timings may be selected in any one time period so that the step in the operation is repeated accordingly.

The nature of the present invention will be more clearly understood from the following description, with reference to the accompanying drawings, of one example of the way in which it may be carried into effect. The time switch described and illustrated embodies features which are the subject-matter of co-pending applications Nos. 637,418, now Patent No. 2,544,089, March 6, 1951 and 637,649 now abandoned.

In the drawings:

Fig. 1 is a side elevation of the complete time switch mounted within its enclosing casing which is shown as sectioned substantially along its longitudinal centre line,

Fig. 2 is a sectional elevation taken on the line II—II of Fig. 1, the cover or lid of the casing being removed,

Fig. 3 is a front elevation of the mechanism of the time switch removed from the casing, with the control elements or electric switches omitted (save for a part of one of them) and the cams indicated only by a broken circle,

Fig. 4 is a side elevation taken from the left of Fig. 3, of an insulating block upon which the control elements are adapted to be mounted, and

Fig. 5 is an exploded perspective view of the complete mechanism, illustrating the association and construction of the parts.

In the example chosen, a top plate 1 is formed with appropriate apertures (and a downwardly extending lug or bracket 7 (Fig. 5) at its rear edge) for the attachment of, or to provide clearance for, parts of the actuating mechanism and an insulating block 3 upon which may be secured one or more control element units 9 which are fully described and illustrated in the specification of co-pending application No. 637,649.

The actuating mechanism comprises a cam assembly 10 which is fully described and illustrated in the specification of co-pending application No. 637,418 and is adapted to actuate a rocking element associated with each control element unit 9 when the assembly is rotated step-wise by either of two pawl-and-ratchet drives 11 and 12 of similar construction as hereinafter described.

A support 13 of moulded insulating material attached to the underside of the top plate 1 exhibits grooves 14 (Fig. 5) each adapted to receive a loose terminal block 15 (Fig. 2). A cover-plate 16, also moulded from insulating material, has an appropriate series of apertures 17 giving access to cable-securing screws 18 in the blocks 15

(Fig. 3). It also has an upstanding rib 19 formed with an aperture 20 for a press-button 21 intended to be employed to advance the cam assembly manually, for test purposes, through the medium of a pawl-and-ratchet drive and appropriate levers, one of which latter is mounted on the lug or bracket 7.

The bottom of the support 13 is closed by a bottom plate 25 removably attached to the bottom 34 of an enclosing casing comprising a lower part 37, with a hinged or removable lid 38 having a glazed opening 39, and a cable entry 40 in either the bottom 34 or the end wall of the part 37, such entries being fitted with an insulating block 41 having apertures for the passage of the cables.

A timing element 22 is mounted on the bottom plate 25 and a timing dial 45, carrying actuating "hands" 46, 47 in adjustable manner, is applied to the output spindle 44 of the timing element 22 so that the hands will co-operate correctly with the free ends of the rocking levers of the actuating mechanism 11, 12. This element 22 may be a clock embodying a direct current electric motor, a spring motor or a synchronous alternating current electric motor. Other sizes and types of timing elements can be affixed to either the top or bottom plate, or both, as best suits the construction thereof.

The insulating block 8 is located laterally of and closely adjacent to the cam assembly 10 and is recessed at 55 to suit the disposition of a pillar 54 forming part of the actuating mechanism. Three screw-threaded apertures 59 (or inset nuts) are provided in the block 8 and have their entry ends each surrounded by a recess 60. They serve to receive screws (not shown) employed for securing the control element or elements 9 in place, the screws being chosen of a length to suit one, two or more superposed elements which are all of identical unit construction. Such elements need not be described in detail here, as they are so described in co-pending application No. 637,649, but certain parts thereof will be mentioned incidentally in the following description.

Similarly, the cam assembly 10, being fully described in co-pending application No. 637,418, will be only briefly referred to here. It comprises a cam shaft 87 with end pivots 87a, 87b, and a lower end 87c carrying ratchet wheels 92, 96 and 97 with spacers 93, 94, 95. The ratchet wheel 92 is adapted to be advanced by one tooth each time that the pawl (to be described) operated by the test-button 21 is actuated. The ratchet wheels 96 and 97 are each advanced by one tooth each time that the corresponding pawl 126 (yet to be described) in the actuating mechanism is effectively operated by means of one of the hands 46 or 47. Since these pawls are normally operated alternately by "on" and "off" hands, the teeth of the ratchet wheels are angularly staggered in relation to each other by half a tooth-length and the number of teeth on each wheel (shown as six) is half the number of teeth on the ratchet wheel 92. Also secured on the cam-shaft part 87c is a positioning wheel 98 with twelve peripheral recesses and co-operating with a detent roller 99 carried on an arm 100 and urged against the wheel by a spring 101.

The upper end 87d of the cam-shaft has twelve splines disposed so that the centre line of each corresponds in angular disposition around the axis of the shaft to the radial face of one of the teeth of the ratchet wheel 92. On the splined shaft-portion 87d is mounted a set of cams 102

having central splined openings and cam rises and troughs located in a predetermined relationship to the centre-lines of the splines the shapes of the cams being selected to suit the character of the movements that are to be imparted to the rocking elements of the switch units 9. Many forms of cam may be produced to correspond to desired combinations of some or all of these movements in predetermined sequences (the switches being each capable of assuming three distinct settings) as described in co-pending application No. 637,418, three different forms of cam being shown by way of example in Fig. 5.

Spacers of tubular and spring form are shown at 107 and 108 between the cams 102 and the cams and spacers are temporarily locked on the shaft 87 by means of a locking disc 110 formed with tongues 111 adapted to engage in corresponding apertures 112 in the cam 102 which is endmost. The disc 110 is engaged with the shaft by means of a groove 114 in the latter and a key-hole slot 113 in the disc.

Referring now to the actuating mechanism and the selector discs, the pillar 91 at the side of the cam assembly remote from the units 9 serves as a common pivot for the rocking levers 115 and 116, respectively, of two similar pawl-and-ratchet drives and a rocking lever 117 arranged to be actuated by the button 21. The levers 115, 116, 117 are substantially identical in shape and disposition, each being engaged with the pillar 91 at a point in its length such that its rear and shorter end 115a, 116a or 117a extends rearwardly, and the extremities of the two levers 115 and 116 being adapted to be actuated by the "hands" 46, 47.

A pillar 118 serves both as a spring-anchoring post and as a stop for blocking levers (yet to be described) and a tension spring 119 is provided between this post 118 and an upturned lug 120 formed on the forward end of each rocking lever 115, 116 and 117, the springs normally holding these ends against a first stop pillar which is that pillar 91 located forwardly of the pivot pillar 91. A second stop pillar (which is a further one of the pillars 91) is provided inwardly of the forward ends of the levers 115, 116, 117 to limit the movement that may be imparted to them against the action of the springs 119.

Also pivoted on the pivot pillar 91 are the blocking levers 121, one for each of the levers 115 and 116, these levers 121 each having an outer end extending away from the pivot pillar for a distance such that an abutment 122 thereon will bear on the spring-anchoring post 118 and then inclining forwardly to terminate in a slightly inwardly turned tapered finger 123. Each blocking lever 121 also has an inner end 121a, which is short and inclined rearwardly to terminate in a pawl-supporting edge surface, and a rearwardly projecting lug 124 on its pivot-engaging portion that is connected by a tension spring 125 to the anchoring post 118.

On the rear extremity of each rocking lever 115, 116, 117 is pivotally mounted a pawl 126 extending towards the cam assembly 10, the pawl 126 on the manually-actuated lever 117 being disposed closely adjacent the top plate 1 and normally urged into engagement with the appropriate ratchet wheel 92 on the cam assembly 10 by a tension spring 127 extending between the pawl and a lug on the lever 117 as shown in Fig. 5. Each of the other pawls 126 is located at a height corresponding to the appropriate ratchet wheel 96 or 97 on the cam assembly 10

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and is formed with a forwardly extending lateral extension 128, towards its operative end, that bears on the pawl-supporting edge-surface of the inner end 121a of the corresponding blocking lever 121 under the action of a tension spring 129 connecting the respective pawl 125 to a further pawl 130 also pivoted on the rear extremity of the appropriate rocking lever 115 or 116. Each such spring 129, therefore, also serves to urge the respective further pawl 130 towards the pivot pillar 91 and these further pawls are made of considerable length to extend substantially in line with the forwardly inclined parts of the blocking levers 121 and terminate substantially beneath the fingers 123 thereon.

A pillar 131 (Fig. 5) having a screw-threaded axial bore 132 in its upper end is secured in the top plate 1 between the first stop pillar 91 and the location of the finger-ends 123 of the blocking levers 121 and has rotatably mounted thereon two selector discs 133 and 134. The two discs are both (in the example chosen) subdivided by engraved radial lines on their upper faces into seven equal sectors and each sector contains three of a circumferential series of uniformly spaced screw-threaded apertures 135. Each disc 133 or 134 has secured to its underside a ratchet wheel 136 (Fig. 5) having twenty-one teeth, each tooth being disposed with its substantially radial face disposed diametrically of one of the apertures 135, and the long pawls 130 on the rocking levers 115, 116 co-act with the respective ratchet wheels 136. The selector discs 133, 134 are similarly disposed initially, with the respective sectors coinciding, and are provided with a lost motion connection between them (not illustrated) such that the one may be advanced in relation to the other by one, two or three steps, each step corresponding to one tooth space of the ratchet-wheels 136, but no more. An attempt to advance one disc 133 or 134 relative to the other after three such relative advances have been effected results in both discs 133 and 134 advancing together. For convenience of adjustment, the lower disc 134 is of larger diameter than the upper disc 133 so that the ring of apertures 135 in the lower disc is disposed outside the edge of the upper disc. Between the lower disc 134 and the top plate 1 and between the upper and lower discs there are disposed spring spiders 137 (Fig. 5) which have anchoring extensions 138 slotted for engagement over the first stop pillar 91 and have each spider arm formed with a positioning nib 139 adapted to enter one of a circumferentially extending series of locating apertures 140 formed in a guard or retaining disc 141 to the underside of the respective ratchet wheel 136 to prevent the associated long pawl 130 from disengaging by movement parallel with the axis of the selector assembly. The locating apertures 140 have their centres on radial lines passing through the points of the ratchet-wheel teeth.

A series of short studs 142 having screw-threaded lower ends adapted to be selectively engaged in the screw-threaded apertures 135 in the selector discs 133 and 134 is provided. Normally, the finger-ends 123 of the blocking levers 121 are disposed in such relation to the selector discs 133 and 134 that they each extend over the edge of the respective disc to overlap by a small amount one of the apertures 135 in the same, the position occupied by this aperture being referred to herein as the "operative location." When a stud 142 is engaged in one of the apertures 135 and brought to the operative location,

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the appropriate finger-end 123 is displaced outwardly, substantially radially of the selector disc (133 or 134), and the corresponding blocking lever 121 is thereby rocked on the pivot pillar 91 to move its short inner end 121a forwardly. The shorter pawl 126 on the associated rocking lever (115 or 116) is thus allowed to rock forwardly under the action of its spring 129 to follow up the movement of the pawl-supporting edge-surface on the said inner end 121a. When the pawl 126 is in this forward position, a movement thereof produced under the action of the spring 119 working on the attached rocking lever (115 or 116), after the completion of a displacement of the latter by a "hand" driven by the timing element, imparts a step-wise advance (through one tooth-space) to that ratchet wheel (96 or 97) on the cam assembly 10 which is associated with the respective rocking lever. While the blocking levers 121 remain in the normal position, however, similar movements of the shorter pawls 126 do not produce any advance of the ratchet wheels 96 and 97 on the cam assembly since the inner ends 121a of the blocking levers are then disposed to support the pawls 126 so that their lines of movement are outside the ratchet teeth. Nevertheless, each movement of a rocking lever 115 or 116 under the action of its "hand" causes the longer pawl 130 carried thereby to feed the associated selector disc 133 or 134 forward by an angular distance corresponding to the spacing of the apertures 135 formed therein.

In the example chosen, see Fig. 3, each sector of the upper disc 133 is marked to correspond to a day of the week, the central aperture 135 on each sector is marked "N," the leading aperture on each sector (considered in the direction of rotation of the discs) is marked "E" and the remaining aperture on each sector is marked "L." The selector discs 133, 134 are retained on their pillar 131 by a disc 143 held in place by a screw 144 engaged in the screw-threaded bore 132 in the pillar, this latter having flats or other positioning means engaging corresponding formations on the retaining disc 143 to ensure that the latter is always disposed correctly with an index mark 145 thereon pointing directly to the operative location.

The dial 45 of the timing element 22 to suit the example chosen, is arranged to rotate once in every twenty-four hours and carries six "hands" (only one pair is shown) which are individually adjustable around the dial and capable of being locked in adjusted position in known manner. Three of these are "'on' hands," such as that shown at 46, and adapted to operate the rocking lever 116 and three are "'off' hands," such as that shown at 47, adapted to operate the other rocking lever 115.

By means of the selector mechanism described it is possible to arrange a program of switching on the following lines, it being understood that the character of the switching operation and the complexity thereof is determined by the shapes and number of the cams 102 in the cam assembly 10 and the number, types and systems of connection of the switch units 9 controlled thereby. For this reason and for the sake of simplicity of description it will be assumed in the following example of operation that there is only one switch unit 9, which is connected to act as a single-throw single-throw switch, giving an "on" and an "off" position, and therefore only one cam 102.

Let it be assumed that the program calls for switching on of the circuit including the switch unit 9 at 6.0 a. m. on each Monday, Tuesday, Saturday and Sunday and the switching off thereof at 6.30 p. m. on each Monday, Tuesday and Saturday, with the following additional special switchings—switching off at 12 noon, switching on again at 6 p. m. and at 9 p. m. and switching off at midnight, all on Mondays, switching on again at 9 p. m. and off at midnight on Tuesdays, switching on at 6 p. m. and off at midnight on Wednesdays, switch on at 9 p. m. and off at midnight on Saturdays, and switching off at 12 noon, on again at 6 p. m. and off at midnight on Sundays.

For this program the three "on" hands 46 (only one is shown) are set to correspond, respectively, to 6.0 a. m. 6 p. m. and 9 p. m. and the three "off" hands 47 (only one is shown) are set to correspond, respectively, to 12 noon, 6.30 p. m. and 12 midnight. The 6 p. m. switching will be considered the normal "on" switching and the 6.30 p. m. switching the normal "off" switching. Studs 142 are now inserted in the apertures 135 in the selector discs as follows: For each day having a normal "on" switching, a stud 142 is inserted in the central aperture 135, marked "N," of the appropriate sector of the selector disc 134 corresponding to the rocking lever 116 actuated by the "on" hands. In the same way, a stud 142 is inserted in the central aperture 135 of each appropriate sector of the other selector disc 133 for each day having a normal "off" switching. For each day having an "on" switching, earlier than normal a stud 142 is inserted in the aperture 135 marked "E" on the corresponding sector of the "on" selector disc 134, and for each day having an "on" switching later than normal, a stud 142 is inserted in the aperture 135 marked "L" on the corresponding sector of the "on" disc. The same steps are taken in connection with the "off" switchings, studs 142 being inserted in the appropriate leading apertures 135 of the "off" selector disc 133 for earlier than normal switching and in the appropriate trailing apertures 135 of the same disc for later than normal switching. It will be noted that, as no switching is to occur on Thursdays and Fridays, there are no studs 142 inserted on any of the sectors of both discs corresponding to these days.

In operation, the timing element 22 is set into motion at a certain time, say on a Monday before 6:00 a. m., the dial 45 having been set in proper initial timing relation to an index carried on the top plate 1 and the selector discs 133 and 134 having been arranged with the "L" apertures for the Sunday sectors in the operative location. As the dial 45 rotates it brings the first "on" hand 46 into contact with the "on" rocking lever 115 and displaces this until, at 6.0 a. m., it slips past the displaced end thereof and allows the associated spring 119 to return it rapidly into contact with the first stop pillar 91. During the displacement of the lever 116, the longer pawl 130 carried thereby has fed the "on" selector disc 134 forward by one tooth to bring the stud 142 in the "E" aperture for the Monday sector into the operative location and thus has caused the associated blocking lever 121 to move to its inoperative position. The subsequent return of the rocking lever 116 is therefore effective in imparting a step-wise advance to the cam assembly 10, with the consequent displacement of the switch contact 80 to the "on" position. Continued rotation of the

dial 45 next brings the first "off" hand 47 into contact with the "off" rocking lever 115 to cause the same sequence of events but for the "off" mechanism, namely, the advance of the stud 142 in the "E" aperture for the Monday sector of the "off" selector disc 133 to the operative location, the displacement of the appropriate blocking lever 121 to the inoperative position and the advance of the cam assembly 10 by a further step to cause the displacement of the switch contact 80 to the "off" position, at 12 noon. As there are studs 142 in all the apertures of the Monday sectors of the two selector discs, the same operations take place for each of the other "hands" to effect switching on at 6.0 p. m., off at 6.30 p. m., on at 9 p. m. and off at midnight. The Tuesday sectors have studs in the "E" and "L" apertures on the "on" disc and in the "N" and "L" apertures on the "off" discs and the appropriate operations take place where studs are present, as set out above. When the 6.0 a. m. "on" switching has been effected and the first "off" hand 47 eventually displaces and releases the "off" rocking lever 115, at 12 noon, the longer pawl 130 will have advanced the unfilled "E" aperture 135 of the "off" disc 133 to the operative location, with the result that the corresponding blocking lever 121 will have moved to the operative position, before the shorter pawl 126 is moved by the return of the rocking lever 115. In consequence, no advance is imparted to the cam assembly 10 and the switch setting is not changed. This sequence of operations is performed, for the respective "on" or "off" sets of actuating parts, each time that an unfilled aperture 135 in a selector disc is brought to the operative location by the initial displacement of the corresponding rocking lever by the "hand" concerned. For example, on Thursdays and Fridays no switching operations are performed but the selector discs are each advanced by three steps. It will be understood, therefore, that the pre-setting of the studs in the manner indicated will result in the performance of the desired switching program each week so long as the timing element is running.

As will be obvious, the actual switching operations performed at the pre-set times may be made of considerable complexity and be varied in character by suitable choice of the number, type and mode of connection of the switches 9 and of the shape of the cams 102 in the cam assembly 10.

As an indication of the adaptability of the time switch described herein, it may be mentioned that with a range of only three switch units 9 of the character specified herein with reference to the drawings and a range of only four different types of cam, it is possible to build up time switches for controlling approximately sixty different circuit arrangements.

The dial 45 of the timing element 22 may be arranged to rotate once in an hour, or at any other desired rate, and may have a large number of "hands" applied thereto, being enlarged in diameter if necessary, so that great flexibility in application is possible. More than two selector discs and sets of actuating parts may be provided, in some cases, with more than two types of "hands" to correspond. In addition, the sets of actuating parts may readily be designed to operate more than one cam assembly under the control of a single timing element and even greater complexity may be provided for by arranging two or more of the time switches according to the invention in tandem. The program may be one

that requires any desired number of subdivisions on the selector discs and it will be appreciated that the specific examples described herein are for purposes of illustration only.

What I claim is:

1. Clock-controlled mechanism capable, when appropriately pre-set, of automatically carrying through a series of timed changes in the setting of a control device according to a program in which the number of differently timed changes to be effected in any one of a predetermined number of sequential like periods of time may vary from zero to a given maximum number which is an integer greater than one, comprising a dial adapted to be rotated by the clock once in each of the said periods of time, a series of actuators mounted on the dial at pre-selected settings representing the respective times at which the changes included in the said maximum number are to be effected, a trip device displaceably mounted in proximity to the dial, biasing means constantly urging the trip device to an initial position from which it will be positively displaced by each of the actuators in succession as the dial is rotated, a rotatable disc, a ring of positioning locations formed on the disc at an angular distance apart of

$$\frac{360^\circ}{n}$$

where n is the product of the said maximum number of changes and the said predetermined number of like periods of time, operating elements mounted at preselected positioning locations on the disc, a blocking element displaceably mounted in proximity to the said disc, biasing means constantly urging the blocking element to a first position in which it may be engaged by each operating element mounted on the disc in turn, driving means for advancing the said disc through the said angular distance of

$$\frac{360^\circ}{n}$$

for each positive displacement of the trip device by an actuator, each such advance bringing a positioning location on the disc to a position in which any operating element present at the location will displace the blocking element to a second position, an element actuatable to change the setting of the control device, further driving means operatively connected to the trip device and adapted when operative to actuate the said setting-changing element once for each positive displacement of the trip device, and means which holds the said further driving means inoperative while the blocking element is in the one of its two positions.

2. Clock-controlled mechanism capable, when approximately pre-set, of automatically carrying through a series of timed changes in the setting of a control device according to a program in which the number of differently timed changes to be effected in any one of a predetermined number of sequential like periods of time may vary from zero to a given maximum number which is an integer greater than two, at least one of the said maximum number of possible changes being of one character and the remainder thereof being of another character, comprising a dial adapted to be rotated by the clock once in each of the said periods of time, a first series of actuators mounted on the dial at pre-selected settings representing the respective times at which the changes of the said one character included in the said maximum number are to be effected,

a second series of actuators mounted on the dial at pre-selected settings representing the respective times at which the changes of the said other character included in the said maximum number are to be effected, a first trip device displaceably mounted in proximity to the dial, biasing means constantly urging the said trip device to an initial position from which it will be positively displaced by each of the actuators of the first series in succession as the dial is rotated, a second trip device displaceably mounted in proximity to the dial, biasing means constantly urging the second trip device to an initial position from which it will be positively displaced by each of the actuators of the second series in succession as the dial is rotated, a first rotatable disc, a ring of positioning locations formed on the said disc at an angular distance apart of

$$\frac{360^\circ}{n_1}$$

where n_1 is the product of the number of actuators in the said first series and the said predetermined number of like periods of time, operating elements mounted at pre-selected positioning locations on the said first disc, a first blocking element displaceably mounted in proximity to the said first disc, biasing means constantly urging the first blocking element to a first position in which it may be engaged by each operating element mounted on the said first disc in turn, driving means for advancing the said first disc through the said angular distance of

$$\frac{360^\circ}{n_1}$$

for each positive displacement of the first trip device, each such advance bringing a positioning location on the said first disc to a position in which any operating element present at the location will displace the first blocking element to a second position, a second rotatable disc, a ring of positioning locations formed on the said second disc at an angular distance apart of

$$\frac{360^\circ}{n_2}$$

where n_2 is the product of the number of actuators in the said second series and the said predetermined number of like periods of time, operating elements mounted at pre-selected positioning locations on the said second disc, a second blocking element displaceably mounted in proximity to the said second disc, biasing means constantly urging the second blocking element to a first position in which it may be engaged by each operating element mounted on the said second disc in turn, a second driving means for advancing the said second disc through the said angular distance of

$$\frac{360^\circ}{n_2}$$

for each positive displacement of the second trip device, each such advance bringing a positioning location on the said second disc to a position in which any operating element present at the location will displace the second blocking element to a second position, an element actuatable to cause changes of either one of the said two characters in the setting of the control device, a third driving means operatively connected to the first trip device and adapted when operative to actuate the said setting-changing element once in the sense for causing a change of the said one character in the setting of the control device

for each positive displacement of the first trip device, a fourth driving means operatively connected to the second trip device and adapted when operative to actuate the said setting-changing element once in the sense for causing a change of the said other character in the setting of the control device for each positive displacement of the second trip device, means which holds the said third driving means inoperative while the first blocking element is in the one of its two positions, and further means which holds the said fourth driving means inoperative while the second blocking element is in the one of its two positions.

3. In a time switch, a dial rotated by clock-mechanism, at least one actuator of a first character mounted at a pre-selected setting on the dial, at least one actuator of a second character mounted at a different pre-selected setting on the dial, a first trip mechanism arranged to be displaced from a normal position by each actuator of the first character as the dial rotates, a second trip mechanism arranged to be displaced from a normal position by each actuator of the second character as the dial rotates, biasing means for restoring the respective trip mechanisms to their normal positions after each such displacement, a control element actuatable by either trip mechanism during its restoration to the normal position, a first blocking means normally holding the first trip mechanism in an inoperative condition, but operable to a second position in which it holds the first trip mechanism in an operative condition, a first disc rotatable by equal stepwise advances to displace a plurality of selector-receiving locations thereon successively into a predetermined position, a selector mounted at at least one of the said locations and adapted to operate the first blocking means to its second position when the said location is displaced into the predetermined position, a second blocking means normally holding the second trip mechanism in an inoperative condition but operable to a second position in which it holds the second trip mechanism in an operative condition, a second disc rotatable by equal stepwise advances to displace a plurality of selector-receiving locations thereon successively into a predetermined position, a selector mounted at at least one of the said locations on the second disc and adapted to operate the second blocking means to its second position when the last-mentioned location is displaced into the predetermined position, means operated by the first trip mechanism during each displacement thereof from its normal position to advance the said first disc by one step, and further means operated by the second trip mechanism during each displacement thereof from its normal position to advance the said second disc by one step.

4. In a time switch, a dial rotated by clock-mechanism, a plurality of actuators of a first character each mounted at one of a set of pre-selected settings on the dial, a plurality of actuators of a second character each mounted at one of a different set of pre-selected settings on the dial, a first trip mechanism arranged to be displaced from a normal position by each actuator of the first character as the dial rotates, a second trip mechanism arranged to be displaced from a normal position by each actuator of the second character as the dial rotates, biasing means for restoring the respective trip mechanisms to their normal positions after each such

displacement, a control element actuatable by either trip mechanism, during its restoration to the normal position, a first blocking means normally holding the first trip mechanism in an inoperative condition but operable to a second position in which it holds the first trip mechanism in an operative condition, a first disc rotatable by equal stepwise advances to displace a plurality of selector-receiving locations thereon successively into a predetermined position, the locations constituting an integral number of groups each consisting of as many locations as there are actuators of the first character, a selector mounted at at least one of the said locations and adapted to operate the first blocking means to its second position when the said location is displaced into the predetermined position, a second blocking means normally holding the second trip mechanism in an inoperative condition but operable to a second position in which it holds the second trip mechanism in an operative condition, a second disc rotatable by equal stepwise advances to displace a plurality of selector-receiving locations thereon successively into a predetermined position, the locations constituting an integral number of groups each consisting of as many locations as there are actuators of the second character, a selector mounted at at least one of the said locations on the second disc and adapted to operate the second blocking means to its second position when the last-mentioned location is displaced into the predetermined position, means operated by the first trip mechanism during each displacement thereof from its normal position to advance the said first disc by one step, and further means operated by the second trip mechanism during each displacement thereof from its normal position to advance the said second disc by one step.

5. A time switch comprising a clock-driven dial carrying a plurality of actuators and adapted to be rotated once in each of a given number of like periods of time, an actuating mechanism operated by each of the actuators in turn, a pre-set selector having a plurality of controlling positions through which it is adapted to be displaced stepwise, the number of such positions being the product of the number of like periods of time and the number of actuators, means actuated by the actuating mechanism to effect a stepwise displacement of the pre-set selector for each operation of the actuating mechanism, selector-controlled means arranged to place the actuating mechanism in an inoperative condition for certain operations thereof as determined by the pre-setting of the selector, and a control device actuated only by those operations of the actuating mechanism which are effected while the said mechanism is in an operative condition.

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