May 22, 1962 R. M. BASSETT 3,036,228

CLOCK OPERATED ELECTRIC SWITCH

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Fig. 1

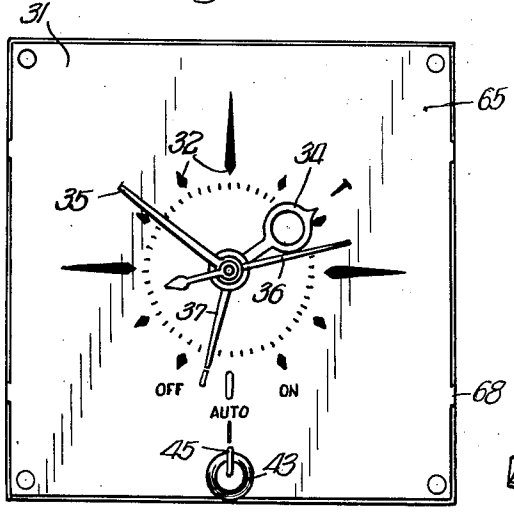


Fig. 3

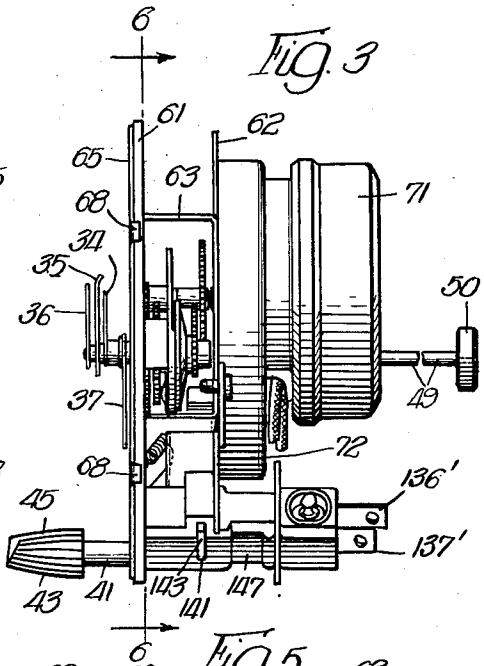


Fig. 2

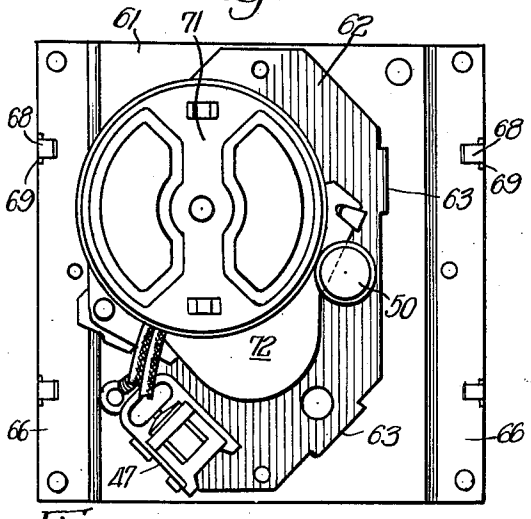


Fig. 5

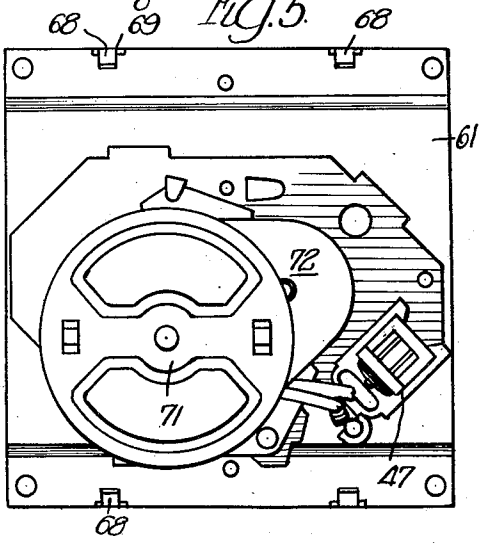
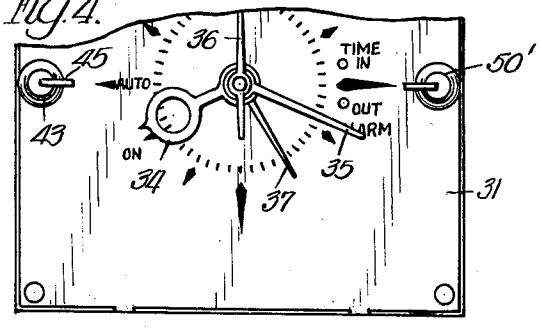


Fig. 4



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CLOCK OPERATED ELECTRIC SWITCH

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Fig. 6.

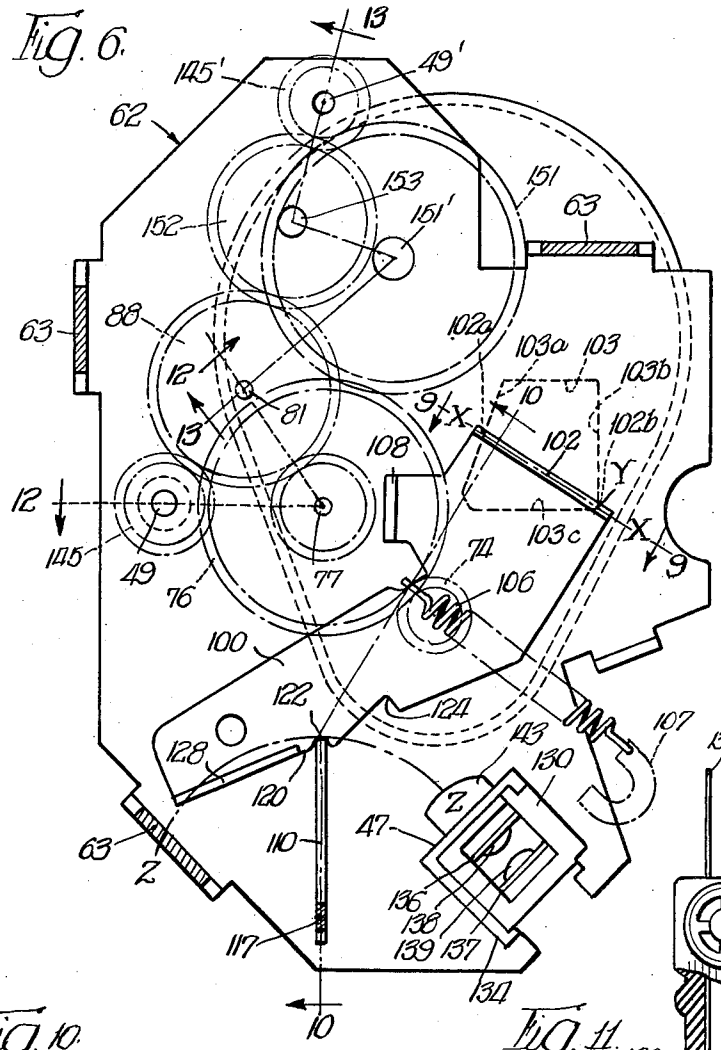


Fig. 10.

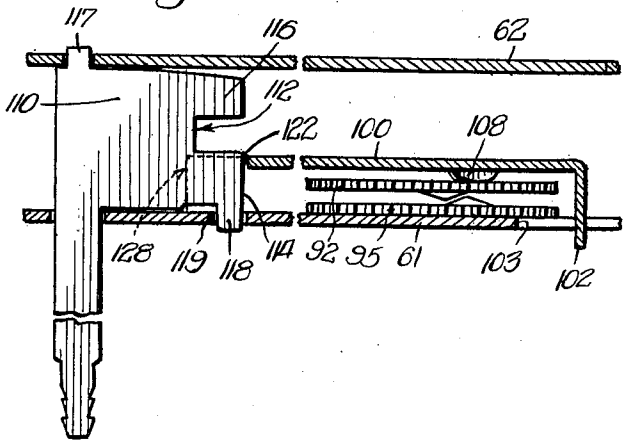
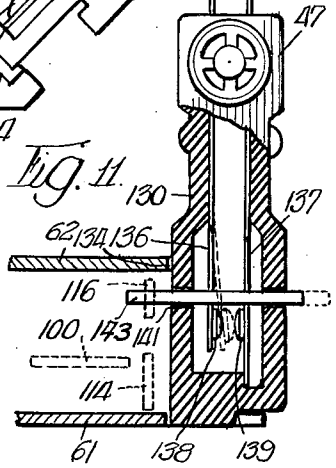


Fig. 11.



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Fig. 7

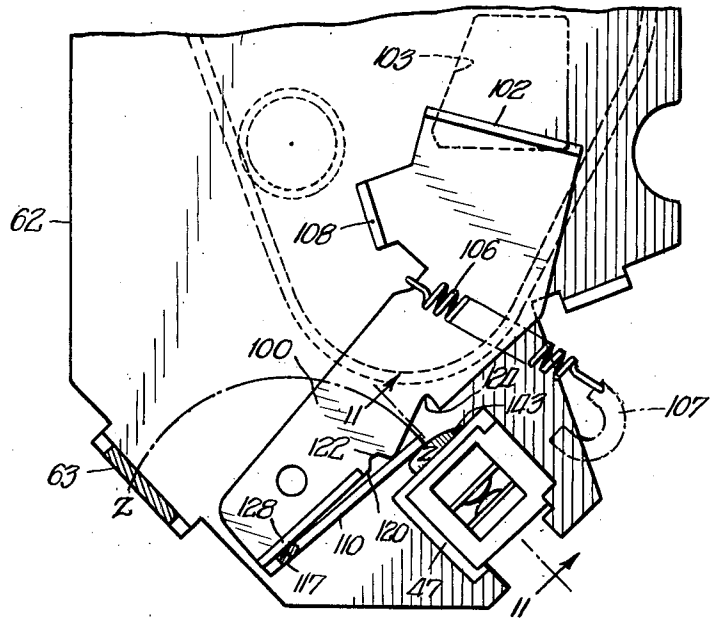


Fig. 8

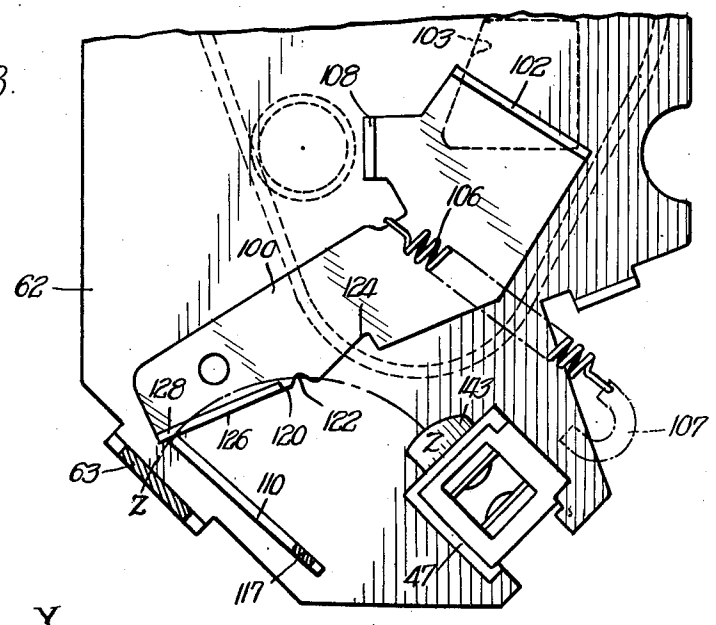
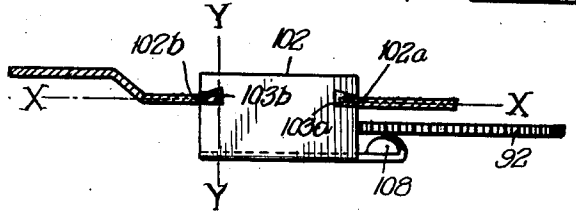


Fig. 9



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Fig. 12

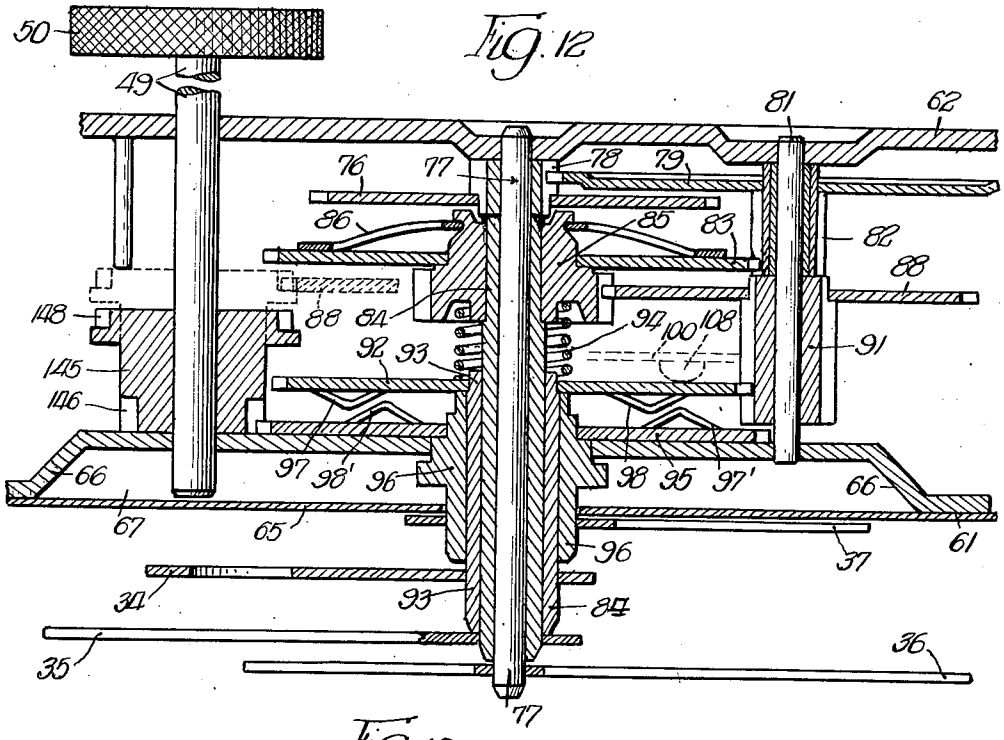
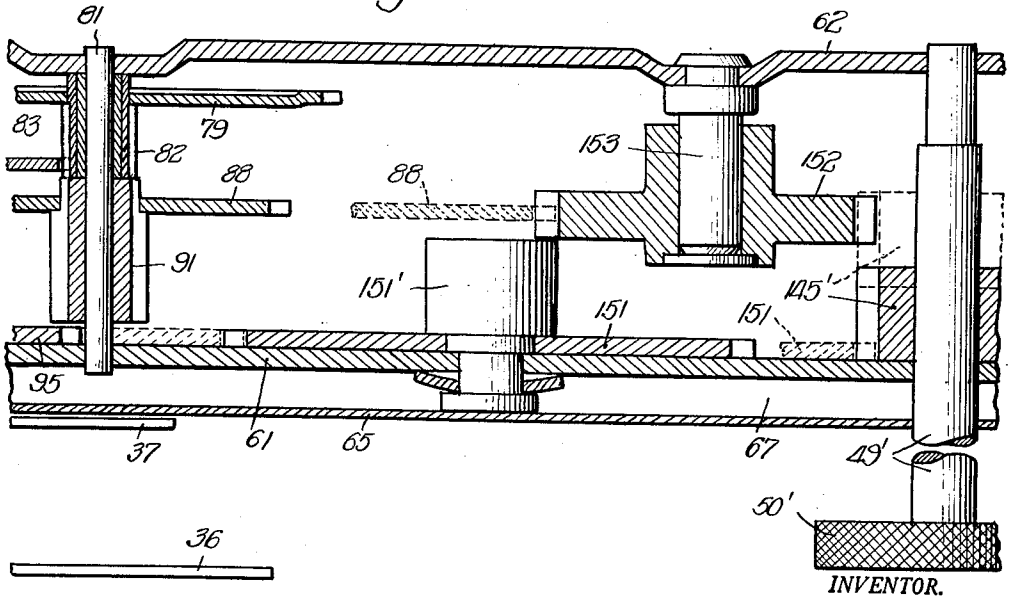


Fig. 13



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Fig. 14

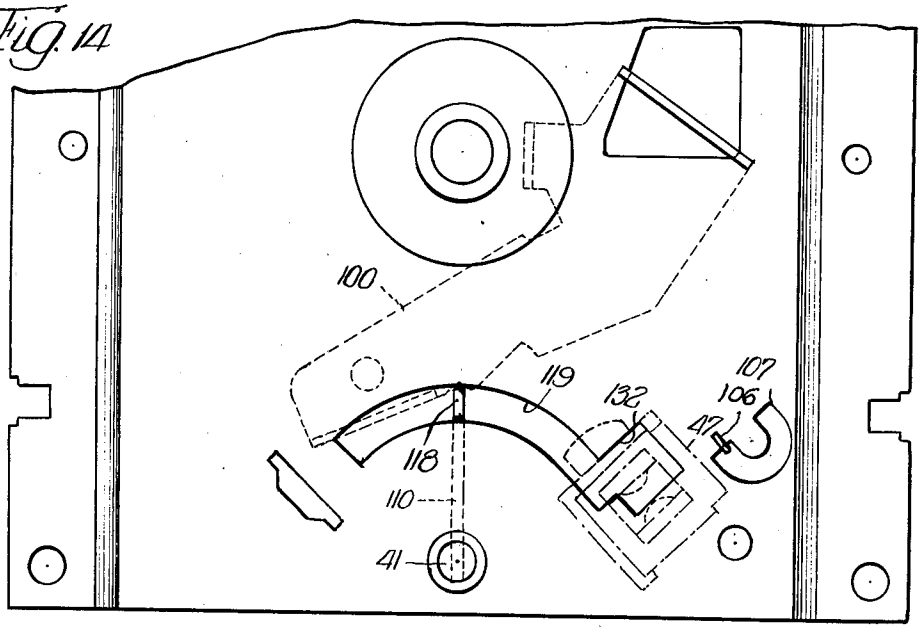


Fig. 15

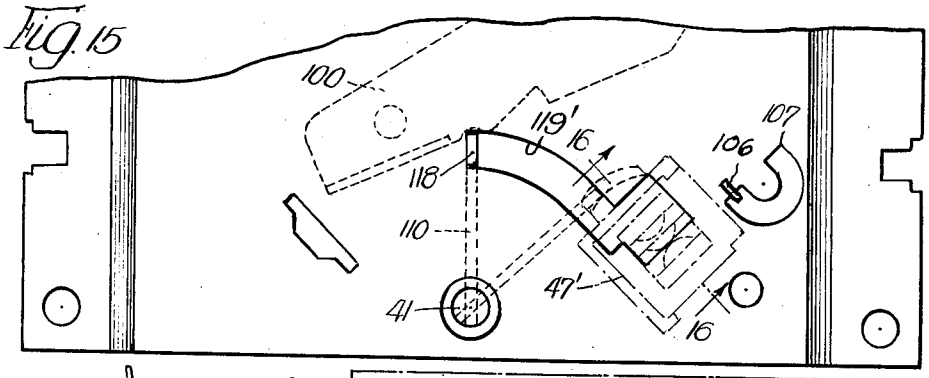


Fig. 16

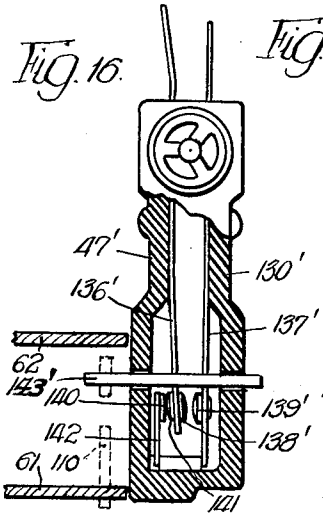
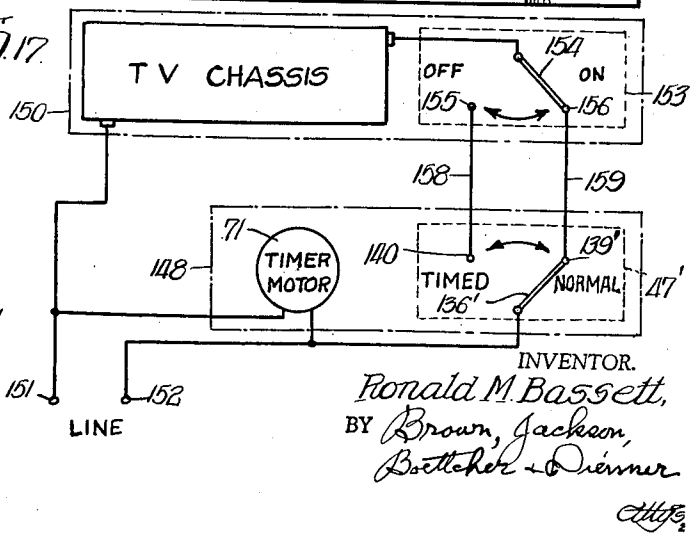


Fig. 17



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United States Patent Office

3,036,228

Patented May 22, 1962

3,036,228

CLOCK OPERATED ELECTRIC SWITCH

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Filed July 30, 1959, Ser. No. 830,489
5 Claims. (Cl. 307—114)

The present invention relates to improvements in clock operated electric switches. These switches are intended to function primarily as timers for the timed control of radios, television sets, clothes washers and other appliances.

One of the objects of the invention is to provide such a clock switch which is extremely compact in its dimensions, so as to occupy the least amount of space when used in ultra small table model radios, small portable television sets, and other small appliances.

Another object is to provide such a clock switch which is very simple and inexpensive to construct so that it can favorably compete in the highly competitive field of radio clocks, timers, etc.

Another object is to provide a clock switch characterized by an improved switch actuating and indexing mechanism wherein the switch setting knob always indexes or shows the position then occupied by the switch; wherein there is a wide angular span, of approximately 90°, between the two end positions of the setting knob; and wherein the "Auto" (automatic) setting of the switch setting knob lies midway between the "On" setting and the "Off" setting, so that there is no mistaking the position of the switch setting knob and the condition of the switch.

Another object is to provide a unique cooperative relationship between a spring biased unlatching lever which is made time responsive so as to move to an unlatching position when a preset time arrives, and a switch actuating stem which is tripped when the unlatching lever responds to the arrival of the preset time interval. One of the unique features of this biasing lever is its mounting for pivotal motion around two axes, substantially at right angles to each other. One of these axes is a hinging axis around which its time responsive hinging motion occurs, and the other is a pivoting axis around which the lever is capable of transmitting its spring bias to the switch actuating stem in opposite directions, i.e. in one direction toward switch closing position and in the other direction toward switch opening position.

Another object is to provide a readily convertible construction which, in the assembly thereof, can be easily made into a "rear-set" type of unit or into a "front-set" type of unit. In the "rear-set" type, the manually actuated setting knob which sets the clock hands and presets the time of automatic switch operation is located to the rear of the clock dial, and in the "front-set" type this knob is located in front of the clock dial. My improved construction can, in the assembly, be converted from one type to the other by the mere addition of a few parts and the making of slight changes in the markings on the clock dial.

A further object of the invention is to provide a modified construction embodying a two-position electric switch (comparable to a single pole, double throw switch) which collaborates with another two-position electric switch (single pole, double throw) on a television set or other appliance for enabling the television set or other appliance to be placed under clock timer control so as to be turned on automatically at a preset time or to be turned off automatically at a preset time.

Other objects, features and advantages of the invention will appear from the following detailed description of certain preferred embodiments thereof. In the accompanying drawings illustrating such embodiments:

FIGURE 1 is a front elevational view of one embodiment of my improved clock switch, prior to its mounting in the radio, television set, clothes washer, etc.; this embodiment being of the "rear-set" type in which the knob for setting the clock hands and for presetting the time for automatic operation is disposed in rear of the clock;

FIGURE 2 is a rear elevational view of this embodiment of clock switch;

FIGURE 3 is a side or edge elevational view thereof;

FIGURE 4 is a fragmentary front elevational view of the clock dial showing the converted arrangement of the "front-set" type in which the knob for setting the clock hands and for presetting the automatic switch operating time is located at the front of the clock;

FIGURE 5 is a rear elevational view of this latter type;

FIGURE 6 is a sectional view on the plane of the line 6—6 of FIGURE 3, taken just inside of the front mounting plate, looking rearwardly in the direction of the arrows, and showing the positions of the latching-biasing lever and of the stem wing when the device is set in its "Auto" (automatic) setting;

FIGURE 7 is a fragmentary view similar to FIGURE 6, but showing the positions of the latching-biasing lever and stem wing when the device is in its switch closed "On" setting;

FIGURE 8 is a similar view showing the positions of the latching-biasing lever and stem wing when the device is in its switch open "Off" setting;

FIGURE 9 is a detail section taken on the plane of the line 9—9 of FIGURE 6, showing the hinging axis X—X and the pivoting axis Y—Y of the latching-biasing lever;

FIGURE 10 is a zig-zag detail section taken approximately on the plane of the line 10—10 of FIGURE 6, for showing the cooperation between the latching-biasing lever and the stem wing;

FIGURE 11 is a detail sectional view taken on the plane of the line 11—11 of FIGURE 7, showing in dotted lines the switch closing action of the stem wing, and showing that this electrical switch is of the single pole, single throw type;

FIGURE 12 is a transverse sectional view taken on the zig-zag sectional planes 12—12 drawn in dotted lines in FIGURE 6, this view illustrating some of the gear trains, particularly of the "rear-set" construction shown in FIGURES 1, 2 and 3;

FIGURE 13 is a similar transverse sectional view taken on the zig-zag sectional planes 13—13 drawn in dash-and-dot lines in FIGURE 6, this view illustrating some of the gear trains, particularly of the "front-set" construction shown in FIGURES 4 and 5.

FIGURE 14 is a diagrammatic fragmentary elevational view showing the front side of the front mounting plate, with the face plate removed, showing the arcuate slot in the front plate of approximately 90° angular span for accommodating or limiting the range of angular movement of the stem wing in the construction of the invention having three switch positions; i.e. "Off," "On" and "Auto" (automatic);

FIGURE 15 is a fragmentary elevational view similar to FIGURE 14, showing the arcuate slot as being limited in angular span to approximately 45° for reducing the angular movement of the stem wing in that construction of the invention which has only two switch positions, i.e. "Auto" and "On."

FIGURE 16 is a detail sectional view taken approximately on the plane of the line 16—16 of FIGURE 15, showing that the electrical switch used in this latter construction is of the single pole, double throw type; and

FIGURE 17 is a circuit diagram showing the latter construction embodied in or associated with a television set or other appliance for enabling the television set or other appliance to be turned on automatically at a preset time or to be turned off automatically at a preset time.

Referring first to FIGURE 1, the clock switch comprises a clock dial 31 having hour markings 32, relatively to which the hour and minute hands 34 and 35 indicate the time of day. Rotating concentrically of the hour and minute hands is a sweep second hand 36 which gives an approximate second indication, and which also gives visual indication as to whether the synchronous electric motor of the clock is running. Also mounted for rotation concentrically of the hour, minute and second hands is a manually settable time switch indicating hand 37 which is adapted to be manually set at the time at which it is desired that the radio (or other appliance) be turned on. In a typical installation within a table or console type of radio, the clock dial 31 and the four hands 34—37 are protected by a cover glass with a surrounding bezel, which are not shown because they will vary with each radio manufacturer's requirements. Projecting from the bottom edge of the clock dial, either through or outside of such cover glass, is a switch setting stem or shaft 41 on which the setting knob 43 is mounted. This knob carries an upwardly extending indicating rib 45 for indicating the position then occupied by the radio controlling switch. There are three positions denoted on the face of the dial toward which the indexing rib 45 can be pointed, the left hand position designating the "Off" condition of the switch; the right hand position designating the "On" condition of the switch; and the intermediate or central position designating the "Auto" (automatic) time set condition of the apparatus for indicating that the electrical switch has been conditioned to close at a preselected time. This radio controlling switch which is responsive to these three positions of the switch setting stem and knob 41—43 is indicated generally at 47 in FIGURES 2, 3, 6, etc. In the "rear-set" embodiment of clock switch illustrated in FIGS. 1, 2 and 3, a setting shaft 49 projects rearwardly from the assembly and carries a setting knob 50 at its end. When this setting knob and shaft are pulled into a rearwardly shifted position they are effective to adjust the hour and minute hands 34 and 35 for correcting the time indication on the clock; and when the setting knob and shaft are shifted forwardly they are effective to adjust the preselected switch closing time set up by the switch indicating hand 37.

Referring now to the details of the assembly, it comprises a front mounting plate 61 and a rear base plate 62 which are secured together in spaced relation by a plurality of spacing legs 63 which are bent forwardly from the rear base plate 62 and which have their front ends anchored by twisting or staking in slotted openings in the front mounting plate 61. A face plate 65 is secured to the front side of the front mounting plate 61. Formed along the vertical side edges of the front mounting plate 61 are forwardly offset flanges 66 which establish a very shallow channel-shaped space 67 extending vertically between the face plate 65 and the vertical medial portion of the front mounting plate 61 lying between the forwardly offset flanges 66. The face plate 65 is secured to the front mounting plate 61 by edge tabs 68 which extend from the face plate and are bent over along the vertical side edges of the face plate to engage in notches 69 cut out in the forwardly offset flanges 66 of the front mounting plate.

Mounted on the back side of the rear base plate 62 is a small synchronous electric motor 71 embodying a speed reducing gear train contained within a housing portion 72 of the motor unit. This speed reducing gear train terminates in a slow speed driving shaft 73 which extends forwardly through the rear base plate 62 and carries a drive pinion 74 (FIG. 6) at its front end. This drive

pinion meshes with a gear wheel 76 which is disposed concentrically of the clock dial and is secured fast to an axial spindle 77 having bearing support in the front and rear plates 61—62. Secured to the front end of this spindle 77 is the clock second hand 36. Secured to the large gear wheel 76 is a pinion 78 which meshes with a large gear wheel 79 journaled on a pivot shaft 81 having its ends mounted in the front and rear mounting plates. Extending forwardly from the large gear wheel 79 is a relatively long pinion 82 which meshes with a large gear wheel 83 disposed concentrically of the second hand spindle 77. Disposed on the front side of the large gear wheel 83 is a smaller gear wheel 84 which is secured to a minute hand arbor or sleeve 85. This minute hand sleeve 85 surrounds the second hand spindle 77 and carries the clock minute hand 35 at its front end. The motor driven drive from the synchronous motor unit 72 is transmitted from the large gear wheel 83 to the aligned smaller gear wheel 84 through a friction slippage clutch 86 to permit manual setting of the hour and minute hands 34 and 35 relatively to the clock dial and synchronous motor. This journal type of friction slippage clutch is old and well known in the art and need not be described in detail.

Meshing with the smaller gear wheel 84 is a large speed reducing gear wheel 88 which has free rotative mounting on the pivot shaft 81. Secured to this large gear wheel 88 is a pinion 91 which meshes with a large gear wheel 92 that is mounted concentrically of the clock dial axis. This large gear wheel 92 is secured to the rear end of an arbor sleeve 93 which surrounds the minute hand arbor sleeve 85, such arbor sleeve 93 being both rotatable and axially shiftable upon the minute hand arbor sleeve 85. The hour hand 34 is secured to the outer end of this axially shiftable arbor sleeve 93. A compression spring 94 confined between the back side of the large gear wheel 92 and the front side of the adjacent pinion 84 normally tends to hold the shiftable gear wheel 92 and arbor 93 thrust forwardly.

Mounted forwardly of the shiftable gear wheel 92, and bearing against the back side of the front mounting plate 61 is a manually settable gear 95 which is secured to the rear end of a short outer arbor 96 that surrounds the shiftable arbor 93. This outer arbor 96 extends through the front mounting plate 61 and mounts the time settable pointer 37 which indicates the preselected time when the clock switch is to operate. The time settable gear 95 is spaced forwardly from the axially shiftable hour hand gear 92, and projecting toward each other from the opposing faces of these two gears 92 and 95 are coacting humps 97, 97′ and 98, 98′ which, at the preselected time, engage each other and shift the hour hand gear 92 rearwardly for tripping the electric switch, as will be presently described. The humps 97 and 98 project forwardly from diametrically opposite points of the hour hand gear 92, with the hump 97 traveling in a circle of relatively large radius, whereas the other hump 98 travels in a circle of relatively small radius. The other two humps 97′ and 98′ project rearwardly at diametrically opposite points from the time settable gear 95, with the hump 97′ traveling in a circle of relatively large radius, and the hump 98′ traveling in a circle of relatively small radius, whereby these two sets of humps move into contact with each other once every twelve hours for axially displacing the shiftable hour hand gear 92 in a rearward direction. This particular relation of hour hand gear and time settable gear having coacting pairs of axially displacing humps is old and well known, being disclosed, for example, in prior Patent 2,816,969 issued to William P. Gallagher and Ronald M. Bassett on December 17, 1957.

Responding to such rearward axial displacement of the hour hand gear 92 at the preselected time is a relatively long angularly shaped latching lever 100 (FIG. 6) which is disposed in a plane lying between and parallel to the front and rear frame plates 61 and 62. One end of this

tripping lever 100 has a forwardly bent flange 102 which enters an opening 103 in the front frame plate 61 and establishes with this opening a hinging axis and a pivoting axis for the lever 100, which two axes are substantially at right angles to each other; i.e. it establishes a hinging or tilting axis for permitting tilting movement of the lever in a flatwise plane toward and away from the front frame plate 61, and it also establishes a pivoting axis for permitting pivotal movement in an edgewise plane parallel to the front and rear frame plates and toward and away from the electric switch 47. As shown in FIGURES 6 and 9, the opposite edges of the pivoting flange 102 have slots or notches 102*a* and 102*b* formed therein which embrace or engage over companion edges 103*a* and 103*b* of the opening 103. As shown in FIGURE 6, this opening 103 has one diagonal dimension which is longer than the pivoting flange 102, whereby in the assembly this pivoting flange can be inserted into the opening 103 along this long dimension, and then swung to have the slots 102*a* and 102*b* engage over the side edges 103*a* and 103*b* of the opening with a loose rockable fit. This loose fit permits fore and aft tilting of the lever 100 toward and away from the front frame plate, this tilting occurring around the wide span tilting axis which passes through the centers of the slots 102*a* and 102*b* and which is designated X—X (FIG. 9). A diagonally pulling tension spring 106 which is hooked between the inner edge of lever 100 and an aperture 107 punched out in the front plate 61, serves to hold the pivoting flange 102 pulled inwardly toward the electric switch 47 and bearing against the inner edge 103*c* of the opening 103. This results in the slot 102*b* in the flange 102 having a rocking or pivoting fit at the intersection of the edges 102*b* and 103*c*, thereby establishing a pivot axis Y—Y at this point extending transversely of the frame plates, and around which the outer end of the latching lever 100 can swing between any of the positions shown in FIGURES 6, 7 and 8. The lever 100 is also free to tilt or hinge fore and aft around the aforesaid hinge axis X—X established by the engagement of the notches 102*a* and 102*b* over the side edges 103*a* and 103*b* of the opening 103, whenever the humps 97—98′ engage and start shifting the shiftable hour gear 92 rearwardly at a preset time, as will now be described.

The latch lever 100 extends in a plane directly back of the time responsive shiftable hour gear 92, and bent forwardly from said lever to be engaged by the back side of said hour gear is a lug 108. As shown in FIGURE 10, this lug has a rounded edge which normally remains out of contact with the back side of the shiftable gear 92 while the latter is rotating in its normal forwardly disposed position, but when this gear 92 is shifted rearwardly at the preset time by the humps 97—98′ the lug 108 is engaged to deflect the lever 100 rearwardly around its hinging axis X—X. If the switch setting stem 41 occupies its "Auto" (automatic) intermediate position at this time, such rearward hinging deflection of the trip lever 100 under the action of the humps 97—98′ trips the switch setting stem 41 so that it immediately swings from its "Auto" position to its "On" position, thereby instantaneously closing the switch 47.

Referring now to the coaction between the trip lever 100 and the switch setting stem 41 which makes this possible, the stem is provided with a radially projecting wing 110 having an outer edge which swings through an arc Z—Z as the stem moves between its three positions Off, Auto and On.

As shown in FIGURE 1 the outer edge of this wing 110 which swings through the arc Z—Z has a tripping or clearance notch 112 punched out therein, thereby leaving the wing with two projecting tongues 114 and 116 continuing outwardly on opposite sides of the notch 112. The axial width of the wing 110 closely approximates the spacing distance between the front mounting plate 61 and rear base plate 62. Projecting rearwardly from the stem is an axial pivot lug 117 which has pivot bearing in a hole in rear base plate 62. Projecting forwardly from the outer portion of the front tongue 114 is a stop lug 118 which swings through an arcuate slot 119 punched out in the front mounting plate 61 concentrically about the axis of the stem 41 (FIG. 14). In the embodiment of clock operated switch being now described, this arcuate slot 119 has an angular span of approximately 90°, so that the ends thereof function as limiting stops engaged by the stop lug 117 when the switch controlling stem 41 is in the switch "Off" position or in its switch "On" position. In a modified embodiment of the clock operated switch, to be later described, this arcuate slot 119 has a span of only 45° so as to limit the throw of the switch actuating stem 41 between the "Auto" position and the "On" position.

Formed along the outer edge of the lever 100 is a latching and biasing edge 120, which, under the tension of the spring 106 cooperates with the stem wing 110 in each of its three positions. The spring 106 by tending constantly to cause the lever 100 to rotate in a counterclockwise direction (FIG. 6) around the transverse axis Y—Y, tends to force this latching and biasing edge 120 into positions where it will intersect the arc of movement Z—Z of the outer edge of the stem wing. Formed intermediate the ends of this edge 120 is a latching notch 122 which is adapted to hook over the edge of the wing 110 at a level just forwardly of the clearance notch 112 (FIG. 10) when the stem and wing are in the "Auto" position. At the preselected time established by the setting given to the pointer 37, the selecting humps 97—98′ cause axial displacement of the hour hand gear 92 in a rearward direction. This rearward displacement operates through the rounded lug 108 to tilt the lever 100 in a rearward direction around its tilting axis X—X, thereby bringing the latching notch 122 into registration with the clearance notch 112 in the wing, with the result that the wing 110 is free to pivot in a clockwise direction into the switch closing position illustrated in FIGURE 7, under the action of the latching and biasing edge 120 pushing sidewise against the left hand surface of the wing. As will be later described, when the wing is thus swung into switch closing position the outer or rear tongue 116 thereof strikes a slide or plunger in the switch structure 47 for moving the switch contacts into closed position.

Formed in the biasing edge 120 and leading from the latching notch 122 in a direction toward the pivot axis X—X is a diagonal kerf 124. The purpose of this kerf is to prevent interference between the wing 110 and the lever 100, and to allow the lever 100 to return to its normal forwardly disposed position after the humps 97—98′ have separated from each other.

Formed along the biasing edge 120 in the other direction from the latching notch 122 is a camming edge or surface 126 which is operative to intersect the arcuate path Z—Z of the wing 110 at such an angle that when the wing is swung manually into its left hand ("Off") position the spring biasing force exerted constantly through the lever 100 yieldingly holds the wing 110 in this left hand position (FIG. 8). Bent forwardly at right angles along this camming or biasing edge 126 is a lip or flange 128 which normally rides on the inner surface of the front mounting plate 61 in the swinging movement of the lever 100 around the transverse axis Y—Y. The tension spring 106, by virtue of having its fixed end attached in opening 107 in the front plate 61, exerts a diagonal pull tending to swing the lever 100 around the hinge axis X—X in a direction toward the front mounting plate, thus normally holding the forward edge of the lip 128 pressed in sliding contact with the inner face of the front mounting plate 61. Hence, the gauge lip or flange 128 functions to normally fix or predetermine the height of the tripping notch 122 with respect to the clearance notch 112 in the wing 110 (FIG. 10), so that the tripping notch 122 will normally be maintained at a constant level

with respect to the clearance notch 112 in immediate proximity thereto, substantially as shown in FIGURE 10, whereby very slight tilting movement effected by the humps 97—98' swings the tripping notch 122 into registration with the clearance notch 112. The lip or flange 128 also prevents the front or bottom edge of the clearance notch 122 getting accidentally caught in under the biasing edge of the biasing-latching lever 100. The switch actuating stem 41 and wing 110 can be manually turned through the front knob 43 into any one of the Off, Auto or On positions shown in FIGURES 6, 7 and 8 at any time against the biasing action of the tension spring 106 without the exertion of undue effort through the front knob 43. Also, this ability to manually rotate the stem 41 and wing 110 into any desired one of the above three positions at any time can be effected without the necessity of first manipulating or disturbing any time setting which has been previously set up by the time preselecting means 49, 50, 92, 95, etc.

It will be seen from the foregoing that the single latching lever 100, with its combined pivotal movements around the hinging axis X—X and around the transverse pivot axis Y—Y, is operative under the action of the single tension spring 106 to yieldingly maintain the switch actuating stem 41 in each of the above three positions, and is also operative to automatically release the stem from its "Auto" position for swinging movement into the switch closing position of FIGURE 7 at the time preselected by the setting of the time switch indicating pointer 37.

The electric switch 47 may be of any conventional construction, but in the preferred embodiment illustrated it comprises a relatively long rectangular insulating housing 130 (FIGURE 11) which has its front end anchored in a rectangular aperture 132 formed in the front mounting plate 61 at the right hand end of the arcuate slot 119 (FIGURE 14). The rear portion of the switch housing is anchored in a rectangular opening 134 (FIGURE 11) stamped out in the rear base plate 62. A pair of relatively long contact springs 136 and 137 have their outer or rear ends anchored in the rear end of the housing, and have terminal tabs 136*a*, 137*a* extending from the end of the housing for establishing electrical connection with the circuit of the radio appliance. Carried at the forward ends of the contact springs are the cooperating electrical contacts 138, 139, which are normally biased to remain out of engagement with each other. The switch housing is formed with a tranverse slot 141 adjacent to the rear base plate 62, and mounted in this slot is an insulating slide 143 which is operative to press the two contacts together. The actuating end of this slide projects from the inner side of the switch housing in position to be engaged by the tongue 116 of wing 110 when the wing has been snapped over into the switch closing position shown in FIGURE 7.

Referring now to the operation of the setting knob 50 (FIG. 12), which is operative to set the clock hands, and which is also operative to set the time when the radio is to be turned on automatically, when this knob 50 is shifted to the inner position shown in FIGURE 12 it shifts the hub 145 forwardly to bring the front gear 146 into mesh with the teeth of the manually settable gear 95 which carries one pair of the coacting humps 97 and 98', whereby the angular position given to these humps preselects the time that the clock switch is to close automatically. When the knob 50 is pulled rearwardly it disengages the front gear 146 from the manually settable gear 95 and brings the shiftable rear gear 148 into mesh with gear 88 of the driving clock train, whereby the time setting of the hour and minute hands 34 and 35 can be adjusted. As previously pointed out, in this embodiment the setting shaft 49 extends out from the rear of the clock for disposing the setting knob 50 on the back side of the clock.

In many instances space is not available in rear of the clock for thus mounting the adjusting knob 50, or the knob is not accessible when so mounted, and under such circumstances it is desirable to have the setting shaft extend forwardly from the front face of the clock with the setting knob accessible from the front of the clock. Such an embodiment is illustrated in FIGURES 4, 5 and 13. This modified embodiment is preferably obtained by rotating the entire clock assembly through 90° in a clockwise direction, and having the setting shaft, designated 49', then extend forwardly through the clock dial at what is then the right hand margin of the clock. In this rotated position of the entire clock asembly, the switch setting stem and knob is then located at the left hand edge of the clock dial, and the indicia "Off" and "Auto," and "On" are turned so as to be readable in keeping with this left hand location of the switch setting knob. Similarly, if the dial of the clock is provided with numerals designating the hours of the day, these numerals are correspondingly turned to agree with the 90° rotation of the clock dial. This "front-set" construction can also be obtained without rotating the clock assembly through 90°, by merely extending the setting shaft 49' (with knob 50' mounted thereon) through the upper margin of the clock dial in diametrically opposite relation to the switch setting stem 41 and knob 43, which then remain at the bottom of the clock dial, as shown in FIGURES 1 and 2. One slight objection to such top location of the setting shaft 49' and knob 50' is that in manipulating such upper knob 50' the hand of the user may tend to obscure the settings being given to the hands 34 and 35 or 37.

Referring to FIGURE 13, this figure is a rather schematic zig-zag cross section taken approximately on the plane of the line 13—13 of FIGURE 6, which is a dash-and-dot line to distinguish from the dotted line section plane 12—12 denoting the section plane of FIGURE 12. The upper portion of FIGURE 6 is shown with a "front-set" train of gears embodied therein between the front and rear frame plates 61, 62, which are not ordinarily embodied in the "rear-set" embodiment previously described in connection with FIGURES 1, 2, 3, etc. The front mounting plate 61 and the rear base plate 62 are identical in both embodiments and are both provided with bearing holes for receiving the additional setting gears that are incorporated in the "front-set" embodiment now being described in connection with FIGURE 13.

Mounted on the setting shaft 49' is a shiftable setting gear 145' of relatively wide width. When the setting shaft 49' and knob 50' are in their forward positions the gear 145' meshes with an idler gear 151 which in turn meshes with the manually settable gear 95 carrying the displacing humps 97' and 98'. The idler gear 151 is journaled on a stud 151' anchored in the front mounting plate 61. Thus, in their forwardly set positions the knob 50' and setting shaft 49' are operable to adjust the preselected time when the electric switch 47 is to be closed. As indicated in dotted lines in FIGURE 13, rearward shifting of the knob 50' sifts the wide faced gear 145' out of mesh with the idler gear 151 and into mesh with another idler gear 152 which is pivoted on a stud 153 extending forwardly from the rear base plate 62. This latter idler gear 152 is constantly in mesh with the previously described gear 88 mounted on lateral spindle 81, the rotation of which gear 88 is effective to adjust the time setting of the hour and minute hands 34 and 35.

FIGURES 15, 16 and 17 illustrate still another embodiment of my invention intended for the control of television sets or other appliances, wherein a modified form of electric switch 47' is employed, which, instead of being of the single-pole, single-throw type, is of the single-pole, double-throw type, as best shown in FIGURE 16. This switch 47' embodies the previously described switch springs 136' and 137' carrying their normally open contacts 138' and 139'. However, in addition, this modified switch 47' carries a third contact 140 which normally is in closed circuit relation to a back contact 141 on the shiftable or flexing switch spring 136'. This third or back contact 140 is carried by a clip 142 having a conventional

terminal tab extending out through a slot in the switch housing.

Attention is now directed to the circuit diagram illustrated in FIG. 17 in which the parts of this latter embodiment of clock operated electric switch are embraced within dot-and-dash lines 148. The television set or other appliance is indicated generally at 150 and is adapted to be supplied by line potential transmitted over inlet supply lines 151 and 152. This television set or other appliance, or the herein disclosed circuit therefor, is provided with a manually operated switch 153 of the single-pole, double-throw type for controlling the energization thereof. This manual switch 153 comprises a manually operated switch blade or other form of movable contact 154 which is manually movable into and out of engagement with an "Off" contact 155, and into and out of engagement with an "On" contact 156. In this circuit, one side of the supply line 151, 152 is connected to the flexing blade 136' of the timer switch 47', and the other side of the supply line is connected to one terminal of the television set or the like 150. The back contact 140 of the timer switch 47' is connected through conductor 158 with the "Off" contact 155 of the manually operated switch 153; and the normally open contact 139' of the timer switch is connected through conductor 159 with the "On" terminal 156 of the manually operated switch 153. The manually movable contact 154 of the manual switch 153 is connected with the other terminal of the television set or other appliance 150; and the timer motor 71 is bridged across the supply line 151, 152.

If the owner of the television set or other appliance desires to have the set or appliance turned on automatically at a predetermined time, he sets the manually settable stem 41 in the "Auto" position. He also sets the switch blade 154 of the manual switch 153 in engagement with the "On" contact 156. When the preset time arrives, the automatic swinging of the stem 41 into the right hand switch closing position (FIGURE 7) completes the open side of the circuit through contact 139' and conductor 159 to the "On" terminal of the manual switch 153 and thence through movable switch element 154 to the other terminal of the television set or other appliance 150. If, on the other hand, the owner should desire to have the television set or other appliance turned off automatically at a preselected time, he places the switch controlling stem 41 in the same "Auto" position as before, but at this time he shifts the movable switch element 154 of the manual switch 153 into contact with the "Off" terminal 155 (instead of in contact with the "On" terminal 156). The television set or other appliance immediately begins operation, but at the preselected time the switch setting stem 41 is tripped from its "Auto" position and swings over into its "On" position. In this instance, by virtue of the single-pole, double-throw switch 47', the movement of the switch controlling stem 41 into its "On" position separates movable contact 138 from out of engagement with the third or back stationary contact 140. This opens the circuit to the television set or other appliance through conductor 158. In this embodiment, the short 45° length of the arcuate slot 119', shown in FIGURE 15, limits the movement of the wing 110 between the "Auto" position and the "On" position, and positively prevents any malfunctioning or faulty operation that might otherwise result from turning the wing 110 into the left hand "Off" position.

While I have illustrated and described what I regard to be the preferred embodiments of my invention, nevertheless it will be understood that such are merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In a clock operated electric switch, the combination of an electric switch comprising two cooperating contacts which normally tend to remain in open circuit position, switch closing means, a rotatable switch actuating stem comprising an extending wing adapted to engage said switch closing means for closing said switch, said wing rotating through a substantial arc of movement and having a switch open "Off" position, a switch closed "On" position, and an intermediate "Auto" position in which said wing is set when it is desired that said stem and wing automatically move into switch closed "On" position at a preselected time, a latching and biasing lever, means for mounting said lever for hinging movement about a hinge axis extending substantially in the plane of the lever and also mounting said lever for pivotal movement about a pivot axis extending substantially transversely of the plane of said lever, spring means normally tending to tilt said lever in one direction around said hinge axis and to swing said lever in one direction around said pivot axis, said lever having a latching-biasing edge which is normally urged by said spring means to intersect the arc of movement of said extending wing, a latching notch in said latching-biasing edge adapted to engage and yieldingly hold said wing when the latter is placed in its "Auto" position, a clearance notch in the edge of said wing with which said latching notch is adapted to register at the preselected time for the switch to close, a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, and means for transmitting said shifting movement to said lever for moving said latching notch into registration with said clearance notch.

2. In a clock operated electric switch, the combination of a switch comprising two cooperating contacts which normally tend to remain in open circuit position, switch closing means, a manually rotatable switch actuating stem comprising an extending wing adapted to engage said switch closing means for closing said switch, said extending wing swinging through a substantial arc of movement having a switch open "Off" position at one end of said arc of movement, a switch closed "On" position at the other end of said arc of movement, and an intermediate "Auto" position in which said wing is set when it is desired that said wing automatically move into its switch closed "On" position at a preselected time, a latching and biasing lever, means mounting said lever for hinging movement about a hinge axis extending substantially in the plane of the lever and for also mounting said lever for pivotal movement about a pivot axis extending substantially transversely of the plane of said lever, spring means normally tending to tilt said lever in one direction around said hinge axis and to swing said lever in one direction around said pivot axis, said lever having a latching and biasing edge which is normally urged by said spring means to intersect the arc of movement of said extending wing, a latching notch in said latching and biasing edge adapted to engage and yieldingly hold said extending wing when the latter is placed in its intermediate "Auto" position, clearance means carried by said wing with which said latching notch is adapted to register at the preselected time for the switch to close, said latching and biasing edge comprising means operative to bias said wing in one direction from said intermediate "Auto" position towards the "Off" position at one end of said arc of movement so as to yieldingly hold said wing in said latter position, said latching and biasing edge also comprising means operative to bias said wing in the opposite direction from said intermediate "Auto" position towards said "On" position at the opposite end of said arc of movement, a time driven member, a time settable member cooperating therewith, means operative when said time driven member reaches the set time which has been set up on said time settable member for causing shifting movement of one of said members, and means for transmitting such shifting movement to said lever for causing it to swing about its hinging axis for releasing said extending wing from

movement from said "Auto" position to said "On" position.

3. In a clock operated type of electric switch unit, the combination of a frame comprising front and rear spaced mounting plates, an electric motor carried by said frame, a clock dial and clock hands carried by said front mounting plate, a train of gears connected between said electric motor and said clock hands for driving the latter, an electric switch adapted for automatic operation at a preselected time, a time driven member driven by said electric motor, a time settable member cooperating therewith, a time preselecting pointer rotatable coaxially of said clock dial and connected with said time settable member for indicating the time settings given to said time settable member, means operative when said time driven member reaches the time which has been set up on said time settable member for causing shifting movement of one of said members, means for rendering said electric switch responsive to such shifting movement, a rear setting knob in rear of said rear mounting plate for operative connection with said train of gears to establish said unit as a "rear-set" type of unit, a front setting knob for mounting in front of said front mounting plate, and a set of gears readily interposable between said front and rear mounting plates for operatively connecting said front setting knob with said train of gears for converting said unit into a "front-set" type of unit.

4. In apparatus of the class described, the combination of a manually rotatable switch controlling knob having a centrally located "Auto" position, together with a switch open "Off" position to one side of said centrally located "Auto" position and a switch closed "On" position to the other side of said centrally located "Auto" position, electrical switch means responsive to movement of said knob between said three positions, spring biasing means operative in either direction from said centrally located "Auto" position to exert a biasing force for yieldingly holding said knob in either its "Off" position or in its "On" position, and time presettable tripping means for tripping said knob for automatic movement from said "Auto" position to said "On" position at a preselected time, said spring biasing means coacting with said switch controlling knob for enabling said knob to be manually rotated at any time into any one of said "Auto," "Off," or "On" positions prior to or after a time setting has been established on said time presettable tripping means and

without disturbing any setting which has been previously established thereon.

5. In a clock operated electric switch, the combination of a switch comprising two cooperating contacts which normally tend to remain in open circuit position, switch closing means, a manually rotatable switch actuating stem comprising an extending wing adapted to engage said switch closing means for closing said switch, said extending wing swinging through a substantial arc of movement having a switch open "Off" position at one end of said arc of movement, a switch closed "On" position at the other end of said arc of movement, and an intermediate "Auto" position in which said wing is set when it is desired that said wing automatically move into its switch closed "On" position at a preselected time, a latching and biasing lever, means mounting said lever for hinging movement about a hinge axis extending substantially in the plane of the lever and for also mounting said lever for pivotal movement about a pivot axis extending substantially transversely of the plane of said lever, spring means normally tending to tilt said latching and biasing lever in one direction around said hinge axis and to swing said lever in one direction around said pivot axis, a latching and tripping formation on said lever which is normally urged by said spring means to intersect the arc of movement of said extending wing, electrically operated clock mechanism, automatically operating time presettable mechanism driven by said clock mechanism, and means operative when said time presettable mechanism reaches the set time which has been set up thereon for causing pivotal movement of said latching and biasing lever about one of said two axes whereby said latching and tripping formation on said lever trips said extending wing so that said wing swings into its switch closed "On" position, said latching and biasing lever and said spring means coacting with said extending wing for enabling said wing to be manually rotated at any time into either of its "Auto," "Off" or "On" positions without disturbing any setting which has been previously established on said time presettable mechanism.

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