W. WOOD.

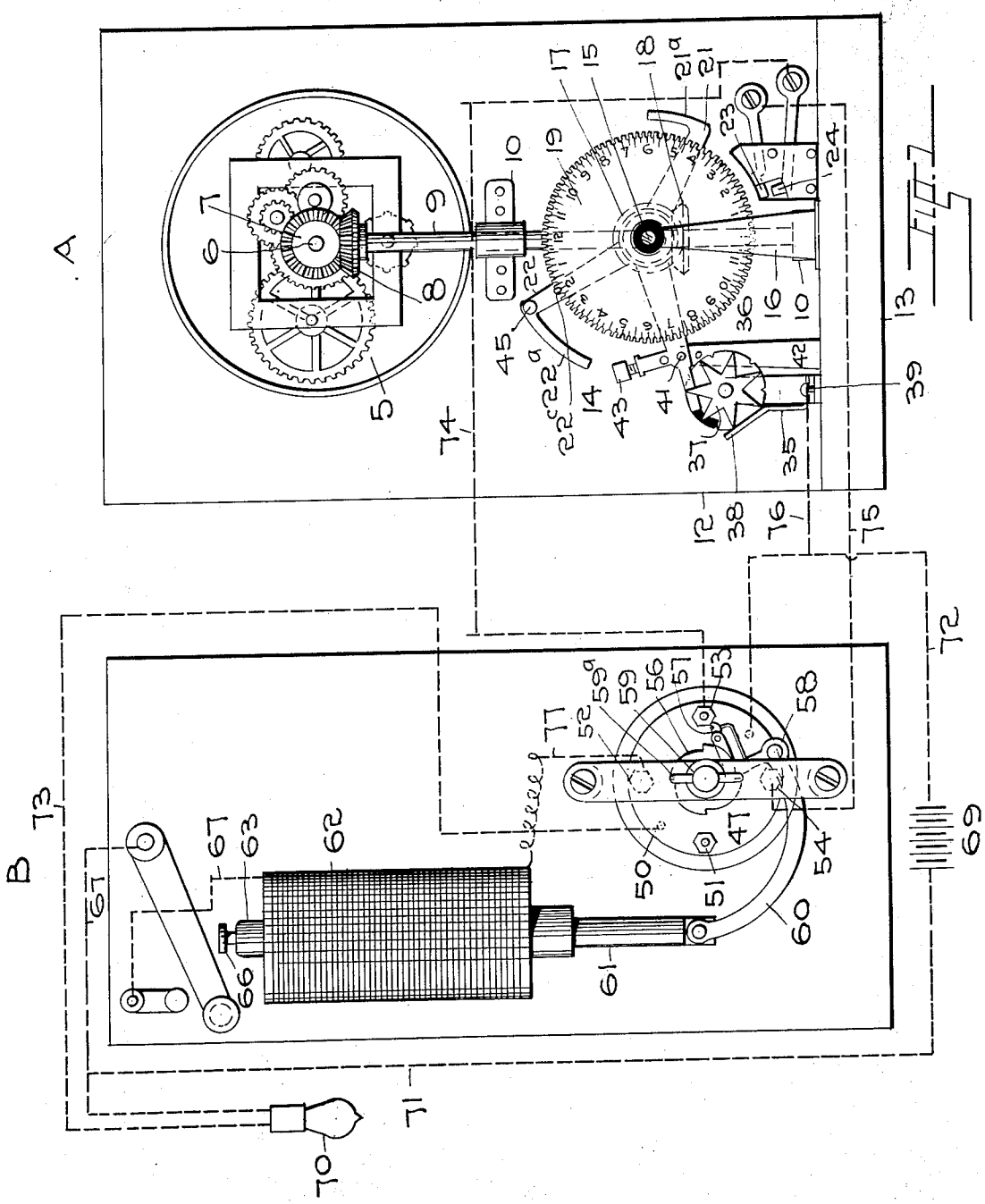
ELECTRIC TIME SWITCH.

APPLICATION FILED JULY 1, 1908.

1,014,277.

Patented Jan. 9, 1912.

3 SHEETS—SHEET 1.



WITNESSES:

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ATTORNEY.

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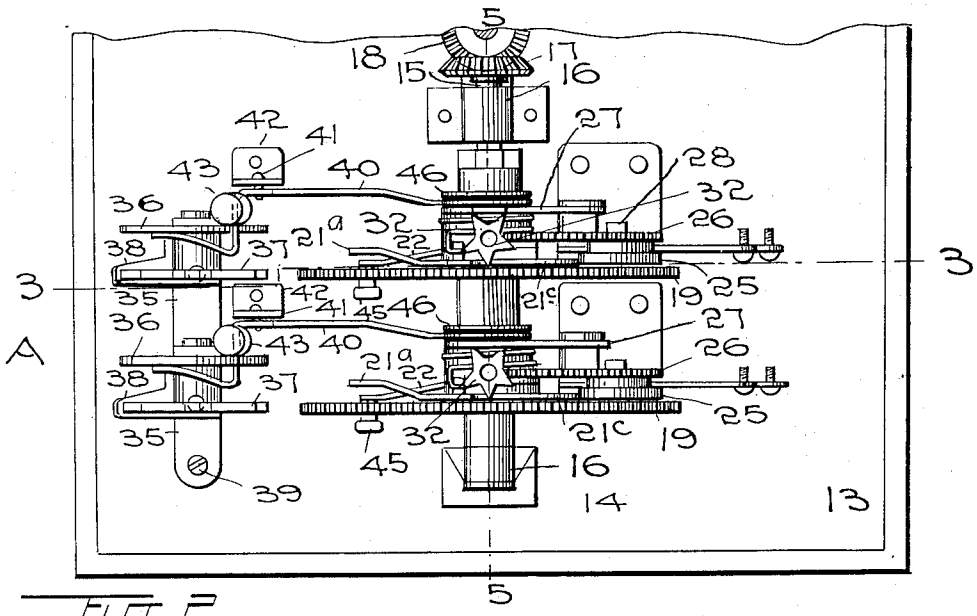

FIG. 2

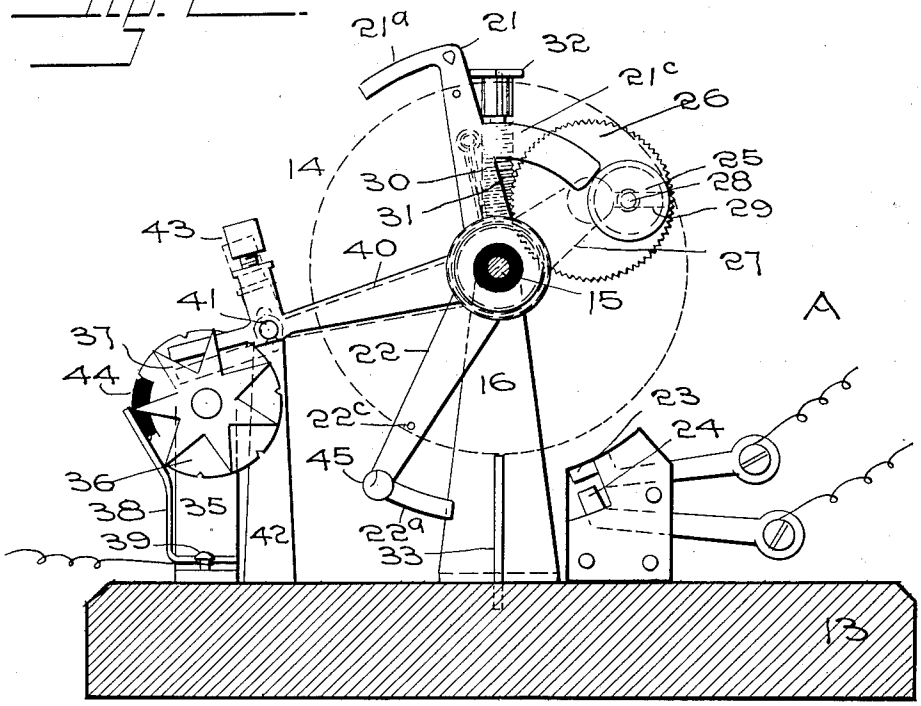

FIG. 3

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3 SHEETS—SHEET 3.

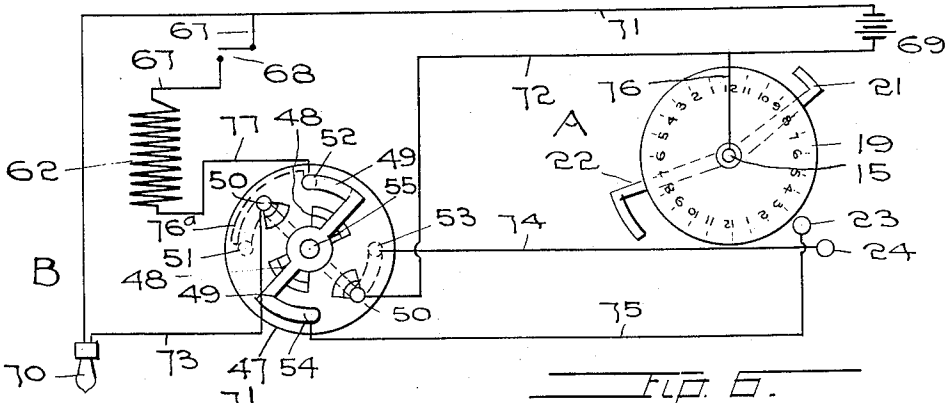

FIG. 6.

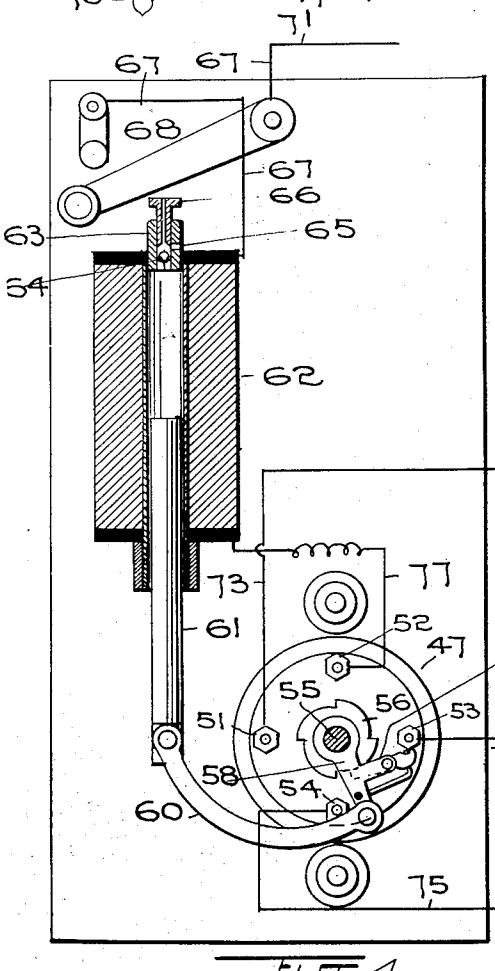

FIG. 4

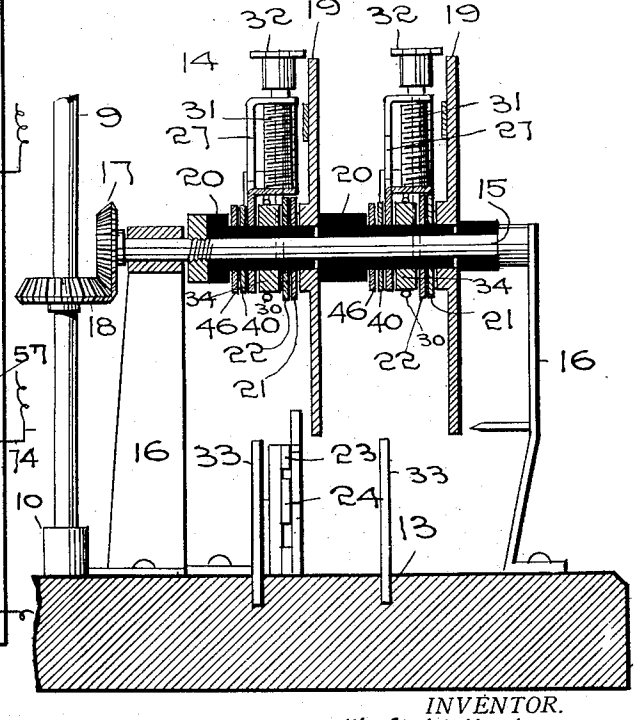

FIG. 5

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UNITED STATES PATENT OFFICE.

WINFIELD WOOD, OF DENVER, COLORADO.

ELECTRIC TIME-SWITCH.

1,014,277. Specification of Letters Patent. Patented Jan. 9, 1912.

Application filed July 1, 1908. Serial No. 441,326.

To all whom it may concern:

Be it known that I, WINFIELD WOOD, a citizen of the United States of America, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Electric Time-Switches, of which the following is a specification.

My invention relates to certain new and useful improvements in automatic electric switches and refers more particularly to the class of clock-controlled mechanisms whereby one or more electric circuits may be opened and closed successively at predetermined intervals.

The present invention is more specifically designed to be used in controlling the electric lighting circuits of stores, business houses, etc., and has for its object to provide a mechanism of the class named in which one impellent element may be employed to open and close a plurality of separate circuits, to provide means whereby the switch element will remain inactive during one day out of seven, and to provide a mechanism whereby the period of time between the closing and opening of the circuit will be automatically varied to correspond with the decreasing or increasing length of the solar day. I attain these objects by the mechanism illustrated in the accompanying drawings in the various views of which like parts are similarly designated and in which—

Figure 1— represents a face view of the two elements comprised in my invention, together with their electrical connections, Fig. 2— an enlarged plan view of the circuit closing mechanism which is directly associated with the impellent clockwork, Fig. 3— a vertical section taken along a line 3—3, Fig. 2, Fig. 4— an enlarged face view, partly in section, of the switch element comprised in my invention, Fig. 5— a vertical section taken along a line 5—5, Fig. 2, and Fig. 6— a diagrammatical view showing the electrical connections and circuits.

Referring to the drawings, let the reference character A designate the master element by means of which a plurality of separate circuits are controlled and B one of the switch elements which are directly connected with the said circuits to open and close the same when actuated by the first named element. The element A comprises a clock movement 5 which may be of any suitable construction of the twenty-four hour type in which an arbor 6 performs a complete revolution once in twenty-four hours. In the movement employed in my invention the hour and minute hands are omitted and a bevel gear wheel 7 is mounted upon the arbor 6, to mesh with a similar gear 8 upon a vertical shaft 9 which is rotatably mounted in bearings 10.

The clock movement 5 is mounted upon an upright support 12, the base 13 of which carries the circuit closing mechanism 14, by means of which the parts of the switch-element B are actuated. The circuit closing mechanism 14 consists of a horizontal shaft 15, which is revolubly mounted in bearings 16 upon the base 13, and which carries a bevel gear 17 which meshes with a corresponding gear 18 on the vertical shaft 9. The horizontal shaft 15 carries a circuit closing contrivance for each circuit controlled by the master-element, two of the said contrivances having been illustrated in the drawings, and, as the construction and arrangement of the parts of each of them is identical to that of the others, the description of one will be sufficient to convey a complete understanding of the construction and operation of this feature of my invention, it being manifest that the number of circuit closing contrivances which may thus be employed, is practically unlimited, and depends solely on the impellent power of the clock movement.

The contrivances above referred to consist each of a dial 19, which is mounted to move with the shaft 15 and is insulated therefrom by a bushing 20 made of non-conductive material. Revolubly mounted upon the latter, in electrical connection with the dial 19, are the contact hands 21 and 22 which are respectively designed to alternately actuate the switch element B for the purpose of opening and closing the electric lighting circuit controlled thereby. The hands 21 and 22, projecting beyond the periphery of the dial 19, are dissimilar in length and are formed at their extremities with segmental spring-metal contact blades 21^a and 22^a, which are designed to engage with stationary contacts 23 and 24, which are secured upon the case 13 in the path of the respective blades and connect with the switch element B as will hereinafter be described.

The dial 19 is divided into twenty-four equal parts, designated by figures to represent the hours of the solar day and each of these parts is subdivided to indicate the half and quarter hours. The peripheral edge of the dial is formed with notches which correspond with the various divisions and subdivisions above referred to and the hand 22, through instrumentality of which the lighting circuit is opened, is provided with a detent 22^c which by engagement with one of the notches, maintains the arm in its adjusted position on the dial 19, with which it moves in unison. The other, shorter, contact arm 21, by means of which the lighting circuit is closed, travels likewise in unison with the dial but is connected therewith so as to be self adjustable for the purpose of automatically changing the moment of closing the circuit in accordance with the daily varying time at which the sun sets.

The difference in time between the setting of the sun on the shortest and longest day of the year being approximately three and one-half hours, I have provided a contrivance by which the contact hand 21 will be impelled to move reciprocatingly in relation to the dial a distance equal to the arcual lengths of three and a half of the aliquot parts in which it is divided. The contrivance referred to consists of a worm gear 26 which is revolubly mounted upon the extremity of a bearing arm 27, the opposite end of which is fixedly secured around the bushing 20 upon the shaft. The gear 26 carries upon its face an eccentrically disposed disk 25 which is adjustably secured thereto by means of a screw 28 which projects through a radial slot 29.

The hand 21 is formed with a segmental arm 21^c, whose extremity is held in constant engagement with the peripheral edge of the disk 25 by a spring 30, the ends of which are secured respectively to a projection on the arm and a metallic collar 34 upon the bushing 20. A worm 31 which meshes with the gear 26, is rotatably mounted upon the same arm 27 and carries upon its outer extremity a five-pointed star wheel 32, the points of which engage a post 33, which is secured upon the base 13. The worm gear 26 has seventy-three teeth and it will thus be observed that, inasmuch as the worm, by contact of the star wheel with the post 33, performs a fifth of a revolution once in every twenty-four hours, the gear wheel will be advanced one tooth once in five times twenty-four equals one hundred and twenty hours or five days and will perform a complete revolution in seventy-three times five equals three hundred and sixty-five days or one year during which time the hand 21 has moved back and forth a distance equal to the eccentricity of the disk 25, in relation to the worm gear upon which it is supported.

The dial and the therewith electrically connected contact hands which, as hereinbefore explained, are insulated from the shaft 15 by the bushing 20, are connected with one of the service wires, which lead from the source of electricity to the element B, by a branch wire, the extremity of which is secured to a binding screw 39 which forms part of the foot of a standard 35 which is secured upon the base 13 in proximity to the dial. A contact disk 36 is revolubly mounted upon the standard 35, in association with a seven pointed star wheel 37, which by frictional engagement of its points with an upwardly extending leaf spring 38, holds the wheel against retrograde motion. As the standard 35, as well as the disk 36, are composed of metal, the electric fluid flowing through the conductor which engages the binding screw 39, will be communicated to the said disk and is conducted from there to the dial 19 and the therewith associated hands, by means of a spring metal arm 40, one end of which surrounds the bushing 20 while its opposite end frictionally engages the face of the disk 36. The arm 40 which is loosely mounted upon the bushing, may be secured at either one of two elevations by means of a pin 41, which is adapted to project through corresponding openings in the upper portion of an upright 42 secured upon the base 13 and the said arm is furthermore provided with a handle 43 made of insulating material, to facilitate its manipulation. The disk 36 has in its face, in adjacency to its peripheral edge, an insulating block 44, the arcual length of which is equal to one seventh part of the entire circumference of the said disk, and the contacting extremity of the arm 40, will, when the latter is in its uppermost position, project in the path of the said block so that, during the revoluble movement of the disk, its electrical connection with the dial and contact hands will be broken during the one seventh part of the complete revolution. The disk is intermittently rotated at intervals of twenty four hours through the instrumentality of a knob 45, which projecting laterally from the outer extremity of the long hand 22, is arranged to engage the points of the star wheel 37 which forms part of the disk 36. As the star wheel 37 has seven points, the therewith connected disk 36 will move one seventh of a revolution once in every twenty-four hours or will make one complete revolution in a week and it will thus be observed that, by means of the insulating block 44, the electrical connection with the dial will be interrupted during one day of every seven. If it is desired to continue the electrical connection during the entire week, the arm 40 is moved into its lower position out of the path of the block 44, as has been shown in broken lines in Fig. 3 of the drawings. The

arm 40 is constantly maintained in contact with the hands 21 and 22, the dial 19 and other metallic parts which are mounted upon the insulating bushing 20, by means of a spring-metal washer 46 which engages an enlarged portion of the latter.

The switch element B consists of an ordinary snap switch 47, the rotating spindle 55 of which carries two sets of contact blades 48 and 49 which are insulated from each other and respectively adapted to engage with contacts 50 connecting with the lighting or service wires and with contacts 51, 52, 53 and 54, which are connected either directly or indirectly with the operating circuit.

Rigidly connected with the protruding portion of the switch-spindle 55, is a ratchet wheel 56, the four peripheral teeth of which are engaged by a spring actuated pawl 57 which is pivotally mounted upon an oscillatory, pendent lever 58, the upper extremity of which movably surrounds an extension of the spindle 55 which is supported in a bearing 59 and is provided upon its outer extremity with a knob 59ª by means of which the switch may be manually operated or adjusted. The lower extremity of the lever 58 is connected by means of a curved link 60, with the end of the movable member or core 61 of an upright solenoid 62 which is secured in operative proximity to the switch. The bore in the coil through which the core 61 moves, is normally closed at its upper end, by a check valve 63, which includes a housing provided with a seat for the ball valve 64, an air outlet 65 and a longitudinally apertured adjusting screw 66. By adjustment of the latter the outflow of air from the solenoid bore, when the core moves upwardly, may be controlled, so as to constitute a cushion of more or less elastic properties against which the core impinges during the upward movement. The solenoid 62 connects with one of the service or light wires by means of a shunt 67, the said connection being established through the instrumentality of a cut out 68 whereby the electroreceptive device by which the switch is actuated, may be abstracted from the circuit of the electric source.

Having thus described the mechanical construction of the two elements included in my invention, I will now proceed to explain the circuits and electrical connections whereby the parts are operated.

Referring to Figs. 1 and 6 of the drawings, the reference numeral 69 designates the source of electricity which supplies the electric fluid for illuminating purposes, 70 one of the electric lamps and 71 the service wire which directly connects the one with the other and from which the shunt wire 67 leads to the solenoid 62, as hereinabove described. The opposite pole of the source 69 connects, by means of a conductor 72, with a contact 50 of the switch 47, the opposite corresponding contact 50 being connected with the other terminal of the lamp 70 by a wire 73. A branch wire 76 leads from the service wire 72 to the binding screw 39 of the element A, as hereinbefore described, the said wire having been shown in the diagrammatic view as leading directly to the dial 19. The two contacts 23 and 24 are respectively connected, by means of wires 74 and 75, with the contacts 53 and 54 at one side of the switch 47, while the opposite, corresponding contacts 51 and 52 are electrically interconnected by a conductor 76ª and connect with a terminal of the solenoid coil by means of a wire 77. After the hands 21 and 22 have been adjusted to the time of the day when the circuit is to be opened and closed and the clock has been wound by the usual method, the cut out 68 is moved to complete the connection between the solenoid and the wire 71 of the lighting circuit. Assuming that the circuit is open and the lights are, in consequence, extinguished, the switch blades 48 and 49 occupy the position illustrated in Fig. 6 of the drawings, in which the blades 49 are in engagement with the contacts 52 and 54. When, by the revoluble movement of the dial 19, the hand 21 is brought in contact with the contact 23, the solenoid will be energized by the closing of the circuit through the wires 75, 77, 67, 71, 72 and 76. The consequent upward movement of the core 61 is through the instrumentality of the link 60 and the lever 58 and the therewith associated pawl 57, transposed into a rotary movement of the ratchet 56 and a corresponding movement of the switch blades. This movement, being one quarter of a complete revolution brings the revoluble element of the switch in the position shown in broken lines in Fig. 6, with the blades 48 in engagement with the contacts 50 and the blades 49 in connection with the contacts 53 and 51. This closes the lighting circuit through the wires 72, 73 and 71 and simultaneously breaks the operating circuit with the result that the lamps included in the lighting circuit, are lighted and the solenoid included in the operating circuit, is deënergized, which allows the gravity-impelled core 61 to resume its original position. When, by further movement of the dial, the hand 22 engages the contact 24, the solenoid is again brought in the circuit through the wires 74, 76ª, 77, 67, 71, 72 and 76, with the result that the above described operation is repeated and the revolving switch element describes a quarter of a revolution to establish the connections as at the beginning of the operation, when both the lighting and operating circuits are broken.

By means of the adjusting screw 28 which projects through the radial slot 29 in the

wheel 26, the disk 25 may be moved for the purpose of adjusting the mechanism whereby the arm 21 is impelled by the wheel 19, in accordance with the variation in the length of the day at different latitudes.

As the operation of the mechanical devices included in my invention have been referred to at intervals in the course of the foregoing description, further explanation will not be necessary at this point. It will be understood that, if so desired, the switch 47 can be operated by hand without interfering with the subsequent regular cooperative action of the parts and I wish it understood that, while I have shown and described the various parts in the best form at present known to me, variations in their arrangement and details of construction may be availed of within the spirit of my invention.

Having thus described my invention what I claim is:—

1. The combination with a clock-movement, of a rotatable disk operatively associated therewith and formed with peripheral, equidistant indentations, two radial arms of dissimilar lengths movable about an axis common with that of the disk, and terminating in contact blades, electric contacts respectively located in the path of said blades, means to automatically vary the position of one of the arms a predetermined variable distance relative to a point on the disk, during movement of the latter, and a detent on the other arm adapted to be inserted into any one of the indentations of the disk.

2. The combination with a time controlled rotatable wheel, of a disk mounted to move in unison therewith and having an independent circular movement about a point remote from the axis of the said wheel, and a contact blade in resilient engagement with the said disk.

3. The combination with a time controlled rotatable wheel, of a worm-gear rotatable about an axis remote from that of the wheel and mounted to move in unison with the latter, a disk eccentrically mounted upon the gear and adjustable radially with relation thereto, a contact blade in resilient engagement with the said disk, a worm operatively engaging the gear and means to actuate the said worm during each revolution of the wheel.

4. In combination, a time-controlled rotatable dial, a radial arm movable therewith and projecting beyond its periphery, an electric contact in the path of said arm to be engaged thereby during each revolution of the dial, a button on the said arm, a rotatory, metallic disk having an aliquot part of its marginal portion, non-conductive a star wheel rigidly connected with said disk and disposed in the path of the said button, whereby it is intermittently actuated during the revolutions of the dial, a second arm in electric connection with the first named arm and movable about an axis at one of its extremities, its opposite end being in frictional contact with a face of said disk and normally in the path of the non-conductive part thereof, and means for adjusting said second arm to a position in which its free extremity engages the face of the disk out of the path of the non-conductive part thereof.

5. The combination with a clock-movement, of a rotatory dial, two contact blades mounted to move in unison therewith, electric contacts in the paths of the respective blades, a solenoid in an electric circuit with said contacts, a rotatory switch in the said solenoid circuit and in an electric lighting circuit and in electric connection with said blades, and mechanical means for transposing the movement of the solenoid-core when the solenoid circuit is closed by engagement of one of said blades with its respective contact, into intermittent motions of said switch in one direction whereby the solenoid circuit is opened during each movement and the lighting circuit is alternately closed and opened.

6. The combination with a clock-movement, of a rotatory dial, two contact-blades mounted to move in unison therewith, electric contacts in the paths of the respective blades, a solenoid in an electric circuit with said contacts, a rotatory switch in the said solenoid circuit and in an electric lighting circuit and in electric connection with said blades, mechanical means for transposing the movement of the solenoid-core when the solenoid-circuit is closed by engagement of one of said blades with its respective contact, into intermittent motions of said switch, in one direction, whereby the solenoid circuit is opened during each movement and the lighting circuit is alternately closed and opened, a valve on said solenoid adapted to retard the effective movement of the core by regulating the outflow of air from the interior of the solenoid, and a check-valve adapted to coöperate with the first named valve during the effective movement of the core to permit the air to freely enter the interior of the solenoid during the return movement of the core.

7. The combination with a clock-movement of a rotatory dial, two contact blades mounted to move in unison therewith, electric contacts in the paths of the respective blades, a solenoid in an electric circuit with said contacts, a rotatory switch in the said solenoid circuit and in an electric lighting circuit and in electric connection with said blades, and mechanical means for transposing the movement of the solenoid-core when

the solenoid circuit is closed by engagement of one of said blades with its respective contact, into intermittent motions of said switch in one direction whereby the solenoid circuit is opened during each movement and the lighting circuit is alternately closed and opened, the said mechanical means including a ratchet wheel mounted on said switch, a lever movable about an axis common with that of the ratchet wheel, a pawl on said lever engaging said ratchet wheel and a link connecting said lever with the core of the solenoid.

8. The combination with a clock-movement, of a rotatory dial, two contact blades mounted to move in unison therewith, electric contacts in the paths of the respective blades, a solenoid in an electric circuit with said contacts, a rotatory switch in the said solenoid circuit and in an electric lighting circuit and in electric connection with said blades, a rotatory device in said connection adapted to break the same during an aliquot part of its movement, mechanical means for transposing each revolution of the dial into a partial rotation of said device, and mechanical means for transposing the movement of the solenoid-core when the solenoid circuit is closed by engagement of one of said blades with its respective contact, into intermittent motions of said switch in one direction whereby the solenoid circuit is opened after each movement and the lighting circuit is alternately closed and opened.

9. The combination with a clock movement, of a rotatable wheel operatively associated therewith, contact blades mounted to move in unison with said wheel, electric contacts in the paths of the respective blades, adjustable mechanical means to automatically vary the position of one of said blades relative to a point on the wheel, during movement of the latter, a distance proportionate to the variation in the time of setting of the sun during the same period, a rotary switch in an electric lighting circuit, a solenoid in an electric circuit with said blades, mechanical means for transposing the movement of the solenoid core into intermittent motions of said switch, and electrical connections between said switch, the solenoid and the contacts whereby alternate engagement of the latter with the respective blades will close the solenoid circuit and the consequent movements of the switch will alternately open and close the lighting circuit.

10. The combination with a clock movement, of a rotatable wheel operatively associated therewith, contact blades mounted to move in unison with said wheel, electric contacts in the paths of the respective blades, adjustable mechanical means to automatically vary the position of one of said blades relative to a point on the wheel, during movement of the latter, a distance proportionate to the variation in the time of setting of the sun during the same period, a rotary switch in an electric lighting circuit, a solenoid in an electric circuit with said blades, a rotatory device in one side of said circuit and adapted to break the same during an aliquot part of its movement, mechanical means for transposing each revolution of the wheel into a partial rotation of said device, mechanical means for transposing the movement of the solenoid core into intermittent motions of said switch, and electrical connections between said switch, the solenoid and the contacts whereby alternate engagement of the latter with the respective blades will close the solenoid circuit and the consequent movements of the switch will alternately open and close the lighting circuits.

11. The combination with a clock work, of a plurality of independent elements adapted to be simultaneously actuated thereby, each of the said elements comprising a rotatory dial, two contact blades mounted to move in unison therewith, electric contacts in the paths of the respective blades, a solenoid in an electric circuit with said contacts, a rotatory switch in the said solenoid-circuit and in an electric lighting circuit and in electric connection with said blades, and mechanical means for transposing the movement of the solenoid-core when the solenoid circuit is closed by engagement of one of said blades with its respective contact, into intermittent motions of said switch in one direction whereby the solenoid circuit is opened after each movement, and the lighting circuit is alternately closed and opened.

In testimony whereof I have affixed my signature in presence of two witnesses.

WINFIELD WOOD.

Witnesses:
G. J. ROLLANDET,
K. M. STUMP.