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A. B. BALLANCE ET AL

TIME SWITCH FOR ELECTRIC CIRCUITS

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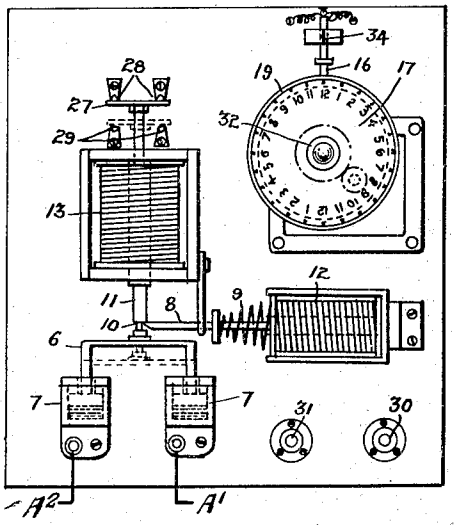


Fig. 1.

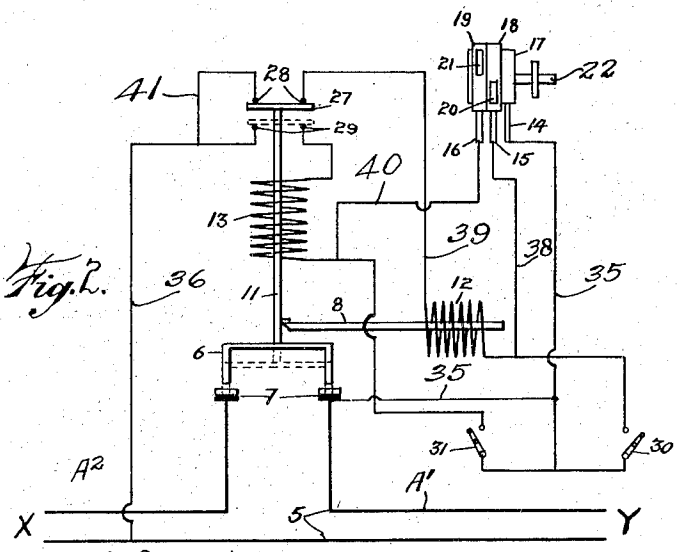


Fig. 2.

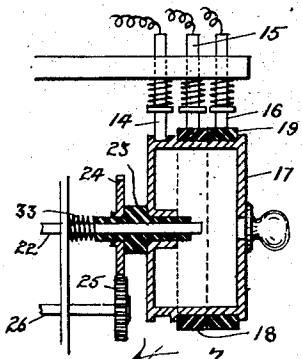


Fig. 3.

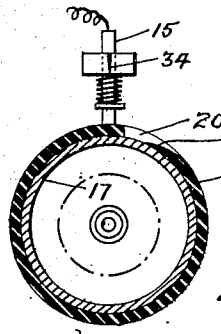


Fig. 4.

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UNITED STATES PATENT OFFICE.

ARTHUR BARRY BALLANCE, OF KOGARAH WEST, NEAR SYDNEY, AND WILLIAM THOMAS ANDERSON, OF SANS SOUCI, NEAR SYDNEY, NEW SOUTH WALES, AUSTRALIA.

TIME SWITCH FOR ELECTRIC CIRCUITS.

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To all whom it may concern:

Be it known that we, ARTHUR BARRY BALLANCE and WILLIAM THOMAS ANDERSON, subjects of the King of Great Britain and Ireland, residing at 43 Washington Street, Kogarah West, near Sydney, in the State of New South Wales, Commonwealth of Australia, and Vista Street, Sans Souci, near Sydney, in the State of New South Wales, Commonwealth of Australia, respectively, have invented certain new and useful Improvements in Time Switches for Electric Circuits, of which the following is a specification.

This invention relates to electrical switches the operation of which is controlled and regulated by a clock or other similar mechanism and the object of the invention is to provide a simple, reliable and easily manufactured switch which can be automatically opened or closed at certain predetermined times.

Further features of the invention are that the operating current required is very small and flows for only a very short period through the operating coils and that the switch may be operated independently of the clockwork mechanism without altering the adjustment of same.

A further advantage is that the switch controlling the main circuit may be placed in a suitable position while the clock controlled contact maker or the switch for operating the main switch independently may be positioned elsewhere wherever is found most convenient.

The invention comprises a solenoid or electro-magnet for opening the switch, a spring controlled detent for holding same in open position, a solenoid or electro-magnet for withdrawing the spring controlled detent, a clock controlled contact maker for energizing the solenoids or electro-magnets at the required predetermined times, means for opening the circuit of each solenoid or electro-magnet after it has operated satisfactorily and means for causing the switch to operate independently of the clock controlled contact maker.

The invention may be more readily understood by referring to the accompanying drawings which illustrate one means of carrying out the invention and in which:—

Figure 1 is a front elevation showing a suitable arrangement for a complete switch.

Figure 2 is a diagram showing the electrical connections of same.

Figure 3 is an enlarged sectional side elevation of one form of clock controlled contact maker, and Figure 4 is a sectional front elevation of the same.

In the switch as illustrated the current in the main circuit 5 is interrupted by a single pole switch of the type in which a yoke 6 of conducting material is withdrawn from two cups 7 containing mercury and each connected in series with the main circuit 5, the cups in this case being connected one to each side of a break in one of the conductors A′ of the main circuit XY. Any other type of switch capable of being actuated by the movement of the plunger 11 may be used.

In Figure 1, the switch is shown by full lines in the open position being held there by the detent 8, which is normally kept in the extended position by the spring 9, engaging the depression 10 on the plunger 11. At a required predetermined time the solenoid 12 is energized to withdraw the detent 8 and so release the yoke 6 which together with the plunger 11 falls by gravity and completes the main circuit. At a second predetermined time the solenoid 13 is energized to withdraw the plunger 11 together with the yoke 6 to open the circuit which is kept open by the detent 8 engaging the depression 10. The solenoids 12 and 13 are energized at the required time by the closing of their circuits through the contacts 14 and 15 or 16 and the drum 17. Round the outer periphery of this drum are two independent rings 18 and 19 of insulating material having slots 20 and 21 therein. The periphery of the drum 17 is constructed of a conducting material with which a brush 14 is continually in contact while the brushes 15 and 16 make contact with the drum 17 through slots 20 and 21 in the insulating rings 18 and 19 which are rotatably mounted on the drum 17. The drum is mounted on a spindle 22 by means of the insulating sleeve 23 and is connected by

toothed wheels 24 and 25 and shaft 26 to the clock gear in such a manner that the drum 17 revolves once in twenty four hours.

The face of the drum 17 is marked off in hours or parts thereof and the rings 18 and 19 are slidably mounted so that they may be moved to allow the contacts 15 and 16 to fall into the slots 20 and 21 at any desired time and thus cause either of the coils 12 or 13 to become energized.

After either of these solenoids have become energized and operated successfully the circuit through the solenoid last to operate is broken by means of the disc 27 leaving either of the pair of contacts 28 or 29 thus cutting off the operating current almost immediately. For example as shown in Figures 1 and 2 in full lines the main circuit is open. On the solenoid 12 becoming energized through the contacts 14 and 15 and the detent 8 being withdrawn the main switch 6 closes, at the same time interrupting the circuit through solenoid 12 at 28 and by bridging the contacts 29 putting the solenoid 13 in a state to be energized to open the circuit again when required. Similarly on the solenoid 13 operating satisfactorily the circuit at 29 is immediately opened and the solenoid 12 is enabled to operate to close the circuit again. If it is desired to open or close the main circuit independently of the clock controlled contact maker either of the small switches 30 or 31 may be closed to short circuit the contacts 14 and 15 or 14 and 16 thus causing the solenoids 12 or 13 to operate.

To correct any time error in the clock mechanism the drum 17 may be pushed in by means of the insulated knob 32 against the spring 33 till the wheel 24 is clear of wheel 25 and then rotated till the graduation corresponding to the time of adjustment is just below the mark 34.

In operation—assuming the main switch to be open as shown in full lines Figures 1 and 2 and the switch about to be operated to close the main circuit, the brush 15 enters the slot 20 and comes into electrical contact with the brush 14 through the drum 17. The circuit is then as follows:—the current flows from the conductor A', through the conductor 35, through the brush 14, drum 17 and brush 15 to the conductor 38, through the solenoid 12 to the conductor 39 through the contacts 28 and disc 27 and conductor 36 to the other conductor B of the main circuit XY.

The energizing of the solenoid 12 causes the detent 8 to be withdrawn against the spring to allow the plunger 11 to fall and close the main circuit. At the same time the disc 27 is drawn away from the contacts 28 and the circuit through the solenoid 12 is opened and the contacts 29 are bridged by the disc 27.

Further rotation of the drum 17 causes the brush 15 to ride up the incline 20ª out of the slot 20 and, later, the brush 16 to fall into the slot 21 and make contact with the drum 17. Under these conditions the current flows from the conductor A' through the conductor 35 and brush 14 to the drum 17 thence through the brush 16 and conductor 40 to the solenoid 13 and through the contacts 29 and disc 27 and conductor 36 to the conductor B. The solenoid 13 is thus energized and withdraws the plunger 11 which is caught and held in the raised position by the detent 8 which is free to be projected by the action of the spring 9.

Provided that the solenoid 13 is suitably designed and that the line voltage is kept at its proper value, the pull exerted on the plunger 11 will always be sufficient to open the switch whatever the state of the load on the circuit controlled by the switch may be.

It may be clearly seen that the mechanism may be easily adapted to operate a switch of any number of poles and that the clock controlled contact makers or the switches for independent operation may be placed in any convenient position remote from the operating mechanism.

We claim:—

1. In a time switch, means for operating the switch comprising an electro-magnetic device, a member adapted to be withdrawn by said device to open the switch, means for holding said member in the withdrawn position comprising a detent adapted to be operated mechanically in one direction and magnetically in the reverse direction, mechanically operated timing means for controlling the action of the electro-magnetic device, and means for operating the switch independently of the timing means.

2. A time switch comprising an electro-magnetic device for opening the switch, a spring controlled detent for maintaining the switch in an open position, an electro-magnetic device for withdrawing the detent, a clock controlled contact maker for energizing the electro-magnetic devices at the required predetermined times, means for opening the circuit of each electro-magnetic device after it has been operated successfully, and means for causing the switch to operate independently of the clock controlled contact maker.

3. A time switch comprising a solenoid for opening the switch, a spring controlled detent for holding the switch in an open position, a solenoid for withdrawing the spring controlled detent, a clock controlled contact maker for energizing the solenoids at required predetermined times, means for opening the circuit of each solenoid after it has been operated successfully, and means for operating the switch independently of

the clock controlled contact maker, said last mentioned means comprising a pair of manually operated switches adapted to short circuit the clock controlled contact maker, the solenoids being energized by the operation of the last mentioned switches.

4. In an improved time switch means for energizing an electro-magnetic device at predetermined times comprising a rotatably mounted drum operated by a clock mechanism, a contacting device adapted to wipe said drum or disc, rotatably mounted insulating rings on the outer periphery of said drum, slots in said insulating rings, contacting devices adapted to bear against said insulating rings and make contact with the drum through the said slots at predetermined times, markings on the face of said drum and means for putting said drum out of engagement with the clock train, means for reengaging the same, as herein set out.

5. In an improved time switch as claimed in claim 2 in which the means for operating said switch independently of the clock controlled contact makers comprise a pair of manually operated switches adapted to short circuit the clock controlled contact makers and solenoids to operate the switch energized by the operation of the last mentioned switches.

6. A time switch comprising an electro-magnetic device for opening the switch, a a spring controlled detent for maintaining the switch in an open position, an electro-magnetic device for withdrawing the detent, a clock controlled contact maker for energizing the electro-magnetic device at the required predetermined times, means for opening the circuit of each electro-magnetic device after it has been successfully operated, a pair of manually operated switches adapted to short circuit the clock controlled contact maker, solenoids energized to operate the last mentioned switches, and a disc or strip operated to make and break the circuits to the solenoids.

7. An improved time switch comprising a switch opening solenoid, a plunger adapted to be operated by said solenoid to open the switch, a spring controlled detent adapted to engage said plunger, a solenoid adapted to withdraw said detent, a rotatably mounted conducting drum operated by clock mechanism, a contact adapted to wipe against said drum, rotatably mounted insulating rings on the outer periphery of said drum, slots in said drum, contacts adapted to bear against said rings and to make contact with said drum through said slots at predetermined times, markings on the face of said drum, means for disengaging said drum from the clock train, electrical connections between said contacts and said solenoids, means for opening the circuits through said solenoids after the successful operation of the same comprising a strip attached to the switch operating plunger adapted to make and break the circuits to the solenoids and means for operating the switch independently of the clock controlled contact maker comprising a pair of manually operated switches adapted to short circuit the contact maker to energize the solenoids.

8. An improved time switch comprising means for operating the switch consisting of an electro-magnetic device, a member adapted to be withdrawn by said device to open the switch, means for holding said member in the withdrawn position consisting of a detent adapted to be operated mechanically in one direction and magnetically in the reverse direction, and means for operating said magnetic device consisting of a clock controlled contact maker.

9. An improved time switch comprising an electro-magnetic means for opening the switch, a spring controlled detent adapted to maintain said switch in the open position, electro-magnetic means adapted to withdraw said detent, clock controlled contacts, adapted to complete the circuits of said electro-magnetic devices at predetermined times and means for opening the circuits of said electro-magnetic devices after the successful operation of the same.

10. An improved time switch as set out in claim 9 in combination with means for operating the switch independently of the clock controlled contacts, as herein set out.

In testimony whereof they have affixed their signatures.

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WILLIAM THOMAS ANDERSON.