

Oct. 24, 1967

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3,349,293

AUTOMATIC ELECTRON TIME-SWITCHES

Filed March 16, 1965

2 Sheets-Sheet 1

FIG. 1

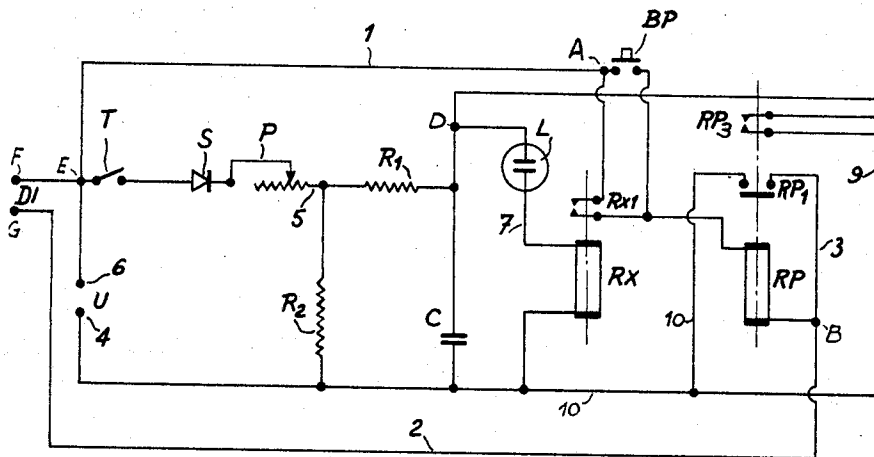
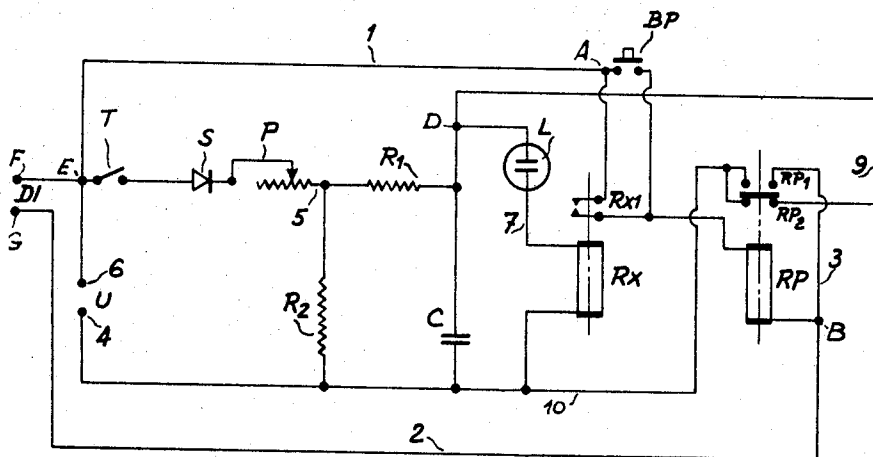


FIG. 2



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FIG. 3

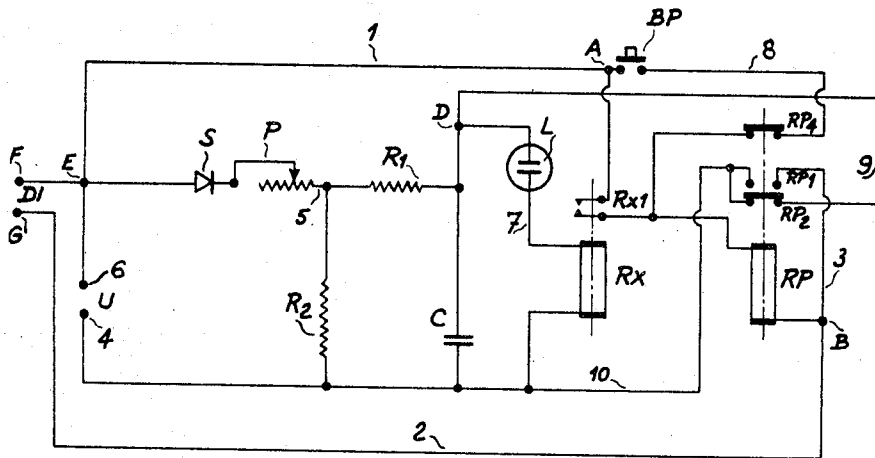
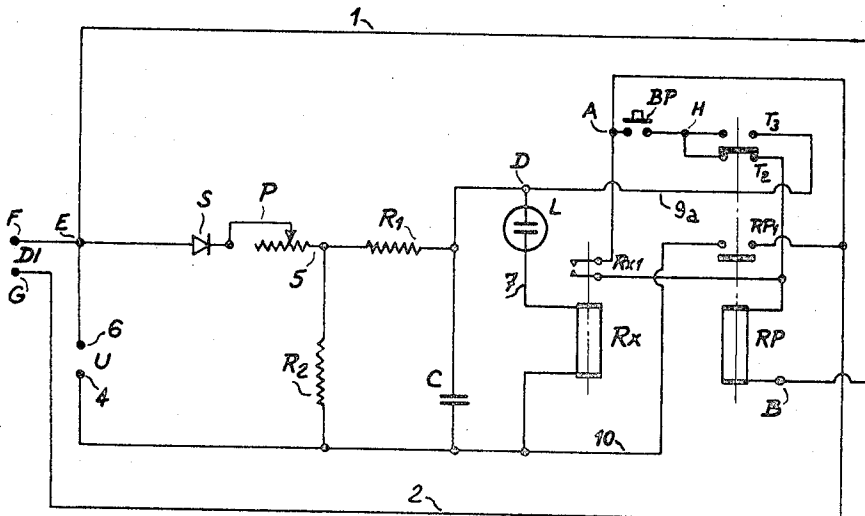


FIG. 4



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3,349,293

AUTOMATIC ELECTRON TIME-SWITCHES

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Filed Mar. 16, 1965, Ser. No. 440,099

Claims priority, application France, Mar. 17, 1964,
967,743

5 Claims. (Cl. 317-142)

Automatic time-switches mounted in electrical networks consist as a rule of electromechanical devices, mostly rather noisy, of which the time-lag is adjustable only within relatively narrow limits. Heat-responsive time switches are also known, but to operate them the user must depress the control knob during a relatively long time period, at least one second. Moreover, their time-lag characteristic is subordinate to the room temperature and the useful life of their heat-resisting element is rather short.

It is the essential object of this invention to provide an automatic time-switch free of the various drawbacks set forth hereinabove which characterize conventional time-switches.

To this end, the invention provides an automatic electron time-switch comprising a main relay of which the energisation is controlled by depressing the control knob, and a time-lag system of which the energisation is controlled in turn by said relay, this automatic time-switch being characterized in that the main relay is of the so-called step-by-step type having two stable positions, and that its contacts control on the one hand the passage and the breaking of the load current and on the other hand the energisation of the time-lag device of which the circuit comprises a condenser having connected in parallel across its terminals a branch circuit comprising a gas-filled lamp and the winding of a secondary relay controlling the closing of a conductor adapted likewise to energise the main relay.

Four typical forms of embodiment of the automatic electron time-switch according to this invention are described hereinafter by way of example with reference to the attached drawings, in which:

FIGURES 1 to 4 are wiring diagrams corresponding each to one of these four forms of embodiment.

The automatic electron time-switch illustrated in FIGURE 1 comprises a main relay RP of a special type, that is, a step-by-step controlled pulse relay of which the main contact RP₁ has two stable positions. Thus, each time the coil of this relay is energised, the main contact RP₁ moves to the other position; in other words, it closes if it was open and opens if it was closed. In the inoperative or de-energised position this main contact is normally open. The coil of this main relay may be energised from a suitable mains distributor designated by the reference letters DI, for example a 110-volt A.C. mains.

This relay controls the supply of current to a load circuit U as well as to a time-lag device comprising a condenser C having connected in parallel across its terminals a branch circuit comprising a gas-filled lamp L and the winding of a secondary relay RX adapted to control the opening of the time-switch circuit.

To simplify the description, the diagram may be divided into four main sections.

I.—The control circuit of main relay RP,

II.—The charging circuit of condenser C in the time-lag device,

III.—The discharge circuit of this condenser C, and

IV.—The load circuit proper U.

The charging circuit of condenser C and the discharge circuit thereof constitute somewhat the complete circuit

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of the automatic time-lag device, which is designated as a whole by the reference numeral 5.

I.—The control circuit of the main relay RP comprises a push-button BP mounted in parallel with the contact RX₁ of an auxiliary relay, this assembly being connected in series with the coil of the main relay RP. The two ends of this control circuit are designated by the letters A and B, the end A (on the push-button side) being connected through a conductor 1 to the mains terminal F while the other end B (coil side) is connected through another conductor 2 to the mains terminal G.

Of course, if the case contemplated is that of a time-switch installation adapted to be operated from several points, a corresponding number of control push-buttons may be connected in parallel.

II.—The charging circuit of condenser C consists of a resistance R₁ connected in series with the condenser C. The charging current is controlled directly by the value of this resistance R₁ which may therefore be variable in order to increase the range of permissible adjustment.

The assembly consisting of condenser C and resistance R₁ is connected in parallel with a resistance R₂ connected in series with a potentiometer P and a rectifying cell S. A switch T permits of opening the charging circuit, if necessary.

The end E of this circuit (on the switch side) is connected to the supply terminal F.

The other end of this circuit, which consists of a conductor 10, is connected to the other mains terminal (terminal G) through the main contact RP₁ of main relay RP, and through conductors 3 and 2.

The function of potentiometer P is to adjust the potential difference across the terminals of resistance R₂ and therefore the charging current flowing through resistance R₁.

III.—The discharge circuit comprises, in parallel with condenser C, a conductor 7 in which a gas-filled lamp (neon tube) L and the coil of auxiliary relay RX are inserted.

This condenser may also be discharged through the medium of another conductor 9 comprising a contact RP₃ and connected in parallel to condenser C.

Contact RP₃ (which is one of the contacts of the main relay RP) is a transient contact closing only when the coil of the main relay RP is energised.

IV.—The load circuit U is connected in parallel to the charging circuit of condenser C. In fact, the terminal 4 of circuit U is connected to the mains terminal G through conductor 10, contact RP₁ and conductor 2, the other terminal 6 of this circuit U being connected to the other terminal F.

This time-switch operates as follows:

Assuming that the time-switch is properly connected to an electric mains and that switch T is closed, the time-switch is operated by depressing, even for a very short time, the push-button BP, thus energising the coil of main relay RP. As a consequence, the contact RP₁ of this relay, which was open, will close and cause on the one hand the energisation of the load circuit U and on the other hand the charging of the time-lag circuit 5 comprising the resistances and condenser C.

At the end of the time period for which the time-switch was previously adjusted by means of the potentiometer P, the voltage across the terminals of condenser C is sufficient to ignite the neon tube L which becomes conducting. As a consequence, the coil of main relay RP is energised and the main contact RP₁ of this relay moves from its preceding closed position to its open position, thus discontinuing on the one hand the energisation of the time-lag circuit 5.

At the same time the transient contact RP_3 of main relay RP has closed and short-circuited the condenser C so as to eliminate any residual charge therefrom.

In the operation described hereinabove a single depression of push-button BP causes the energisation of the load circuit during the predetermined time period for which the automatic time-switch was adjusted.

This time-lag may be adjusted at will by means of the potentiometer P. The resistance R_2 inserted in the circuit 5 may be of an adjustable type, so that several ranges of time-lag values may be obtained. Other resistances may also be inserted in the supply circuit in order to adapt the device to the mains voltage.

It may be noted that if during the operation of the automatic time-switch, as the time-lag period is elapsing, the push-button BP were depressed again at any moment, the main relay RP would be energised prematurely, this involving the opening of the load circuit U before the preselected time period has elapsed.

Under these conditions, the user can reduce by a voluntary act the time-lag period without interfering in any manner with the time-switch adjustment and without adding any complementary element to the installation, since the circuit is open by depressing the same button as that used for closing it.

The automatic electron time-switch according to this invention is advantageous in that its operation is reliable and noiseless, and its wear is reduced practically to zero. Moreover, this automatic time-switch permits of operating the installation as a remote switching control, without any modification, since it is sufficient to depress the control push-button another time for breaking the load circuit before the predetermined time-lag of the time-switch has elapsed. The time period already elapsed during the first portion of the cycle is eliminated and is in no way deducted from the time-lag period of the next cycle.

On the other hand, by opening the switch T the user may neutralise the timing system. In this case a first pressure exerted on the push-button BP will energise the coil of relay RP and therefore the load circuit U as long as this push-button is not depressed again. This second depression, when exerted, causes the contact RP_1 of the main relay to move from its closed position to its open position, whereby a real remote control of the load circuit U is obtained.

By way of example, in a specific form of embodiment the following values may be selected for the various component elements of the automatic electron time-switch of this invention:

C—6 μ farad/250-volt paper condenser,
 R_1 —2.2 to 70-megohm resistance,
 R_2 —4.3-megohm resistance,
P—2-megohm linear potentiometer,
RP—Step-by-step, 5-volt-ampere main relay,
RX—10,000-ohm/1-milliampere auxiliary relay,
L—3 to 5-milliampere output neon tube.

With these values, and by properly adjusting the potentiometer P, the time-lag characteristic may be varied between limits ranging approximately from 45 seconds to 45 minutes.

This time-switch is characterized by its low cost, reduced over-all dimensions and the possibility of being mounted in any position, irrespective of the room temperature. It has a zero current consumption outside its periods of actual operation and even in this case the consumption is extremely low, of the order of 150 microamperes.

FIGURE 2 illustrates a modified diagram of the arrangement of FIGURE 1. In this alternate form of embodiment the transient discharge contact RP_3 is replaced by a contact RP_2 associated with the contact RP_1 , these two contacts constituting a double reversing contact. This contact RP_2 is therefore a back contact and has the same

function as contact RP_3 . However, with this arrangement the construction of the main relay RP is simplified.

FIGURE 3 illustrates the diagram of a third form of embodiment of the automatic time-switch according to the present invention, which is so designed that depressing the push-button BP during a cycle of operation of the switch cannot break the load circuit U, as contrasted with the preceding forms of embodiment of FIGURES 1 and 2.

In fact, for certain applications, notably in the case of an automatic time-switch controlling the lighting system in a house, it is necessary to avoid opening the supply circuit during a cycle of operation, for example in case the push-button were depressed by another user.

The general arrangement of this third form of embodiment of the automatic time-switch according to this invention is similar to the preceding one. Therefore, its circuit is nearly the same and the component elements, approximately identical with those provided in the first form of embodiment, are designated by the same reference symbols in the drawing.

As in the preceding case the main relay RP comprises a double reversing contact RP_1 , RP_2 . However, this relay also comprises an auxiliary back contact RP_4 inserted in the conductor 8 also comprising the push-button BP.

Thus, when this contact is open, it prevents the depression of this push-button from controlling the operation of relay RP. Under these conditions during the operating time of the automatic time-switch it is not possible to cause another operation of relay RP and therefore to discontinue the supply of current to the load circuit U by re-actuating the push-button.

Thus, the automatic time-switch is released only through the time-lag system. However, when the time-switch is released, depressing the push-button will normally cause its resetting, for the auxiliary contact RP_4 is then closed. On the other hand, in this specific form of embodiment the switch T is dispensed with, since it has no useful function.

In certain applications, for instance in the case of an automatic time-switch controlling a lighting installation in staircases, it is advantageous to have the possibility of resetting the time-switch at will before its load or lighting circuit opens at the end of the predetermined time-lag. It is also desirable that this resetting takes place in this case without opening the load circuit beforehand, as would occur in the case of the diagram shown in FIGURE 1.

FIGURE 4 illustrates the diagram of an automatic time-switch comprising the same component elements as the preceding forms of embodiment, but so designed as to provide the advantageous features set forth hereinabove.

This diagram may be compared with the diagram of FIGURE 1.

However, the main relay RP comprises, in addition to the main contact RP_1 , a double reversing contact T2—T3. In the latter, contact T2 is a back contact (closed in the de-energised condition) and contact T3 is a front contact (that is, closing when the relay is energised). These two contacts have a common point H connected to the control push-button BP.

On the other hand, contact T3 is connected through a conductor 9a to a point D common to resistance R_1 , condenser C and gas discharge lamp L. As to contact T2, it is connected on the other hand to the winding of the main relay RP.

A specific feature of this diagram lies in the fact that the end points A and B of the control circuit of main relay RP are connected the opposite way with respect to the connections of FIGURE 1. Thus, point A is connected to the mains terminal G through conductor 2, and point B is connected to the mains terminal F through conductor 1.

This automatic time-switch operates as follows:

By depressing the control push-button BP the user causes the coil of main relay RP to be energised, since

contact T2 is closed in the de-energised condition (back contact). Therefore, this relay operates and closes the main contact RP₁ while opening the first auxiliary contact T2 and closing the second auxiliary contact T3.

The closing of main contact RP₁ will energise on the one hand the load circuit U and the circuit 5 of the time-lag system.

After a predetermined time period the voltage across the terminals of condenser C is sufficient to ignite the neon tube L, thus causing the operation of the auxiliary relay RX and therefore the energisation of the coil of the main relay RP.

This last-named relay RP is thus operated to control the opening of its main contact RP₁ as well as of its auxiliary contact T3, while closing the other auxiliary contact T2.

Thus, the supply of current to the load circuit and to the time-lag circuit is discontinued. On the other hand, the various contacts of the relays resume their initial positions, whereby the automatic time-switch is ready to operate again.

However, if during the operation of this automatic time-switch the push-button BP were depressed again, this would not cause the main relay RP to operate again and break the supply of current to the load circuit. In fact, the auxiliary contact T2 inserted in conductor 1 is then open.

On the other hand, depressing the push-button BP will cause current to flow through the conductor 9a since the auxiliary contact T3 was closed. This causes the condenser C of the time-lag device to be short-circuited.

As a consequence, the time period having already elapsed during the present cycle of operation is somewhat cancelled. Thus, the time-lag period commences again from the moment the redepressed push-button BP is released. In fact, the current continues to flow without break through the time-lag circuit, since the main contact RP₁ remained constantly closed.

Under these conditions, it is clear that with the wiring diagram of FIGURE 4 the repeated depression of push-button BP cannot produce a momentary break in the load circuit, this constituting a very important feature.

Moreover, depressing the push-button BP during the operation of the system does not actuate any relay in the automatic time-switch, thus assisting in ensuring the noiseless operation of this device.

On the other hand, if the control push-button were jammed for any reason, the coil of the main relay RP would remain de-energised during the entire time-lag period, as contrasted with the mode of operation obtaining with the forms of embodiment illustrated in FIGURES 1 and 2.

Finally, it will be readily understood by anybody conversant with the art that the automatic time-switch according to this invention may be used to advantage in many different applications, and should not be construed as applying only to the specific case of lighting systems comprising a series of control push-buttons,

What I claim is:

1. Automatic electron time-switch comprising a main relay of which the energisation is controlled by depressing a push-button, and a time-lag system of which the energisation is also controlled by means of said relay, said main relay being of the so-called step-by-step type having two stable positions and controlling by means of its contacts on the one hand the passage and break of current to the load circuit and on the other hand the application of voltage to the time-lag system, this time-lag system comprising a condenser having connected across its terminals a branch circuit comprising a gas-filled lamp and the winding of a secondary relay controlling the closing of a conductor also adapted to supply energising current to said main relay.

2. Automatic electron time-switch according to claim 1, in which said main relay comprises a front contact inserted in a conductor connecting one of the terminals of the mains on the one hand to said load circuit and on the other hand to the circuit of said time-lag system, said main relay also comprising a secondary contact of the transient closing type which is inserted in a conductor adapted to short-circuit the condenser of said time-lag system.

3. Automatic electron time-switch according to claim 1, in which said main relay comprises a double reversing contact, one contact being a front contact inserted in a conductor connecting one of the mains terminals on the one hand to the load circuit and on the other hand to the circuit of the time-lag system, the other contact being a back contact inserted in a conductor adapted to short-circuit the condenser of said time-lag system.

4. Automatic electron time-switch according to claim 3, in which said main relay comprises, in addition to said double reversing contact, an auxiliary contact which is a back contact inserted in the conductor in which said control push-button is inserted.

5. Automatic electron time-switch according to claim 1, in which said main relay comprises a main front contact inserted in a conductor connecting one of the mains terminals on the one hand to the load circuit and on the other hand to the circuit of the time-lag system, said main relay further comprising a double reversing contact of which the back contact is inserted in the conductor comprising said control push-button, the front contact being inserted in a conductor adapted to short-circuit the condenser of the time-lag system when said push-button is depressed.

References Cited

UNITED STATES PATENTS

2,433,254	12/1947	Aiken	317—142
2,453,486	11/1948	Ball	317—142
2,889,495	6/1959	Farmer	317—142
2,965,814	12/1960	Gartner	317—142

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