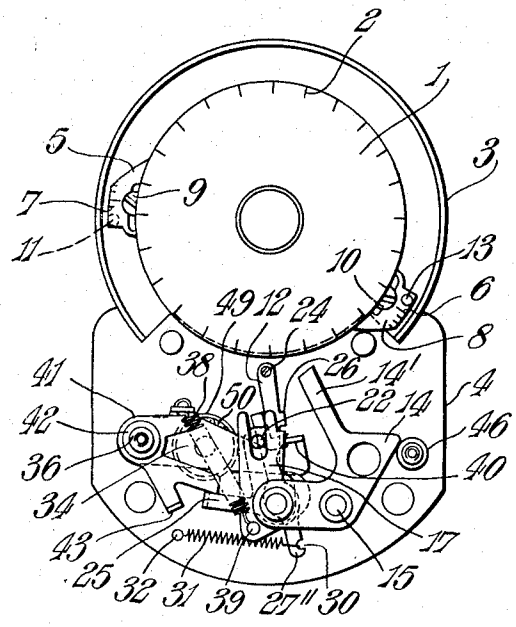
Sept. 15, 1959 K. J. HORSTMANN ET AL 2,904,648

ELECTRIC TIME SWITCHES

Filed Dec. 13, 1957 2 Sheets-Sheet 1

Fig. 1.



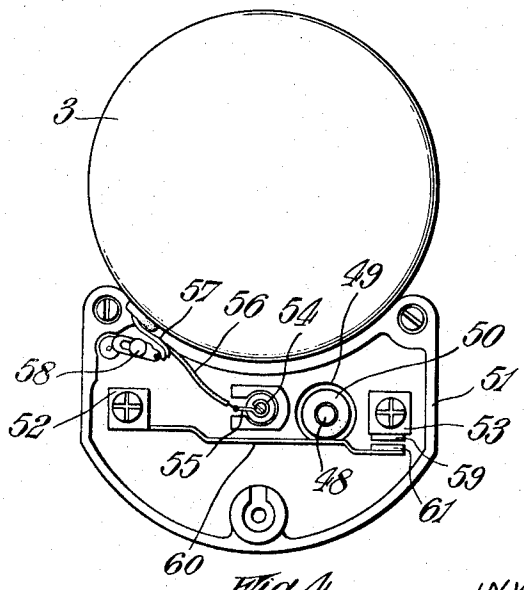


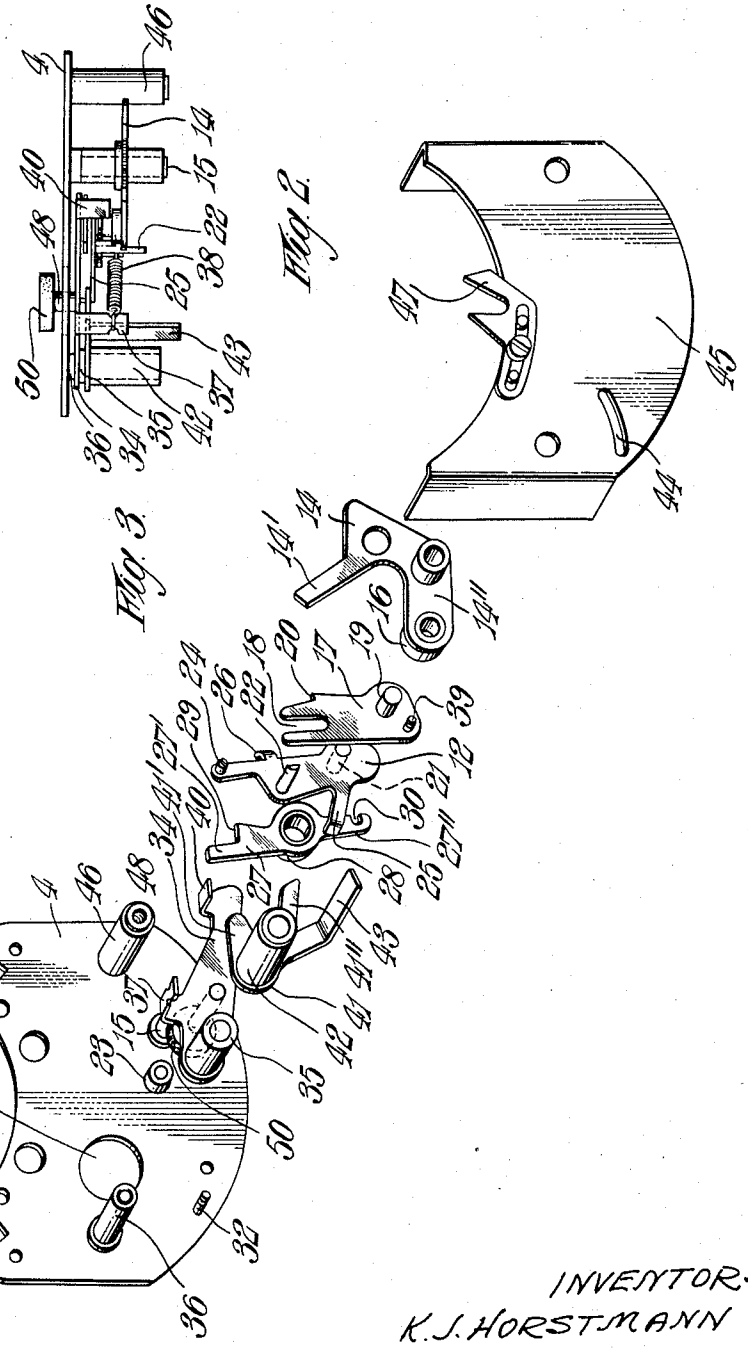
Fig. 4.

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ELECTRIC TIME SWITCHES

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ELECTRIC TIME SWITCHES

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5 Claims. (Cl. 200—38)

This invention relates to electric time switches of the type used for making or breaking electric circuits, for example electric lighting circuits, at predetermined times of the night or day. Time switches of the type referred to herein comprise a dial plate rotated periodically and carrying members—referred to herein as "tappets"—which are adjustably positioned around the dial plate circumference and adapted selectively to actuate an electric switch mechanism, at least one of the said tappets being adapted to set the switch to its "on" position and at least one other of the said tappets being adapted to set the switch to its "off" position.

Time switches of this type are described in Horstmann's prior British patent specifications Nos. 329,633, 331,083, 373,554 and 500,670.

One switch actuating mechanism advantageously used in time switches of this type has two levers, which are selectively engaged by the tappets referred to above, one of which levers trips the switch to the "on" position and the other of which trips the switch to the "off" position.

In normal operation of the time switch, the two levers are engaged alternately, since it will be understood that if one operation is to switch a circuit "off," the next operation will be to switch it "on." However, circumstances may arise in the use of the time switch resulting in the actuation twice in succession of one or other of the two levers and this may cause the switch to be actuated slowly with consequent arcing at the contact points thereof.

The object of the present invention is to overcome this difficulty.

According to the present invention, an electric time switch of the type described has a lever which is selectively engaged by the said tappets and moved by the rotation thereof to set the switch to one of its said positions and a retaining catch which is set by the movement of the said lever to hold the switch in the said one position in the event of a second engagement of the said lever before the switch is set to its other position.

In order that the invention may be readily carried out, a practical embodiment will be particularly described, by way of example, with reference to the accompanying drawings of which:

Figure 1 is a front view of an electric time switch of the type described;

Figure 2 is a view from above of the time switch of Figure 1, showing the switch actuating mechanism;

Figure 3 is an exploded, isometric view of the switch actuating mechanism shown in Figure 2; and

Figure 4 is a back view of the time switch of Figure 1.

In Figure 1, the electric time switch comprises a dial plate 1, carrying 24-hour graduation marks 2, removably mounted on a spindle by which it is rotated once in 24 hours by a synchronous electric motor. The synchronous electric motor and suitable reduction gearing are housed in the rear part of a cylindrical casing 3. These parts of the time switch are of known form and are not illustrated in the drawings. Further description of them is not necessary for an understanding of the present invention.

The dial plate 1 is housed in the front part of the casing 3 slightly forward of a plate 4 carrying the switch actuating mechanism described below. The dial plate 1 carries two tappets 5 and 6, the outer ends of which are shown in Figure 1. The tappets 5, 6 are angularly settable relatively to the dial plate 1 and are rotated thereby so that they are similarly rotated once in 24 hours.

The tappets 5, 6 are provided with graduated sector plates 7, 8 respectively which are angularly adjustable relatively to the dial plate 1 and are locked by screws 9, 10 respectively.

The sector plate 7 of tappet 5 carries a rearwardly extending pin 11 arranged to engage a lever 12 and to trip the switch to the off position. The lever is referred to as the off trip lever. The sector plate 8 of tappet 6 carries a forwardly extending pin 13 arranged to engage a bell crank lever 14 and to trip the switch to the on position. The lever 14 is referred to as the on trip lever.

The remainder of the switch actuating mechanism will now be described with reference to Figures 1 and 2, which show the mechanism assembled, and to the exploded view of Figure 3. The bell crank lever 14 is carried on a pivot 15 on the casing plate 4 and has a trip arm 14′ extending towards the dial plate 1 for engagement by the on tappet and a second arm 14″ in which is secured a bush 16. The bush 16 receives a pivot pin 19 of a pawl 17 having a forked end 18 and a (first) catch 20 for a switch actuating lever 34. The forked end 18 of pawl 17 engages a forwardly extending pin 22 attached to the lever 12. The lever 12 has a rearwardly extending pivot pin 21, about which lever 12 pivots, and which is received in a bush 23 in the casing plate 4. The lever 12 is also provided with a forwardly extending pin 24 for engagement by the off tappet 7; a manual operation arm 25 with its end turned over and rearwardly extending and a rearwardly extending disengagement lug 26 arranged to engage the upstanding end 27′ of a double ended lever 27 comprising a second catch pawl for the switch actuating lever 34. The pawl 27 carries a bush 28 which fits over the bush 23 and, below the arm 27′, is provided with a catch 29 referred to herein as the second catch. The other end 27″ of pawl 27 is notched at 30 to receive one end of a light tension spring 31, the other end of which spring is held by a pin 32 on the casing plate 4.

A switch actuating lever 34 has a bush 35 at one end by which the lever 34 is pivoted about an internally threaded pillar 36 mounted on the casing plate 4. The lever 34 has a forwardly extending arm 37 reduced near its forward end to receive one end of a tension spring 38, the other end of which spring is attached to a pin 39 on the first catch pawl 17. The lever 34 also has a forwardly extending latch arm 40 arranged to bear on the catches 20 and 29 in the manner to be described.

A three-armed member 41 carries a bush 42 which fits over the bush 35 of lever 34. The member 41 comprises a short arm 41′, which abuts against the arm 37 of lever 34, a longer arm 41″ which abuts against the arm 25 of lever 12 and a forwardly bent arm 43 which extends through an arcuate slot 44 in a cover 45 (Figure 2).

The cover 45 is attached by screws, not shown, to the pillar 36 and to a corresponding, internally threaded pillar 46 on the right hand side of the casing plate 4. The cover carries an adjustable index 47 against which the dial plate graduation marks 2 are read. The pillar 46 also serves as a stop for the clockwise rotation of the bell crank lever 14 which is operated by the on tappet 6.

As shown most clearly in Figure 2, the switch actuating lever 34 carries a rearwardly extending pin 48 which extends through a circular aperture 49 in the casing plate 4. At its end, the pin 48 carries a button 50 of insulating material which engages with the switch contact arm 60.

Referring now to Figure 4, the casing plate 4 carries on its rear face a housing 51 of insulating material in which are mounted two heavy contact pins 52, 53 and a lighter contact pin 54 arranged to fit into a suitable socket, not shown. The pin 54 carries a clip 55 to which is attached one lead 56 of the synchronous driving motor. The other lead 57 is attached to a terminal 58. To the base of pin 53 is brazed a contact point 59 and to the base of pin 52 is brazed a spring contact arm 60 carrying a contact point 61.

The button 50 is arranged to deflect or release the switch arm 60, according to the movement of lever 34, thereby respectively opening or closing the switch contact points 59, 61.

In the operation of the time switch, rotation of the dial plate 1 brings, say, the pin 13 of the on tappet 6 into engagement with the arm 14' of the bell crank lever 14. Continued rotation of the dial plate 1 then carries along the arm 14' producing counterclockwise rotation of the bell crank lever 14. This rotation simultaneously tensions spring 38 and draws downwardly the first catch pawl 17 partially disengaging the fork 18 from the pin 22 until the first catch 20 passes the left hand edges of the latch arm 40 of lever 34. At this point, the pawl 17 is rotated slightly in the clockwise direction by the tension of spring 38 so that the catch 20 engages the latch arm 40.

Further rotation of the dial plate 1 carries the on tappet and the trip arm 14' along divergent arcs until the end of trip arm 14' is free of pin 13. Thereupon the bell crank lever 14 is released and, under tension of spring 38 transmitted through pawl 17 and pivot pin 19, is rotated quickly in the clockwise sense until it is arrested by pillar 46. By this rotation, the pawl 17 is moved upwards again but, since the first catch 20 is now engaging the latch arm 40, the switch actuating lever 34 is rotated in the counterclockwise sense moving the button 50 upwards and allowing the switch contact points 59, 61 to close.

The switch actuating lever 34 is biased to rotate in the clockwise sense, however, by the tension of spring 38 but, as indicated, is held against such rotation by the first catch 20, and the second catch 29 of lever 27 when in this position.

It has been convenient to describe the operation of the time switch so far by assuming a simple dial plate assembly carrying one fixed on tappet and one fixed off tappet. However, in practice, this assembly may comprise more than one of each kind of tappet and, particularly, may comprise means for progressive angular adjustment of the various tappets in operation as provided by the solar dial described in Horstmann's British prior patent specification No. 744,612.

Supposing now that the action of such a time switch brings a second on tappet into engagement with the trip bell crank lever 14. The movement transmitted therefrom to the button 50 will cause the contact arm 60 to be moved slowly downwards and, if permitted to continue, this motion would cause the slow separation of the contact points 59, 61. Such undesirable motion is prevented by the second catch 29, which is a feature of the present invention.

Returning now to the embodiment shown in the drawings, upon the release of arm 14' from on tappet pin 13, and the upward movement of pawl 17, the latch arm 40 is carried upwards past the lip of the second catch 29. Thereupon, the double-ended lever 27 is rotated in the clockwise sense by the tension of spring 31. The catch 29 thus moves into the downward path of the arm 40 and, if the switch actuating lever 34 were released to rotate in the clockwise sense by the action of a second on tappet as described above, such movement is arrested by the abutment of latch arm 40 against second catch 29 before the switch contacts are opened.

Upon engagement of pin 11 of the off tappet 5 with lever 12, the latter lever is rotated in the counterclockwise sense about its pivot pin 21. Pin 22 thereupon engages the left arm of fork 18 to rotate pawl 17 similarly against the tension of spring 38. When pawl 17 is sufficiently rotated, first catch 20 becomes disengaged from latch arm 40 so that the switch actuating lever 34 is released and rotates clockwise under tension of spring 38 until arm 40 is arrested by catch 29.

Also, upon counter-clockwise rotation of lever 12, disengagement lug 26 engages arm 27' of lever 27 so that lever 27 is similarly rotated in the counterclockwise sense. Upon further rotation of lever 12, the corresponding rotation of lever 27 by lug 26 causes the second catch 29 to become disengaged from latch arm 40 so that switch actuating lever 34 is released to rotate clockwise under action of spring 38 so that button 50 moves the switch contact arm 60 quickly to the open position of the switch. After further rotation the off tappet pin 11 disengages from the lever 12 whereupon the lever 12, lever 27 and pawl 17 all rotate in the clockwise sense, under the tension of spring 38 applied to pin 39 and of spring 31, until the edge of pawl 17 and lever 27 are arrested by the edge of latch arm 40. The switch actuating mechanism is then reset for subsequent on actuation.

The time switch described further operates to prevent a slow break of the switch contacts 59, 61 when on and off tappets are set very close together. This close setting of the tappets can occur, for example, by the operation of a solar dial.

The solar dial described in British patent specification No. 744,612 has an early morning "on" tappet. With certain settings of the midnight "off" tappet, approximately 1:00 a.m., and with the early morning "on" tappet set to give the maximum early morning lighting period, approximately 1½ hours, this "on" tappet is moved back towards midnight by the solar "off" tappet and may pass and actually be positioned before the midnight "off" tappet. Under such conditions, the "on" and "off" levers 14 and 12 respectively move together. Such movement does not result in ambiguous operation of the switch mechanism, however, due to the shape of the right hand edges of pawl 17, lever 12 and lever 27, as seen in Figure 3. It is particularly to be noted that the "second" catch 29 on lever 27 projects further to the right than does the "first" catch 20 of the pawl 17. The "second" catch 29 is thus always the controlling catch in such circumstances so that switch actuating lever 34 is always released clearly and sharply, under the action of spring 38, to its extreme downward position thereby opening the switch contacts 59, 61 quickly.

The forwardly extending arm 43 of multi-armed lever member 41 provides for manual operation of the switch. Movement of the arm 43 to the left in the slot 44 (Figure 2) causes arm 41'' to bear against the turned over end of arm 25 on lever 12. This action rotates the pawl 17, lever 12 and lever 27 in the counterclockwise sense releasing in turn the two catches 20 and 29 so allowing the switch actuating lever 34 to rotate clockwise under the action of spring 38 to open the switch contacts 59, 61. Movement of the arm 43 to the right in slot 44 causes arm 41' to bear against arm 37 of switch actuating lever 34 which is thereby lifted to allow the switch contacts 59, 61 to close. During this movement of lever 34, the catches 20, 29 move into their positions of engagement as described.

We claim:

1. An electric time switch of the type comprising a dial plate rotated periodically and carrying on and off tappets which are adjustably positioned about the dial plate circumference for actuation of switch mechanism, wherein said switch mechanism comprises spring con-

trolled switch contacts, an actuating lever controlling said contacts, first and second catches controlling said lever, means whereby the on tappet moves said lever through the first catch to close the switch contacts and positions the second catch to lock the said lever in the switch closed position, and means operable by the off tappet first to release both catches, the first in advance of the second from said lever whereby the switch contacts open, and thereafter to reset the catches for subsequent on operation of said switch mechanism.

2. An electric time switch according to claim 1, wherein said respective means comprise an on trip lever having one arm in the path of the on tappet, a forked pawl lever pivoted on another arm of said on trip lever, and carrying said first catch, a fixed pivot, and off trip lever operable by the off tappet and pivotal on the fixed pivot, said off trip lever having a member engaging in the fork of said pawl, a second catch carrying lever having the second catch thereon and pivoted on said fixed pivot, a latch arm on said actuating lever, said catches being juxtaposed to said latch arm with the second catch longer than the first and arranged such that said second catch engages with and disengages from said latch arm after the first catch, and spring means normally biassing said trip and catch carrying levers to the reset position.

3. An electric time switch of the type comprising a dial plate rotated periodically and carrying on and off tappets which are adjustably positioned about the dial plate circumference for actuation of switch mechanism, wherein said switch mechanism comprises spring controlled switch contacts, an actuating lever controlling said contacts, first and second catches directly controlling said lever, separate trip levers adapted for displacement by the on and off tappets respectively, separate catch levers carrying said catches respectively, and connections between said catch levers and said trip levers whereby displacement of the on trip lever moves said first catch in advance of the second catch to cause the switch actuating lever to close said contacts, and subsequent displacement of the off trip lever disengages said first catch in advance of the second catch from the actuating lever to close the switch contacts and reset the levers in the normal on position.

4. An electric time switch according to claim 3, wherein said connections include a fixed pivot and a multi-arm lever pivotal in opposite directions on said fixed pivot for manual operation of said actuating lever, one

arm being an operating arm, another arm co-operating with the off trip lever to effect displacement thereof to the off position when the manual lever is moved in one direction whereby to effect release of the first and second catches in turn from said actuating lever to open the switch contacts, and a third arm co-operating directly with said actuating lever to move it to the switch closed position when the manual lever is moved in the opposite direction.

5. An electric time switch of the type comprising a dial plate rotated periodically and carrying on and off tappets which are adjustably positioned about the dial plate circumference for actuation of switch mechanism, wherein said switch mechanism comprises spring controlled switch contacts, an actuating lever controlling said contacts, first and second catches controlling said lever, a mounting plate having a first pivot carrying said actuating lever, a second pivot and a third pivot, an on trip lever having one arm in the path of the on tappet, and pivotal on the second pivot, a forked pawl lever pivotal on another arm of said on trip lever and carrying said first catch, an off trip lever pivotal on said third pivot and having one arm in the path of the off tappet, a member on said off trip lever engaging in the fork of said pawl, a second catch carrying lever having the second catch thereon and pivotal on said third pivot, a latch arm on said actuating lever, said catches being juxtaposed to said latch arm with the second catch longer than the first and arranged such that said second catch engages with and disengages from said latch arm after the first catch, and spring means normally biassing said trip and catch carrying levers to the reset position, and a multi-armed manual lever mounted on said first pivot with two of its arms co-operating with the said actuating lever and off trip lever respectively to effect displacement of the actuating lever to switch open and closed positions by opposite pivoted displacements of the manual lever.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,904,648 September 15, 1959

Kenneth John Horstmann et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1 and 2, for "Kenneth John Horstmann and Leslie George Mountjoy, of Payne, Bath, England," read -- Kenneth John Horstmann and Leslie George Mountjoy Payne, of Bath, England, --; line 11, for "Kenneth John Horstmann and Leslie George Mountjoy, their heirs" read -- Kenneth John Horstmann and Leslie George Mountjoy Payne, their heirs --.

Signed and sealed this 29th day of March 1960.

(SEAL)
Attest:

KARL H. AXLINE
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Commissioner of Patents

UNITED STATES PATENT OFFICE

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