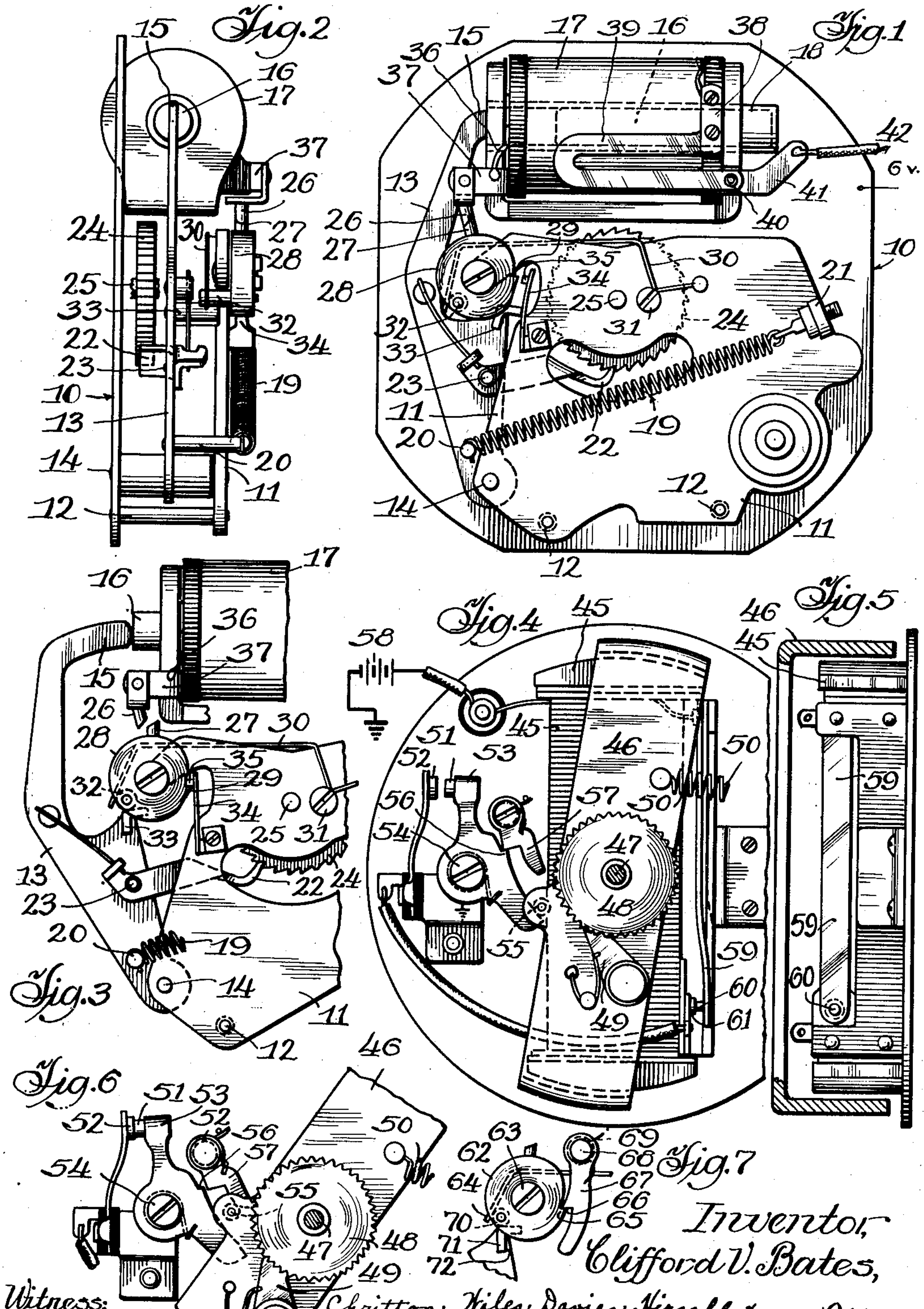
Sept. 10, 1940. **C. V. BATES** **2,214,654**

ELECTRIC TIMING DEVICE

Filed June 1, 1937



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UNITED STATES PATENT OFFICE

2,214,654

ELECTRIC TIMING DEVICE

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Application June 1, 1937, Serial No. 145,885

7 Claims. (Cl. 185—40)

This invention relates to an electric timing device, and more particularly to a spring driven clock of the character adapted to be re-energized at intervals by electric means.

One feature of this invention is that it provides an electric clock particularly adapted for use in places subject to vibration.

Another feature of this invention is that it provides improved switch means for making and breaking the circuit energizing the means provided for storing energy in the driving spring of the clock at intervals.

Still another feature of this invention is that positive operating means is provided for insuring a tight closing of the contacts and a clean and complete separation thereof, as conditions may require.

A further feature of this invention is that means is provided for breaking the energizing circuit should the switch contacts stick or if for any other reason current should flow through the electric device for longer than a desired period.

Other features and advantages of this invention will be readily apparent to one familiar with the art from a consideration of the following specification.

In the accompanying drawing:

Fig. 1 is a front elevation of one form of electric clock;

Fig. 2 is a side elevation thereof;

Fig. 3 is a partial view similar to Fig. 1 but with certain parts in a different position;

Fig. 4 is a front elevation of another form of the invention;

Fig. 5 is an end elevation partly in section;

Fig. 6 is a partial view similar to Fig. 4 with certain parts in a different position; and

Fig. 7 is a fragmentary view of certain modified details.

In Fig. 1, in which parts of a clock are shown, a supporting plate 10 is provided having a second plate 11 spaced from it by suitable spacers 12. An actuating lever 13 is arranged between the two plates, being pivoted at 14. Said lever has the configuration best shown in Fig. 3, its free end having an extension 15 arranged at an angle and being adapted to bear against the loose plunger or core 16 of soft iron which is mounted to move back and forth in a solenoid 17. At one end of the solenoid is a cap 18 to prevent the core from falling out. Said core is normally positioned as far to the right as possible, as viewed in Fig. 1, but when the solenoid is energized, said core moves to the left and swings the lever 13 about its pivotal support, thereby tensioning the spring 19. The spring in this instance is a helical spring secured at one end to a pin 20, mounted on the pivoted actuating lever and adjustably secured at the other end to a fixed abutment 21 on the plate 11. When the actuating lever is pushed back against the action of said spring, it assumes the position shown in Fig. 3, said spring tending to restore it to the position shown in Fig. 1.

The actuating lever has a spring pawl 22 pivotally mounted on it at 23 and engaging the ratchet wheel 24 which is mounted on a shaft 25, the latter constituting the main shaft of a clock mechanism which includes the escapement, whereby, as the spring 19 contracts, the clock will operate for several minutes before the actuating arm 13 reaches the limit of its movement. At this point the circuit to the solenoid is closed by switch means, about to be described, thereby resetting the actuating arm so that the cycle of operations continues indefinitely.

In devices heretofore used, the switch in many cases has comprised an arm which snaps over a dead center to close the contact. With this construction the spring is not very powerful and under certain conditions where the supporting plate vibrates, the switch will open and close the circuit rapidly instead of holding it definitely in closed position. This frequently happens where the clock is mounted in an automobile or aeroplane, particularly the latter. Not only do the contacts vibrate but in some cases they heat and adhere to each other, rendering the clock inoperative.

I provide an improved form of switch in which the opening and closing action is very definite and avoids chattering or vibration of the contacts.

In the improved switch the stationary contact 26 may be mounted on one end of the solenoid and the movable contact 27 is mounted on a rotatable disc or cam member 28 which has a shoulder 29 thereon. The cam member is normally impelled in a direction to hold the beveled ends of said contact members in engagement with each other, as shown in Fig. 1. This is accomplished by any suitable form of spring such as the spring wire 30 which is mounted at 31 with its free end in engagement with a pin 32 on said cam disc. Said spring normally maintains said disc in Fig. 1 position but the latter may be rotated to the Fig. 3 position by means of an abutment 33, which, in this instance, is preferably L shaped in section, as shown in Figs. 1 and 3, said abutment being mounted on the actuating arm 13. When said arm is swung to the right, as in the Fig. 1 position, said abutment strikes a spring pawl 34 with a projection or tooth 35 thereon which is thus held out of engagement with the shoulder 29. When said actuating arm is moved to the Fig. 3 position, the shoulder 33 engages the pin 32 and rotates the cam disc 28 until said pawl snaps against the shoulder, thereby locking said cam in the position shown in Fig. 3 against tendency of the spring 31 to restore the same to initial position. In the Fig. 3 position the contacts 26, 27, are disengaged from each other and thus open the circuit to the solenoid 17. The projecting end 36 of the insulated conductor forming the solenoid, is soldered or otherwise connected to the support 37 (Fig. 1) on which the fixed contact 26 is mounted. The circuit is through said contacts to the metal parts of the clock which ground it. The other end of the solenoid is connected to the terminal 38.

One phase of my invention comprises the employment of a thermostat to open the circuit to the solenoid, regardless of the type of switch used. This thermostat opens the circuit to the solenoid in case the contacts remain closed too long and thus prevent said contacts from sticking, as has been the case with switches previously used in electric clocks.

The thermostat in Fig. 1 comprises two formed strips of metal 39, superimposed on each other in the usual way so that when heated the same will bend. One end of the thermostat is supported in contact with the small metal plate 38, the other end having a contact 40 which is lifted from the fixed contact 41 immediately behind the same as viewed in Fig. 1. The terminal 41 is connected by a wire 42 to a battery or other source of current, the battery being grounded or otherwise connected to complete the circuit.

As the actuating arm 13 swings slowly to the right, as viewed in Fig. 1, actuating the clock mechanism, it pushes the plunger 16 to the right and when the spring pawl 35 releases the cam disc 28, the contacts 26 and 27 engage each other with a very positive action, accompanied by a tendency toward a wiping action to keep said contacts clean. The effectiveness of the contact may be determined by the spring 30 which is independent of the spring pawl 34. The latter is released very easily by a light pressure, and therefore the effectiveness of the contact is not dependent on this light spring but on the other spring 30. When the solenoid is energized and the plunger pushes the actuating arm to the left, as shown in Fig. 3, the abutment 33 pushes aside the pin 32 on the cam disc 28 and the latter is rotated until it is caught by the spring latch. The plunger moves the actuating lever with a very definite, positive action, which results in a quick separation of the contacts 26, 27, whereby arcing is minimized. In fact, the abutment 33 strikes the pin 32 a blow which separates the contact with a quick action and insures against arcing and pitting of said contacts and overheating, which might in some cases weld said contacts together.

In the embodiment of this invention illustrated in Figs. 4, 5 and 6 the electromagnetic device is here shown as a magnet 45 rather than a solenoid, and is adapted to cause rotary movement of the armature 46 about an axis which coincides with that of the main driving shaft 47 of the clock. The shaft 47 carries a ratchet wheel 48 adapted to cooperate with a spring-pressed pawl 49 mounted on the armature 46. A spring 50 has one end thereof fastened to the armature and the other end to the frame of the clock, so that it tends to bias or urge the armature to rotate clockwise, with reference to Fig. 4. When the magnet 45 is energized its pull causes the armature 46 to rotate in a counterclockwise direction (again with reference to Fig. 4) against the bias of the spring, the pawl 49 meanwhile idling on its cooperating ratchet wheel 48. When the armature has reached the limit of its movement in this direction and is substantially parallel with the magnet 46 the circuit is broken by means hereafter to be described, and the spring 50 tends to draw the armature back in a clockwise direction. The pawl 49 at once locks against its ratchet, and thereafter movement of this armature or actuating member drives the train of gears through the main shaft 47.

The clock is here shown as provided with a pair of switch contacts 51 and 52, the contact 51 being mounted on the movable support 53 which is in turn pivotally mounted about the screw 54, being spring-urged in a direction toward its cooperating contact by a coil spring not here shown. The support 53 has a projecting portion adapted to be contacted by a pin 55 carried by the armature or actuating member 46, and is provided with a shoulder 56 adapted to be engaged by a pawl 57 to form latch means maintaining positive separation of the contacts 51 and 52 until the latch is tripped.

The position illustrated in Fig. 4 shows the train of gears being driven through the actuating member by the spring 50, it being understood that the actuating member 46 is moving in a clockwise direction. This movement would continue for a desired interval of time, comprising several minutes, until the armature has rotated to a position approaching that illustrated in Fig. 6. The pin 55 would then contact the pawl or latch member 57, and further movement of this actuating member near the termination of its driving movement would serve to force the pawl upwardly and out of engagement with the shoulder 56. As soon as this engagement is completely broken, as illustrated in Fig. 6, the movable support 53 would throw the contacts 51 and 52 together with a quick positive movement, thus completing the circuit through the magnet 45. Current would then be supplied through a battery illustrated diagrammatically as 58 to energize the magnet and cause counterclockwise rotation of the actuating member or armature 46. During the latter part of this electrically effected movement the pin 55 on the armature would contact the projecting portion of the movable support 53, separate the contacts 51 and 52, and permit engagement of the shoulder 56 with the pawl 57, again locking the contacts in separated position as shown in Fig. 4. This, of course, breaks the circuit and enables the bias of the spring 50 to again cause driving movement of the armature.

In order to provide a safety feature in the event of an excess current flow, a thermostat 59 is provided, being here shown as a straight bimetal strip carrying one of a second pair of contacts 60 and 61 forming a second circuit-breaking means protecting the clock and the electromagnetic device if for any reason the current should flow in the circuit for longer than the brief period normally necessary to return the actuating member to its initial position.

Referring more particularly to Fig. 7, a switch releasing devise is shown which is quite similar in operation to the corresponding device shown in Figs. 4 and 6, but which is adapted more particularly as a substitute for the switch and the actuating device therefor, illustrated in Figs. 1 and 3. In other words, the switch of Fig. 7 is the preferred form of switch for the device of Figs. 1 and 3 and it includes a support 62 adapted to carry one of the contacts, and mounted for rotational movement about the screw 63. It is spring-urged in a counterclockwise direction by a spring 64 similar to that illustrated in Fig. 1. The member is provided with a shoulder 65 adapted to cooperate with a shoulder 66 on a pawl or latch member 67 pivotally mounted at 68. A coil spring 69 is shown about the pivot 68 urging the pawl in a direction toward the support 62, that is, clockwise with reference to this particular view. The support 62 is provided with a pin 70 adapted to cooperate with and be engaged by a stop member 71 carried by the actuating member 72, again similar to that illustrated in Fig. 1. The operation of this switch is similar to that described in connection with the other two switches, the interaction of the shoulders 65 and 66 serving to latch the support 62 in such position as to keep the contacts separated until the stop 71 has struck the end of the pawl or ratchet member 67 and disengaged the shoulders, whereupon the contacts close quickly and positively to return the actuating member 72 to the position illustrated in Fig. 7, this latter movement being accomplished by an electromagnetic device against the bias of a spring.

As previously stated, the clocks are intended particularly as automobile or aeroplane clocks. Automobile clocks, as now constructed, give considerable trouble as it requires a current of about three to five amperes to operate the same properly and the pressure of the circuit closing and opening contacts is not sufficient to take care of current of this amount. Also, as previously stated, the switches are of a mechanical construction which results in what is known as a buzzer effect and in many cases this rapid vibration of the contacts will keep up until the coil of the clock has burned out or the contacts are burned. The buzzing also occurs when the driver steps on the starter at a time when the battery is somewhat depleted, with the result that the energization of the electromagnet in the clock is insufficient to throw the armature all the way up or out, as the case may be. To overcome burning out of the clock some manufacturers have connected the lead-in wire to the coil with soft solder so that the same may melt before the coil burns out. Others have inserted a small fuse in the circuit.

With my construction any degree of contact pressure may be had by adjusting the spring, and regardless of the pull of the spring the operation of the clock is not affected as the release is by means of the positive engagement of a dog with a tooth or shoulder, which tooth cannot be jarred or vibrated into engagement ahead of time and which, on the other hand, may be released by very light pressure. Also, a sensitive thermostat is used in the circuit over the coil so that if the coil heats materially the circuit will be broken and will remain broken for about a minute, or such interval of time as is necessary for the clock to run down so that when the circuit is again closed the armature will be given a definite movement.

While I have described and claim certain embodiments of my invention it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims in which it is my intention to claim all novelty inherent in my invention as broadly as permissible, in view of the prior art.

I claim:

1. A device of the class described, including: a train of gears; an actuating member biased for movement in one direction to drive said gears; means for moving said member in the opposite direction against said bias; a pair of contacts; means tending to move said contacts together; a circuit including said contacts and said moving means and adapted to energize said moving means to effect movement of said member against said bias; and latch means for keeping said contacts separated during driving movement of said member, said means comprising a rotatable member having a radial shoulder thereon, a spring pawl to engage said shoulder and an abutment on said actuating member positioned to release said pawl by a slight pressure near the termination of such movement.

2. An electric clock of the class described, including: a base, a shaft thereon for rotating a train of gears; a bell crank lever pivoted at one end on said base, a spring connected to said lever to rock the same in one direction to drive said gears through a spring pawl; a solenoid and core for moving said lever in the opposite direction against said spring; a pair of contacts, having inclined engaging surfaces to cause a wiping action, one of said contacts being rotatably mounted; an additional spring tending to rotate said contact to engage the other contact; a circuit including said contacts and said solenoid to energize said solenoid and effect movement of said lever; and latch means for keeping said contacts separated during driving movement of said lever, said latch means comprising a disc turning with said contact and having a shoulder, a pawl to engage said shoulder, a pin on said disc, an abutment on said lever to engage said pawl and release said disc and said contact when moved in one direction and to engage said pin and rotate said disc to latching position when moved in the other direction.

3. An electric clock of the class described, including: a train of gears; an electro-magnet and a pivoted armature therefor to drive said gears; a spring for moving said armature in the opposite direction from the pull of said magnet; a pair of contacts; a movable support on which one of said contacts is mounted, said support having a radial shoulder thereon and being pivotally mounted to permit movement of the contact carried thereby towards or away from said other contact; a spring biasing said support in a direction to cause said contacts to engage each other; a circuit including said contacts and said magnet to energize the same and effect movement of said armature against said spring, said armature effecting movement of said support in a direction causing separation of said contacts; a spring urged pawl adapted to engage said shoulder to maintain said contacts separated, and an abutment on said armature to engage said pawl and readily release said movable support.

4. An electric clock of the class described, including: a train of gears; an actuating member; a spring biasing said member for movement in one direction to drive said gears; an electromagnetic device for moving said member in the op-

posite direction against said spring; a pair of contacts; a movable support on which one of said contacts is mounted, said support having a shoulder thereon and being pivotally mounted to permit movement of the contact carried thereby towards or away from said other contact; a second spring biasing said support in a direction to cause said contacts to engage each other; a circuit including said contacts and said electromagnetic device and adapted to energize said electromagnetic device to effect movement of said actuating member against said spring bias, said member effecting movement of said support in a direction causing separation of said contacts; a spring-urged pawl adapted to engage said shoulder to maintain said contacts separated, said pawl being so constructed and arranged as to be disengaged therefrom by said actuating member near the termination of driving movement thereof; a second pair of contacts in said circuit, said contacts being normally closed; and a thermostat mounted on said electromagnetic device and carrying one of said second contacts, said thermostat being adapted to effect separation of said second contact when said electromagnetic device becomes heated by a prolonged current flow therethrough.

5. A timing device including a driving mechanism having an actuating spring, electrically operable means including an operating coil for intermittently stressing said spring, a supply circuit connected to said coil, and heat responsive means for automatically opening and closing said coil circuit, said heat responsive means being mounted in close proximity to said coil, whereby its operation is influenced by the heat radiated from said coil.

6. A timing device including a spring actuated driving mechanism, electro-magnetic means energizable to stress said spring, a supply circuit, switch means including contacts normally operable to connect the electro-magnetic means relative to said circuit when the spring becomes substantially unstressed, and disconnect the electro-magnetic means relative to said circuit when the spring is substantially fully stressed, and heat responsive switch means disposed in close proximity to the electro-magnetic means including contacts in series with said first contacts for opening and closing said circuit in response to the heating of said electro-magnetic means, in the event that the energization of the electro-magnetic means is insufficient to cause said first contacts to open.

7. A clock comprising main driving means, an armature associated with said main driving means, an electro-magnet operative with said armature to intermittently re-energize the main driving means, switch mechanism actuated by the movement of said armature for controlling the operation of said electro-magnet in accordance with the state of energization and de-energization of the main driving means, thermostatically controlled switching means in series with said switch mechanism and responsive to the temperature condition of the electro-magnet for opening and closing the circuit of said electro-magnet at intervals sufficiently spaced to keep the electro-magnet from becoming over-heated and yet sufficiently close together to maintain the operation of a clock in the event of failure of the armature to operate said switch mechanism in the normal manner due to decreased power supply, said thermostatically controlled switching means being mounted in close proximity to the electro-magnet and having its operation influenced by the heat radiated therefrom.

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