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2,465,582

ELECTRIC CLOCK

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Fig. 1

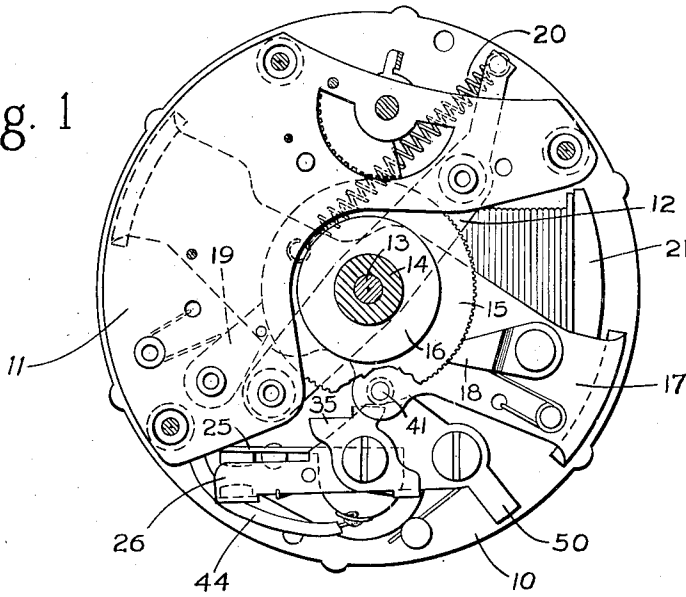


Fig. 2

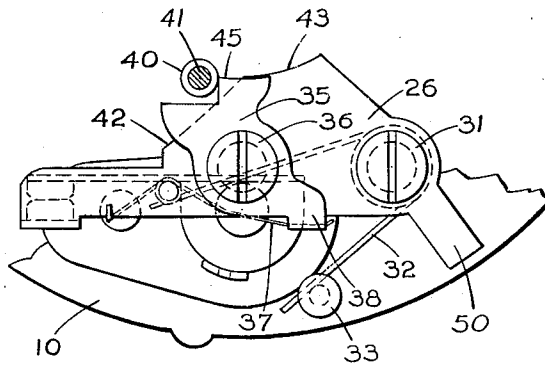
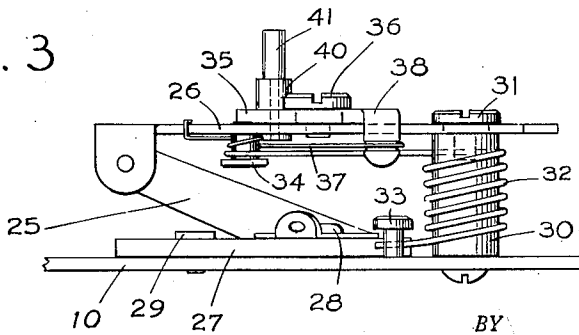


Fig. 3



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ELECTRIC CLOCK

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5 Claims. (Cl. 185—40)

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The present invention relates to spring driven clocks, such as are used in automobiles, for example; which are provided with automatic electromagnetically operated winding mechanisms, and the object of the invention is to provide a new and improved switch for controlling the winding mechanism in a clock of this character.

An automobile clock of the type with which the invention is concerned is shown in the patent to Hobbs, No. 2,146,119, granted February 7, 1939. The Hobbs clock has a switch which is closed with a snap action by means of a toggle device, said device including a spring tensioned by the main spring of the clock and supplying the power to close the switch. Since the toggle spring is tensioned just prior to rewinding, the power which is required to tension it is taken from the main spring at a time when the latter is nearly run down and has little tension remaining beyond what is required to drive the clock. In consequence of this somewhat inefficient mechanical arrangement, the toggle spring has to be made rather weak, resulting in low contact pressure at the switch, or the main spring has to be made stiffer than would otherwise be necessary, which requires a more powerful electromagnet.

In contrast to this known arrangement, my improved switch has no toggle device, although it closes with a snap action, and is not operated by power taken from the main spring. It is operated by a spring which is tensioned by the electromagnet during the winding operation and at a time when the magnet has surplus power beyond what is needed to tension the main spring. The new switch is superior from a mechanical standpoint, therefore, and makes it possible to secure increased contact pressure without increasing the size of any other parts.

The invention will be described more in detail hereinafter with reference to the accompanying drawing, in which—

Fig. 1 is a transverse section through a clock embodying the invention showing the switch in open position;

Fig. 2 is a plan view of the switch on a larger scale in which the switch is shown in closed position; and

Fig. 3 shows the switch in elevation, on the same scale as it is shown in Fig. 2.

Referring to the drawing, the frame of the clock comprises a back plate 10, a center plate 11, and a front plate (not shown) which are secured together in spaced relation by means of the usual pillars or posts. There is also a bridge member 12 which is attached to the center plate 11.

The reference character 13 indicates the center shaft or minutes shaft of the clock, which has bearings in the bridge member 12 and in the front plate. This shaft carries the minute hand

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of the clock and drives the hour hand in the usual manner.

The armature 17 and the gear wheel 15 are rotatably mounted on the center shaft 13 between the bridge member 12 and the center plate 11. The armature is rotated in a clockwise direction by the main spring 20, which is tensioned between the armature and an extension of the bridge member 12, and drives the gear wheel 15 by means of the pawl 18. A pawl 19 pivotally mounted on the lower side of the center plate 11 prevents retrograde movement of the gear wheel during winding or tensioning of the main spring. The winding operation is performed by an electromagnet 21 mounted on the back plate 10. The energization of the electromagnet rotates the armature 17 in a counter-clockwise direction, thereby tensioning the main spring 20. In Fig. 1 the clock is shown in approximately fully wound condition.

The hub 14 is also rotatably mounted on the center shaft 13 and carries a cup-shaped spring housing 16 the open end of which is closed by the gear 15. A spring located in the housing 16 connects the gear wheel 15 with the hub 14 and, with the pawl 19, constitutes the means for maintaining power during winding. The clock train, escapement, and balance are not shown but it will be understood that these parts are mounted between the center plate 11 and the front plate in the usual manner. The first wheel of the clock train is mounted on the hub 14. The center shaft 13 is driven by means of a frictional connection (not shown) with the hub 14.

The foregoing brief description deals with parts not directly concerned with the invention and will be sufficient for a general understanding of the construction and operation of the clock. For further details reference may be had to the Hobbs patent.

The circuit of the electromagnet 21 is controlled by a switch which will now be described more in detail.

The switch includes a relatively fixed contact member 25 and a movable contact member 26. The fixed contact member 25 is mounted on the insulator 27 by means of the rivet 28 and the insulator is secured to the back plate 10 by the rivet 29. The movable contact member 26 is pivoted on the post 30 by means of the shoulder screw 31. A spring 32 surrounding post 30 and tensioned between the stud 33 on back plate 10 and stud 34 on contact member 26, tends to rotate the contact member 26 in a clockwise direction as seen in Figs. 1 and 2 to close the switch.

The reference character 35 indicates a quick release member which is pivoted on the contact member 26 by means of the shoulder screw 36. The member 35 has an integrally formed stop 33. The spring 37 is supported on stud 34 and tends

to rotate the release member 35 in a counterclockwise direction as seen in Figs. 1 and 2, such rotation being limited by the engagement of stop 38 with the edge of the contact member 26.

The switch is operated and controlled by a roller 40 mounted on a stud 41 fixed to the armature 17. The roller cooperates with the cam surfaces 42 and 43 of the contact member 26 and with the release member 35 in a manner to be presently explained.

It will be understood that the switch is connected in series with the electromagnet 21. The ungrounded pole of the battery is connected to one end of the winding of the electromagnet by means of a suitable terminal on the back plate 16. The other end of the winding is connected to the insulated fixed contact member 25 by means of the conductor 44, Fig. 1. When the switch is closed the circuit is completed to the grounded pole of the battery by the contact member 26, the frame of the clock and the frame of the car.

The operation of the clock and more especially the operation of the winding mechanism and the switch, will now be explained.

For this purpose it may be assumed that the main spring 20 is substantially fully wound as shown in Fig. 1. The switch is open, the contact member 26 being held in the position in which it is shown by the engagement of roller 40 with the cam surface 43. Spring 32 is under considerable tension and tends to close the switch.

The main spring slowly rotates the armature 17 in a clockwise direction and the armature rotates the gear 15 by means of pawl 18. Gear 15 drives hub 14, and the hub 14 drives the clock train, the first wheel thereof being mounted on the hub. The hub also drives the center shaft 13 through its frictional connection thereto. The clock thus runs by power supplied by the main spring.

As the armature 17 is rotated by the main spring, the roller 40 rides on the cam surface 43, which in the open position of the switch is concentric with shaft 13, or the rotation axis of the armature. The contact member 26 accordingly remains stationary in open position. When the roller reaches the end of cam surface 43 it does not ride down on cam surface 42 but rides along the cam surface 45 on the release member 35, the cam surface 45 acting as an extension or prolongation of cam surface 43. Since the cam surface 45 is past dead center, the release member 35 has a tendency to rotate on its pivot 36 in a counterclockwise direction, which it cannot do, however, because of the engagement of the stop 38 with the edge of the contact member 26. The contact member is accordingly maintained in open position.

Before the power in the main spring becomes too far exhausted the roller 40 reaches the end of cam surface 45 and the switch is closed. The switch closes with a snap action due to the fact that as soon as the center of the roller 40 gets a little past the end of cam surface 45 the release member 35 suddenly starts to rotate on its pivot in a clockwise direction, thereby releasing the contact member 26 and allowing it to be moved quickly to closed position by the spring 32. The release member 35 rotates against the tension of spring 37 because of the force applied by spring 32, which develops an increasing component acting to rotate member 35 when the roller 45 reaches the position stated.

The closure of the switch completes the circuit

of the electromagnet 21, which thereupon energizes and quickly rotates the armature 17 substantially to the position in which it is shown in Fig. 1, thereby winding or retensioning the main spring 20. At the beginning of this rotation of the armature 17 the roller 40, which has slipped off the cam surface 45 on release member 35, simply rotates the release member in a clockwise direction and the closed position of contact member 26 is not disturbed. As the rotation of the armature continues, however, the roller 40 engages the cam surface 42 and rotates the contact member 26 to open the switch. At this time the release member 35 is restored by the light spring 37. The switch is opened at about the mid-point in the travel of the armature, at a time when the attraction between the electromagnet and the armature is substantially a maximum and the main spring 20 is only partly wound. There is ample power available therefore for the tensioning of spring 32 which results from the opening of the switch. The armature continues to rotate after the switch has been opened, due partly to the inertia of the armature and partly to the effect of the spark quenching condenser (not shown) until the rotation is stopped by the increasing tension in the main spring.

During the rotation of the armature 17 by the electromagnet 21 the gear 15 is prevented from rotating backward by pawl 19 and the clock train is driven by the power maintaining spring. As soon as the rotation ceases the pawl 18 takes a fresh hold on gear 15 and the drive from power supplied by the main spring is resumed, the power maintaining spring being retensioned at this time.

It will be noted that during the rotation of the armature by the main spring the roller 40 merely holds the switch open, by reason of its engagement with cam surfaces 43 and 45. The contact member 26 remains stationary and no power is taken from the main spring by the switch except the minute and negligible amount required to overcome the friction of the roller. Substantially all the power stored in the main spring is therefore available for driving the clock.

It may be pointed out that in the normal operation of the clock the roller 40 never quite reaches the position in which it is shown in Fig. 2. The switch is closed responsive to rotation of the release member 35, which will evidently take place when the roller is still some little distance to the right.

In case the closure of the switch does not result in the energization of the electromagnet, as may happen sometimes due to a dirty contact, the rotation of the armature in a clockwise direction continues after the switch has closed until the roller 40 reaches its Fig. 2 position, or a little beyond this position, when the armature engages the arm 50 of contact member 26. The main spring 20 now aids the spring 32 in pressing the contact member 26 against the fixed contact member 25 and since the latter is somewhat flexible, it yields a trifle and a slight rubbing action ensues which is generally effective to close the circuit. It will be understood that switch failure because of a dirty contact is very rare, but if it should occur the full power remaining in the main spring is available to force the contacts together as described and thus clear the trouble and avoid stoppage of the clock.

The invention having been described, that which is believed to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

I claim:

1. In a clock, a rotatable armature, an electromagnet for rotating said armature in one direction, a main spring tensioned by such rotation to drive the clock by rotating said armature in the opposite direction, a switch for controlling the circuit of said electromagnet, means including said armature for closing the switch during rotation of the armature by said main spring and for opening the switch during rotation of the armature by the electromagnet, a spring tensioned each time the switch is opened to store power for closing it, and means effective in case the closure of said switch fails to energize said electromagnet for supplying power from said main spring to increase the pressure on the switch contacts, said last means comprising a member forming part of said switch and located beyond the normal range of movement of said armature but arranged to be engaged by the armature in the event of extended movement thereof due to the failure of said electromagnet to energize.

2. In a clock, a main spring, an electromagnet, a rotatable armature rotated quickly in one direction by energization of said electromagnet to tension said main spring and rotated slowly in the opposite direction by said main spring to drive the clock, a switch controlling the circuit of said electromagnet, said switch including a pivoted member having a cam surface, a spring acting on said pivoted member and tending to close the switch, an operating member carried by said armature and engaging said cam surface during the quick rotation of the armature to rotate said pivoted member to open said switch, said operating member also engaging said cam surface during the slow rotation of said armature to hold the switch open, and means comprising a pivoted release member carried by said pivoted member providing a limited extension of said cam surface which is engaged by said operating member to delay the closing of said switch.

3. In a clock, a rotatable armature, an electromagnet for rotating said armature in one direction, a main spring tensioned by such rotation to drive the clock by rotating said armature in the opposite direction, a switch controlling the circuit of said electromagnet, said switch including a pivoted contact member, a spring continuously acting on said contact member to close the switch, an operating member carried by said armature and effective when the armature is rotated by said electromagnet to engage said contact member and rotate the same on its pivot against the tension of said spring to open the switch, and a member pivoted on said contact member and adapted to cooperate with said operating member during the rotation of said armature by said main spring to maintain the contact member ac-

tuated and to release it at a predetermined point in the rotation of the armature to close said switch.

4. In a clock, a main spring, an electromagnet, a rotatable armature rotated in one direction by energization of said electromagnet to tension said main spring and rotated in the opposite direction by said main spring to drive the clock, a switch controlling the circuit of said electromagnet, said switch including a pivoted member having a cam surface, a spring acting on said pivoted member and tending to close the switch, an operating member carried by said armature and engaging said cam surface when the armature is rotated by said electromagnet to rotate said pivoted member to open said switch, and a quick release device carried by said pivoted member providing an extension of said cam surface which is engaged by said operating member when the armature is driving the clock to hold the said switch open, said release device being movable relative to said pivoted member when said operating member reaches the end of said extension to effect closure of said switch with a snap action.

5. In a clock, a main spring, an electromagnet, a rotatable armature rotated in one direction by energization of said electromagnet to tension said main spring and rotated in the opposite direction by said main spring to drive the clock, a switch controlling the circuit of said electromagnet, said switch including a pivoted member having a cam surface, a spring acting on said pivoted member and tending to close the switch, a quick release device pivoted on said pivoted member and having a cam surface adapted to function as a prolongation of said first mentioned cam surface, and an operating member carried by said armature and cooperating with said first mentioned cam surface when the armature is rotated by said electromagnet to open the switch, said operating member cooperating with both cam surfaces during the rotation of the armature by the main spring to hold the switch open for a predetermined time and acting to rotate said release device at the end of said time to release said pivoted member and thereby close the switch.

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The following references are of record in the file of this patent:

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