

July 16, 1935.

C. H. H. RODANET

2,008,338

WATCH

Filed Oct. 17, 1932

3 Sheets-Sheet 1

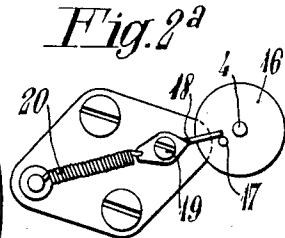
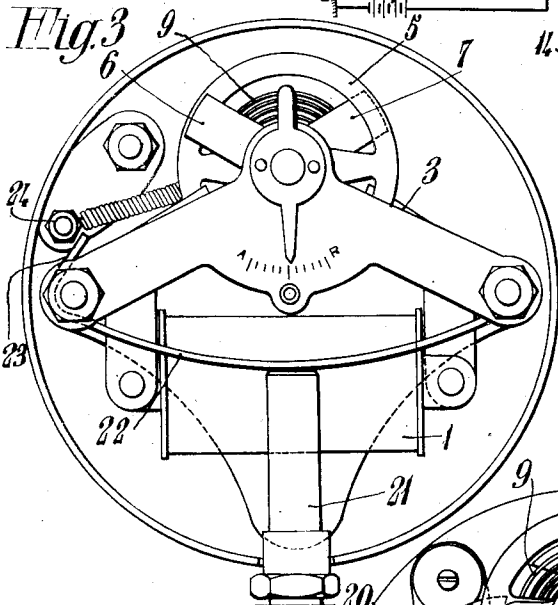
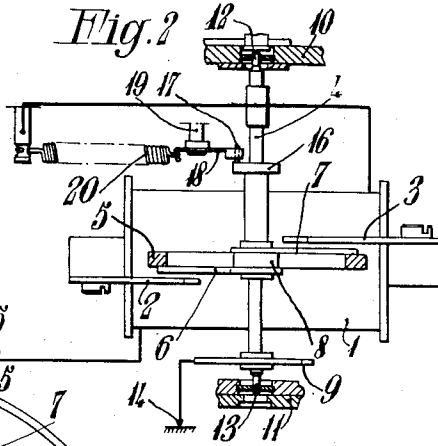
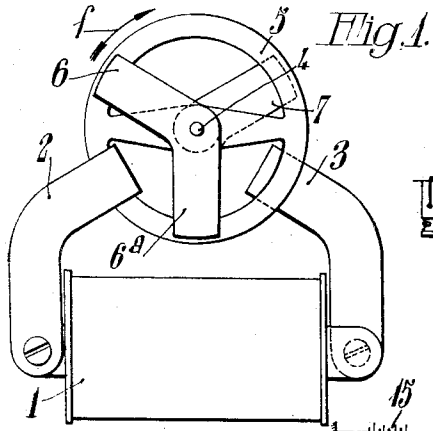
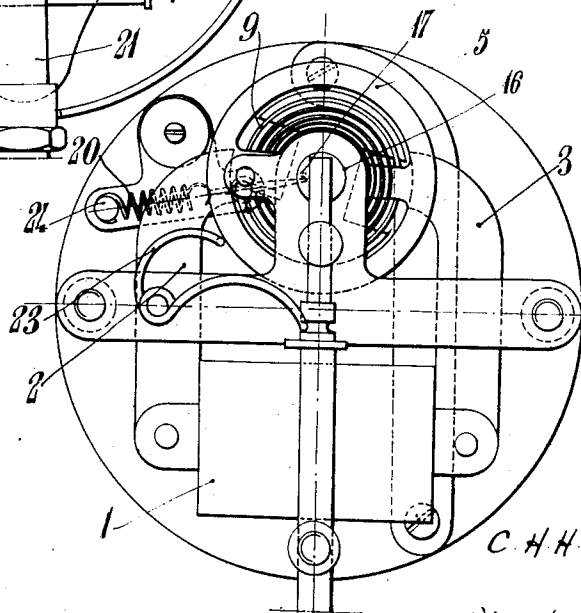


Fig. 8.



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3 Sheets—Sheet 2

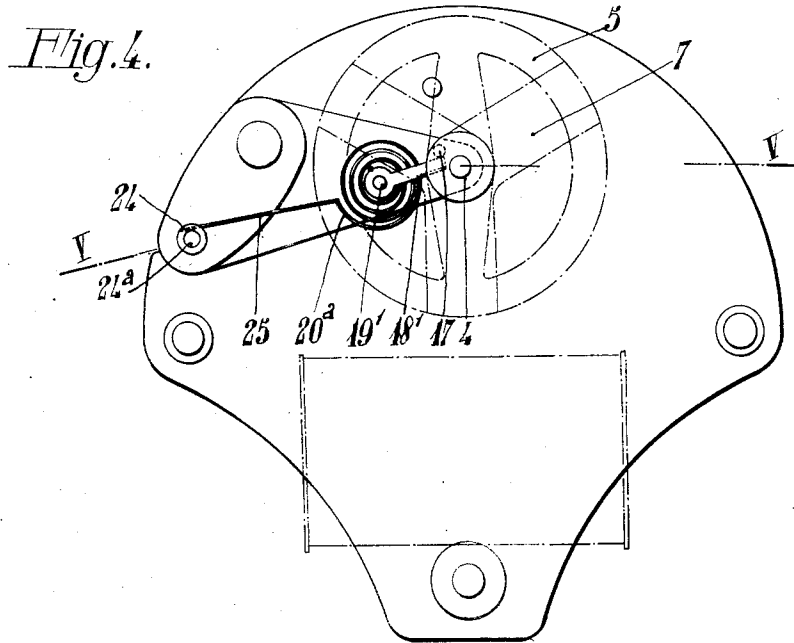


Fig. 5.

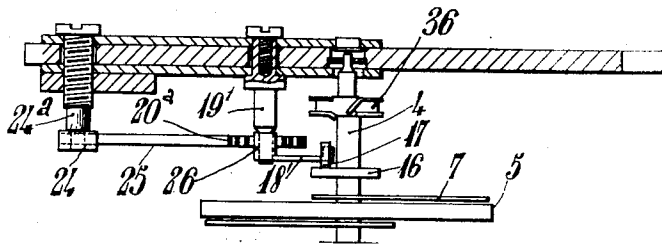


Fig. 6.

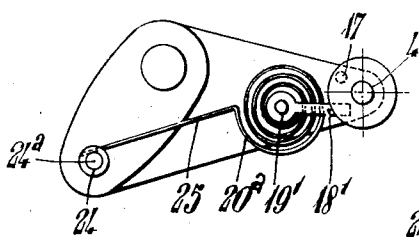
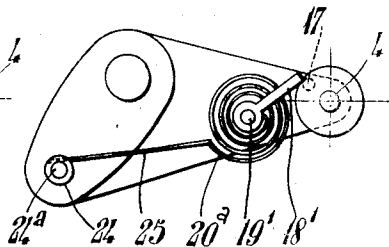


Fig. 7.



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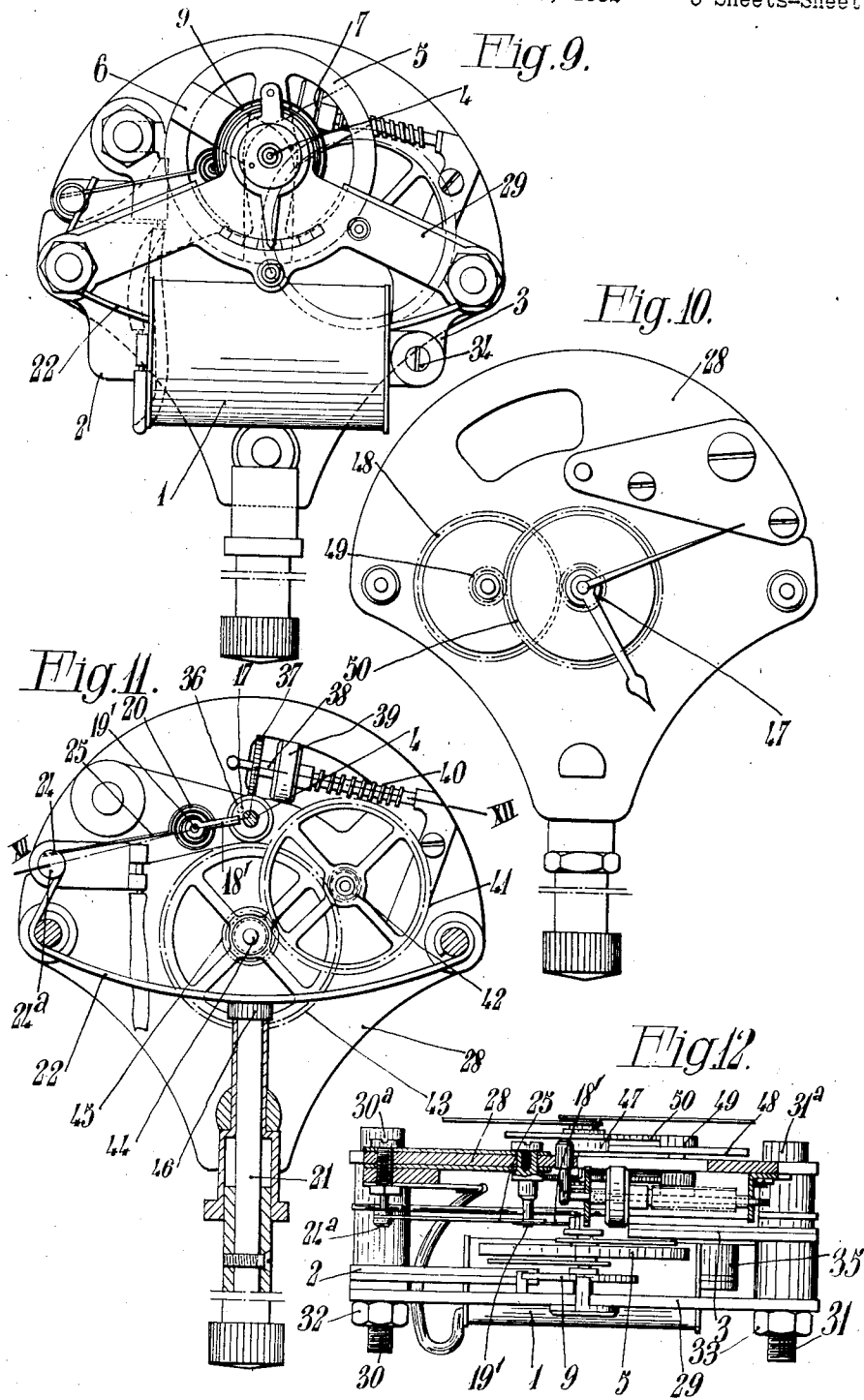
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3 Sheets—Sheet 3



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UNITED STATES PATENT OFFICE

2,008,338

WATCH

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In France October 28, 1931

2 Claims. (Cl. 58—28)

Chronometric oscillating electric motors already exist in which a soft iron member is mounted on the balance in such a manner that, in the position of equilibrium of the said balance, the reluctance of the magnetic circuit of an electro-
magnet imparting impulses is maximum. On the other hand, the electric circuit of this electro-
magnet is controlled by a contact which is itself under the control of the balance, in order that this circuit should be closed at each half-oscillation, when the balance passes through its position of equilibrium.

In these motors, the oscillating soft iron armature is usually constituted by a flat disc rotating between the diametrically opposed poles of an electromagnet, this disc being provided with notches which come opposite the pole pieces, in the position of equilibrium of the balance.

This arrangement is satisfactory concerning the magnetic circuit, but it has an inconvenience due to the remanent magnetism of the electromagnet. In fact, it will be seen that, since the disc is symmetrical relatively to two perpendicular axes, one passing through the middle portions of the notches and the other being at right angles to the first axis, this disc passes again through the same position after an oscillation equal to half a revolution. It is true that, at this moment, the contact is not closed, but the residual magnetism acts in a direction prejudicial to the efficiency of the motor.

In order to avoid this inconvenience, that is to say for eliminating the second axis of symmetry, it has been proposed to use a disc having a single notch movable opposite one pole of an electromagnet. But this remedy is worse than the inconvenience it was to overcome, as the magnetic circuit is then very unsatisfactory.

It has also been proposed to constitute the movable soft iron armature by two V-shaped members arranged one above the other and magnetically connected by an axial iron member. The opening of each V is placed, in the position of equilibrium of the balance, opposite each pole piece of the electromagnet, these pole pieces being exactly superposed.

This arrangement is quite similar to that of the second case under consideration, but there are two superposed armatures, having a single axis of symmetry, magnetically connected together, and on each of which acts one of the poles of the electromagnet, this improving the magnetic circuit.

This arrangement has, however, another inconvenience. In fact, it is necessary that the

pole pieces of the electromagnet should be sufficiently spaced apart in order that the air gap between these poles should be, in the position of equilibrium of the balance, more reluctant than the air gap between the poles and the armature. This necessity leads to a too great cumbersomeness in the direction parallel to the axis of oscillation of the balance.

The main object of the invention is to eliminate this inconvenience, and the invention is particularly characterized by the fact that the pole pieces are displaced relatively to each other, both laterally and angularly; each pole piece combines with an armature having a single axis of symmetry coinciding, in the position of equilibrium of the balance, with the axis of the pole piece corresponding thereto, the armatures being magnetically connected together.

By these means, the cumbersomeness of the entire structure is reduced to the minimum.

On the other hand, in some oscillating electric motors of the type indicated, the contact controlled by the balance is closed when the oscillating system is stopped. By these means, it is substantially possible to ensure starting the motor as soon as the circuit is closed by the usual switch. In fact, this starting is not absolutely positive and certain, particularly when the motor has remained at rest for a long time, because the contact has become unsatisfactory; moreover, if the motor accidentally remains stationary notwithstanding the circuit being closed, it may happen that the electric windings heat up and become damaged, with risk of short-circuit, which is particularly to be feared in the case of a watch placed on board a motor vehicle or airplane.

In other oscillating electromagnetic motors of the type indicated, the electric contact is open when the oscillating system is at rest. In these conditions, the closing of the usual switch does not allow to start the motor, the circuit of which remains open. It is then necessary to impart the first impulse by hand to the balance of pendulum, this being easy to effect with displaceable watch or clock, but is impossible with watches secured on the instrument boards of motor vehicles or airplanes for instance.

The present invention remedies the above mentioned inconveniences in watches adapted to be permanently secured in position, as for instance motor car watches. In the watch according to the invention, the contact is open in the position of rest of the motor, as is already known, but this watch is characterized by the fact that an operating rod, operable from the exterior,

allows, by the movement imparted to it by hand, to give to the oscillating system, a first starting mechanical or electromagnetic impulse.

The operating rod is preferably the same as the rod which is usually used for setting the watch right. In fact, it will be understood that when the watch is stopped and that it is desired to re-start it, it is also necessary to set it right. Therefore the user simply effects this operation which automatically causes starting, without the user being aware of it.

In known watches of the type indicated, the electric contact with which engages the contact carried by the oscillating system, is usually constituted by a resilient blade. This arrangement is not satisfactory, as it gives rise to vibrations prejudicial to correct operation. It has been found, according to the invention, that such vibrations are avoided if the resilient blade used up to now is replaced by a pivoted lever restored to normal position by a spring.

The spring used can be either a torsion spring (for instance a spiral spring) or a tension spring, but it is preferable to use a torsion spring.

In fact, the tension spring is stretched between a fixed pillar and the outer end of the contact lever. In these conditions, there is therefore, during the oscillation of this lever, a relative movement between the said lever and the spring, at the point of attachment, and also a relative movement between the spring and the pillar.

This slight relative movement gives rise to sparks, which indeed are very small but sufficient for darkening the contact points between the spring and the lever, and between the spring and the pillar, and thus for considerably increasing the resistance of the circuit.

By replacing the tension spring by a torsion spring (for instance a spiral spring) one end of which is attached to the oscillating lever and the other to the pillar, a much better contact is ensured between the spring and the other members: pillar and contact lever.

On the other hand, it is then very easy to adjust the initial position of the contact lever by causing the ring secured to the end of the torsion spring, to rotate in one direction or the other on the pillar.

The accompanying drawings illustrate, by way of example, a form of carrying the invention into practice.

Fig. 1 is an elevation showing the arrangement of the magnetic circuit according to the invention, after elimination of all other members for greater clearness of illustration.

Fig. 2 is a plan view relating to Fig. 1, in this figure, all the members constituting the mechanism associated with the oscillating motor have been eliminated.

Fig. 2a is a detail view of the system of contact. Fig. 3 is a view similar to Fig. 1, but completed in order to show the means used for starting the oscillating motor.

Fig. 4 is a detail elevation showing the device for restoring the contact lever in a modification considered as preferable.

Fig. 5 is a sectional view made according to line V—V of Fig. 4.

Fig. 6 is a partial view showing the contact lever in one of its extreme adjusting positions.

Fig. 7 is a partial view showing the contact lever in its other extreme adjusting position.

Fig. 8 is a view similar to Fig. 3, but illustrates a modification of the starting device.

Fig. 9 is a rear view of the preferred practical form of construction of the watch.

Fig. 10 is a front view thereof, the dial being removed.

Fig. 11 is a view similar to Fig. 9, but with certain parts removed.

Fig. 12 is a plan view and a section thereof made according to line XII—XII of Fig. 11.

The actuating electromagnet 1 has, according to the invention, two pole pieces 2 and 3 which are displaced relatively to each other both in a plane perpendicular to the pivot pin 4 of the balance 5, as more particularly shown in Fig. 1, and parallel to the said pivot pin 4, as more clearly illustrated in Fig. 2.

The movable armature of this electromagnet is constituted by two soft iron members 6 and 7, each having the shape of a V, the branches of which form an angle of 120°, these soft iron members being magnetically connected together by a member 8. Both armatures 6 and 7 are so arranged that one of their branches is in coincidence, as more clearly shown in Fig. 1. On the other hand, the angular distance separating the pole pieces 2 and 3 is also of 120°, so that, in the position of equilibrium of the balance 5, subjected to the action of the spiral spring 9, the axes of the pole pieces 2 and 3 coincide with the axes of symmetry of the armatures 6 and 7 respectively corresponding thereto.

The pivot pin 4 of the balance is completely insulated, by the means indicated above, from the plates 10 and 11, in order that the current should not pass through the pivots and counter-pivots 12 and 13. On the contrary, the spiral spring 9 is connected at 14 to the watch body, which is itself connected to one of the poles of the supply battery 15.

The pivot pin 4 of the balance carries a plate 16 on which is mounted a pin 17 which, when the balance oscillates, and every time the latter passes beyond its position of equilibrium, comes in engagement with a contact 18. This contact 18 is constituted (in the case of Figs. 1 to 3) by a small lever pivoted at 19 and restored in position by a spring 20, which is electrically connected to one of the terminals of the electromagnet 1, the other terminal of which is connected to the battery 15. In this way, it will be seen that the electromagnet 1 energizes every time the balance passes in proximity to the position of equilibrium.

It will be assumed for instance that the balance 5 is rotating, at the moment under consideration, in the direction of the arrow *f*. In proximity to the position of equilibrium, the contact 17—18 closes and the electromagnet 1 energizes. The magnetic circuit closes through the pole piece 2, air gap between this pole piece and the branch 6^a of the armature 6, member 8, branch 7 of the second armature, and pole piece 3. The balance receives therefore an impulse in the direction of the arrow *f*, in the manner well known in all these types of oscillating clockworks provided with a motor having a soft iron armature. It is unnecessary to describe further the mode of operation, which is well known, and it will simply be pointed out that by means of the arrangement described, the balance must effect a full revolution before coming again in a position similar to its initial position, because the armatures have but one axis of symmetry.

In the motor described, the initial starting of the motor is effected by means of the setting stem 21. The latter is normally urged downwardly

(Fig. 3) by a spring 22 having a projecting end 23. When this stem is acted upon, for setting the watch right, by means of a wheel it carries and which is not shown in Figs. 1 to 3, it is pushed upwardly; the spring 22 is thus tensioned and the projection 23 comes in contact with the pillar 24 to which the spring 20 is attached. The circuit of the electromagnet is thus closed by the spring 23 which is in body contact. This electromagnet energizes and it will impart an initial impulse to the armatures 6 and 7, provided the latter, in the position of rest, are not exactly placed in the position of symmetry. This result is obviously very easy to obtain. The first impulse imparted suffices in order that, upon return movement, the contact 17 should come in engagement with the contact 18, and the operation then proceeds without interruption.

In the modification which is shown in Figs. 4 to 7, the contact 18' is constituted by a small lever pivoted at 19' and restored in position by a spiral spring 20^a, the central end of which is secured on a socket 26 rigid with the lever 18'. The other end of the spiral spring 20^a is provided with an extension constituted by a straight part 25 secured on a ring 24 tightly fitted on the pillar 24^a electrically connected to one of the terminals of the electromagnet, as stated above.

By causing the ring 24 to slightly rotate in one direction or the other, the free position of the contact lever 18' can be easily adjusted, as shown in Figs. 6 and 7 which indicate the extreme positions of adjustment.

The main advantage of this arrangement resides in the fact that it avoids the production of small sparks which can occur at the points of attachment of the tension spring 20 of the examples of Figs. 1 to 3.

It is also to be noted that the projection 23, instead of coming in contact with the pillar 24 for electromagnetically starting the watch, might be so shaped (Fig. 8) as to mechanically actuate the balance 9 and to impart to the latter a first impulse which suffices for ensuring starting. In fact, the contact occurs during the oscillation between 17 and 18, and the normal operation subsequently takes place.

As previously indicated, Figs. 9 to 12 show the preferred practical form of carrying the invention into practice.

In this example, the entire mechanism of the watch is held between a plate 28 and a bridge 29 which is secured on the plate 28 by means of pillars 30 and 31 and nuts 32 and 33. These pillars serve at the same time to hold the electromagnet 1 by its pole pieces 2 and 3. The pole piece 3 is secured in position on the pole piece 2 and is attached by means of a screw or rivet 34 and of a brace member 35 made of magnetic metal, as more clearly shown in Figs. 9 and 12.

The pivot pin 4 of the balance carries an escapement-wheel 36, more clearly seen in Fig. 5 and which is illustrated in end view in Fig. 11.

This escapement-wheel 36 meshes with a wheel 37 cooperating with it and secured on the arbor 38. This arbor 38 is provided with a small fly-wheel 39 loosely mounted on the same, although with slight friction, so as to regularize its movement.

The arbor 38 carries a worm 40 which actuates the wheel 41; the latter carries a second set of teeth 42 meshing with the minute wheel 43 the arbor 44 of which is provided with teeth 45 for setting the watch right. The stem 21 for setting the watch right carries at its end a wheel 46 which serves in the known manner, to effect this latter operation when the stem 21 is pushed upwardly, so as to cause the wheel 46 to mesh with the wheel 45. It has been previously explained that this movement had also for effect to start the watch. The spindle or arbor 44 passes through the plate 28 and, through the medium of a wheel 47, actuates the wheel 48 which in its turn, by the intermediary of teeth 49, actuates the hour wheel 50. The dial is secured on the outer ends 30^a and 31^a of the pillars 30 and 31.

What I claim as my invention and desire to secure by Letters Patent is:

1. An oscillating electric motor comprising: an electromagnet provided with pole pieces and placed in an electric circuit for generating a magnetic field, a spindle, a movable armature placed in said field and constituted by two soft iron members secured on said spindle, and by an axial iron member connecting these two members, each of said two members having the shape of a V having non-homologous arms in one and the same radial plane, resilient means for restoring this armature towards the position of maximum reluctance of the magnetic circuit, a switch placed in the electric circuit of the electromagnet and controlled by the movement of the armature, said motor characterized by the combination of the following features: (a) the pole pieces of the electromagnet are separated by a certain distance, in a direction parallel to the spindle of the movable armature; (b) the said pole pieces also extend radially relatively to the said spindle of the movable armature and are angularly displaced relatively to each other to such an extent that the two nonhomologous arms of the V-shaped members are in one and the same radial plane and are so angularly arranged as to simultaneously cooperate with said non-homologous arms.

2. In an electric work comprising a stem for setting the watch right, a movable armature, a switch controlled by the movement of this armature and arranged to be opened when the armature is at rest, a second switch arranged in shunt of the first switch, and means causing the actuation of the stem for setting the watch right to close the said second switch.

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