May 31, 1932. A. F. POOLE 1,861,228

ELECTRIC REWINDER CLOCK

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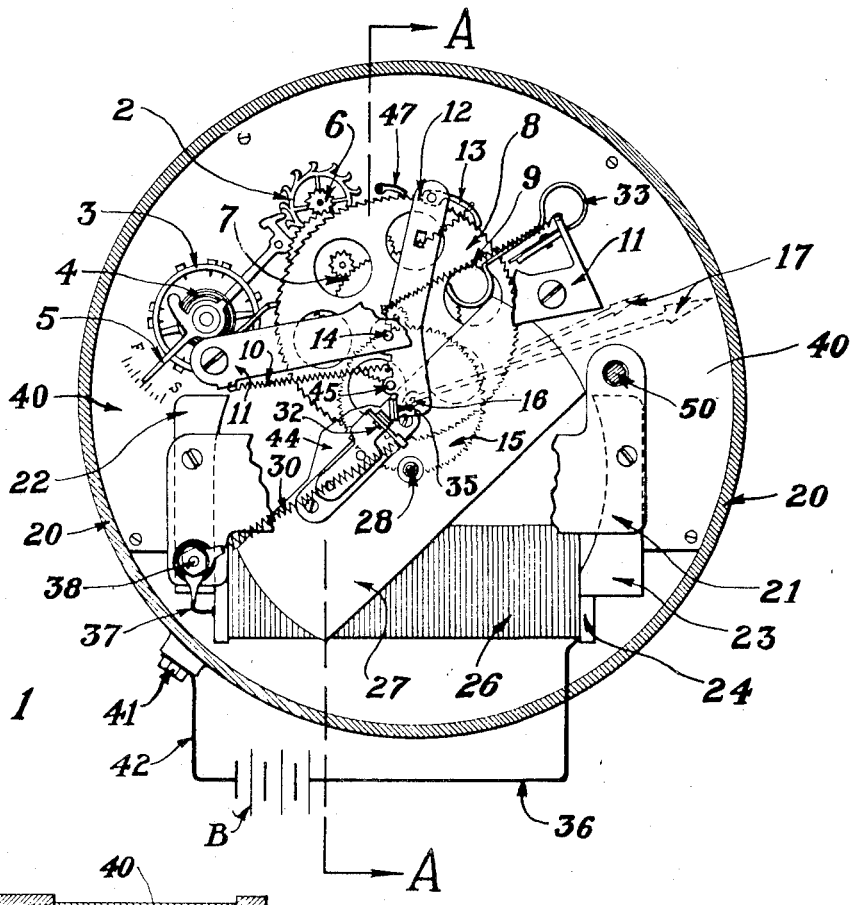

FIG. 1

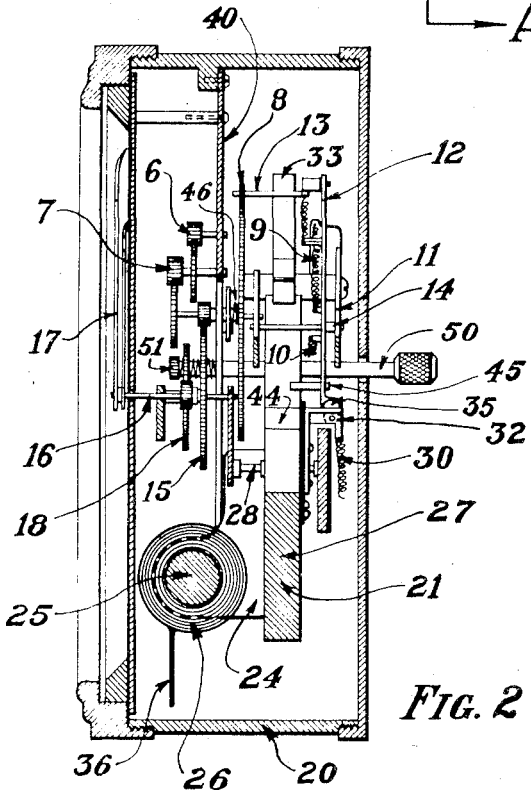

FIG. 2

ARTHUR F. POOLE INVENTOR.

BY Robert V. Morse

ATTORNEY.

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UNITED STATES PATENT OFFICE

ARTHUR F. POOLE, OF ITHACA, NEW YORK, ASSIGNOR TO POOLE MANUFACTURING CO., INC., OF ITHACA, NEW YORK, A CORPORATION OF NEW YORK

ELECTRIC RE-WINDER CLOCK

Application filed May 7, 1928. Serial No. 275,785.

This invention relates to electric clocks of the re-winder type, in which the driving spring is periodically wound by electric power and has for its objects the production of a compact, rugged, reliable and efficient mechanism particularly suitable for small clocks such as are used on automobiles for example, or in the household. Further objects are to reduce the current required, particularly to reduce the maximum current or the current that is drawn on short circuit in case of sticking of the contacts. Another object is to reduce friction and increase the life of the bearings, as well as to increase the reliability of the clock, and various other objects will become apparent as the description proceeds.

Referring now to the drawings, Fig. 1 is a rear elevation partly in section showing the clockwork and re-winding mechanism; Fig. 2 is a cross-section along the lines A—A of Fig. 1 looking in the direction of the arrows, and also includes the front and rear of the case and the setting mechanism.

In general these clocks consist of an escapement mechanism of standard construction such as used in the ordinary watch, but instead of being driven thru a train of gearing connected to a strong spring capable of running it for twelve or twenty-four hours between windings, a comparatively short spring is commonly used, usually only capable of running the clock for a few minutes at the most, and this is re-wound at relatively frequent intervals by some form of electro-magnetic motor which is momentarily energized when the clock runs down. These clocks are often subjected to severe service conditions, particularly from vibration; and the present invention is directed toward meeting these conditions and accomplishing the objects set forth.

In Fig. 1 the time determining mechanism, comprising an escapement 2 controlled by the balance wheel 3 and hair spring 4 having the regulating lever 5, is of the usual watch or clock construction, and any of the ordinary watch or clock escapement mechanisms may be used. This mechanism is driven thru a double gear reduction 6 and 7 from the ratchet wheel 8. This ratchet wheel 8 is rotated by a pair of tension springs 9 and 10, which have their fixed ends secured to the frame or bridge 11 and their other ends connected to a pivoted arm 12, which carries a spring pressed pawl 13 adapted to engage and drive the ratchet wheel 8. The arm 12 is pivotally mounted at 14 in the fixed frame or bridge 11, and the two driving springs 9 and 10 are connected to the arm 12 on opposite sides of the pivot 14, so that the torsional forces are balanced. This relieves the pivot 14 from the wear that would ensue with a single drive spring, reduces the bearing friction, and increases the life and efficiency of the mechanism. It will also be noted that the pivot 14 of the arm 12 is independent of and not necessarily exactly in line with the axis of the ratchet wheel 8,—a slight offset of the pivot 14 if it occurs doing no harm, and the independence from the ratchet wheel axis facilitating assembly of the mechanism as well as relieving the ratchet wheel pivot bearings from additional thrust and load. The springs 9 and 10 also add somewhat to the reliability of the mechanism, for in case of the failure of one of them the other may keep the clock going.

The ratchet wheel 8 is also connected thru the gearing 15 to the central shaft 16 to which the clock hands 17 are connected in the usual manner,—that is, with gearing 18 (see Fig. 2) which drives the hour hand in proper ratio to the minute hand. It will be noted however that the method of applying power to drive the hands and drive the escapement differs from the usual construction in which the spring power is applied originally to the central shaft or slow moving wheel. In the present invention the spring power is applied to the gear train between the central gear 15 and the escapement 2, where the motion is much more rapid and the forces required proportionately less.

Owing to the fact that the force required to rotate the ratchet wheel 8 is only a fraction of what would be required if it were mounted on the central shaft 16, it is possible to make the driving springs 9 and 10 much lighter than would otherwise be the case, and

the bearing friction is thus further reduced. Also, since the power required for each rewinding is proportionately less, the maximum current flow is greatly reduced, thus greatly reducing the danger of sticking at the contacts of the electro-magnetic motor, as will be described. This method of driving also permits an improved arrangement of the parts within the case 20, with more space for the electro-magnetic motor.

The electro-magnetic motor is designated in general by the reference numeral 21, and consists of an iron frame having pole pieces 22 and 23 connected thru forwardly offset portions 24 (see Fig. 2) with a magnetic bridge 25 on which is wound the energizing coil 26. Owing to the arrangement of parts described this coil 26 is of ample size and length to give sufficient power with a small current. An oscillating armature 27 is pivotally mounted at 28, and is normally held at an angle to the pole pieces 22 and 23 by the action of the tension spring 30 which is secured at one end to the magnet frame (but insulated therefrom) and secured at the other end to a contact element 32 which is mechanically secured to but insulated from the armature 27. The tension of the spring 30 tends to hold the armature 27 against the buffer spring 33 when the magnet is not energized.

An electric contact element 35 is attached to the lower end of the driving arm 12, and is normally out of contact with the element 32. But as the arm 12 slowly rotates driving the ratchet wheel 8, the contact 35 gradually approaches the contact element 32, and finally makes contact with it as shown in Fig. 1. This completes a circuit which energizes the electro-magnetic motor 21,—the circuit being as follows:—from the battery or source of electro-motive force B thru the conductor 36 to the coil 26 and thence thru the conductor 37 to the insulated binding post 38, and thru the spring 30 to the contact 32, contact 35, arm 12, and thru the connected springs and bearings to the main frame of the clock 40, case 20, terminal 41, and conductor 42 back to the battery or source of electro-motive force B.

When the electro-magnetic motor 21 is thus energized, the armature 27 is sharply attracted into line with the pole pieces 22 and 23, and the resulting movement of the contact 32 delivers a quick impulse to the contact 35 and arm 12. The arm 12 is thus swung quickly in a counter-clockwise direction with the pawl 13 riding over the teeth of the ratchet wheel 8, and finally catching the ratchet wheel 8 at a new driving position, with the driving springs 9 and 10 re-wound or stretched to a renewed driving tension. The swing of the armature 27 brings a cam 44, which is part of the armature 27, against a pin 45 on the arm 12; and as the pin 45 is nearer the pivot 14 than the contact 35 is, and the cam 44 also has a greater radius of action than the contact 32 around the center 28, the resulting action after the cam 44 strikes the pin 45 is to quickly separate the contacts 32 and 35 and break the circuit. The motor 21 is then de-energized, and the armature 27 returns to its original position against the buffer 33.

The fact that the contact 32 and spring 30 are insulated from the iron of the armature 27 makes it unnecessary to insulate the pin 45 or cam 44, as the circuit can only be completed thru the contacts 32—35. It may also be mentioned that even without the cam 44 the overthrow and return of the armature 27 and the fact that the contact 35 is held in the extreme position of throw by the action of the pawl 13, would cause the mechanism to break its own circuit, though not so quickly as by the use of the cam 44.

The preferred action at the contacts involves a wiping action at the contact points 32 and 35, and also a making of the circuit on one side of the contact points and breaking it on the other side. Since the burning occurs chiefly on the side where the circuit is broken, this insures a clean contact on the side where the circuit is made, which is most important in operation. The wiping action is obtained by locating the meeting point of the contacts 32 and 35 at one side of the line of centers connecting the pivots 28 and 14; and the transfer of the area of contact from one side to the other of the buttons is obtained by making the initial angle between the surfaces of the contact points 32—35 less than the angle of swing of the armature 27 before the cam 44 comes into action.

The action of the clock will be evident from the foregoing, and it will be noted that the clean make and break of the contacts, coupled with the light current flow produced by the long coil structure and light driving springs permitted by the special method of driving, all tend to produce a reliable and effective operation even under severe service conditions.

While the winding action described is practically instantaneous, it is desirable not to interrupt the force on the gear train driving the escapement, and so a maintaining spring 46 is usually provided connecting the ratchet wheel 8 with the shaft that drives the gear trains, and a locking or retaining pawl 47 prevents the ratchet wheel 8 slipping back.

The clock may be set by means of a shaft 50 extending thru the back of the case, as shown in Fig. 2, and having on its forward end a pinion 51 adapted to be drawn into mesh with a gear controlling the clock hands, as is customary in various clocks.

While I have in the foregoing shown and described the invention in a specific embodi-

ment, it will be understood that this is merely by way of illustration, and that it is susceptible to various modifications and adaptations in different installations as will be apparent to those skilled in the art without departing from the scope of the invention as set forth in the following claims.

1. In an electric clock, the combination of a substantially cylindrical case, an exciting coil extending transversely within the case in a direction substantially that of a chord to the circular wall of the case, a field structure having pole pieces connected to the coil, the pole pieces being displaced in an axial direction in the cylinder relative to the coil, a vibratory armature mounted between the pole pieces, said armature being long in relation to the field coil and to the diameter of the case, pivoted inwardly toward the center of the case from the field coil and having its outer end overlapping the field coil and adapted to swing in the sector of the field coil so as to fall within the minimum cylindrical case required by the field coil, contact means for actuating said armature and spring means for retracting it, a re-winder mechanism driven by said armature, and a spring driven clock mechanism operated by said re-winder mechanism.

2. In an electric clock, the combination of a substantially cylindrical case, an exciting coil extending transversely within the case in a direction substantially that of a chord to the circular wall of the case, a field structure having pole pieces connected to the coil, the pole pieces being displaced in an axial direction in the cylinder relative to the coil, a vibratory armature mounted between the pole pieces, said armature being long in relation to the field coil and to the diameter of the case, pivoted inwardly toward the center of the case from the field coil and having its outer end overlapping the field coil and adapted to swing in the sector of the field coil so as to fall within the minimum cylindrical case required by the field coil, contact means for actuating said armature and spring means for retracting it, a re-winder mechanism driven by said armature, the re-winder mechanism being offset from the center of the case substantially on the opposite side from the field structure and exciting coil, and a spring driven clock mechanism operated by said re-winder mechanism.

3. In an electric clock, the combination of a substantially cylindrical case, a supporting frame extending transversely to the axis of the case and intermediate the front and back of the case, an exciting coil substantially on one side of the supporting frame and lying substantially in a plane perpendicular to the axis of the cylindrical case, pole pieces located substantially on the other side of the supporting frame, and ears extending substantially parallel to the axis of the cylindrical case and connecting the exciting coil to the pole pieces, a vibratory armature mounted between the pole pieces in a plane substantially perpendicular to the axis of the cylindrical case and overlaying the plane of the field coil so as to fall within the minimum cylindrical case required by the field coil, a re-winder mechanism operated by said armature, the re-winder mechanism being displaced substantially to the other side of the axis of the cylinder from that on which the pole pieces and coil are located, and a spring driven clock mechanism operated by the re-winder mechanism.

4. In an electric clock, the combination of a clock mechanism including an escapement mechanism, a clock hand shaft, and a gear train between the escapement and the clock hand shaft, a ratchet wheel whose axis is displaced laterally from the clock hand shaft and connected into the gear train at a point between the clock hand shaft and the escapement, a pivoted arm, said arm and ratchet wheel having separate, offset, pivoted supports, a pawl mounted on said arm and adapted to engage the ratchet wheel, a driving spring connected to said arm, an electro-magnetic motor having an armature and a field structure having an exciting coil, the field structure extending transversely of the clock and having ears projecting to one side of the field structure to support the exciting coil.

5. In an electric clock, the combination of a clock hand shaft, a ratchet wheel, gearing connecting the clock hand shaft and ratchet wheel, an escapement mechanism, gearing connecting the ratchet wheel and the escapement mechanism, a pivoted arm, said arm and ratchet wheel having separate, offset, pivoted supports, a pawl connecting the arm to the ratchet wheel, a driving spring connected to said arm, and an electro-magnetic motor mechanism adapted to actuate said arm and energize said spring.

6. In an electric clock, the combination of a clock mechanism including an escapement mechanism, a clock hand shaft, and a gear train between the escapement and the clock hand shaft, a ratchet wheel whose axis is displaced laterally from the clock hand shaft and connected into the gear train at a point between the clock hand shaft and the escapement, a pivoted arm, said arm and ratchet wheel having separate, offset, pivoted supports, a pawl mounted on said pivoted arm and adapted to engage the ratchet wheel, a driving spring connected to said arm, and an electric motor for actuating said arm to re-energize the driving spring.

7. In an electric clock, the combination of a substantially cylindrical case, an exciting coil extending transversely within the case in a direction substantially that of a chord to the circular wall of the case, a field structure having pole pieces connected

to the coil, the pole pieces being displaced in an axial direction in the cylinder relative to the coil, a vibratory armature mounted between the pole pieces and overlaying the plane of the field coil so as to fall within the minimum cylindrical case required by the field coil, a spring for retracting the armature out of alignment with the pole pieces when not energized, a pivoted arm, a contact member carried by the armature, a second contact member carried by the pivoted arm, driving springs connected to the pivoted arm on opposite sides of its pivot, a pawl carried by said pivoted arm, a ratchet wheel adapted to be operated by said pawl, means separately mounting said ratchet wheel and said pivoted arm on offset pivots, a retaining pawl, a maintaining spring connected to said ratchet wheel, a clock hand shaft, an escapement mechanism, and a driving shaft geared to the clock hand shaft and arranged to run faster than the clock hand shaft, said driving shaft being driven by said maintaining spring.

In witness whereof I have hereunto set my hand this fifth day of May, 1928.

ARTHUR F. POOLE.