Jan. 25, 1927. 1,615,664

H. E. WARREN

CLOCK MOVEMENT

Filed Aug. 18, 1926 2 Sheets-Sheet 1

Fig. 1.

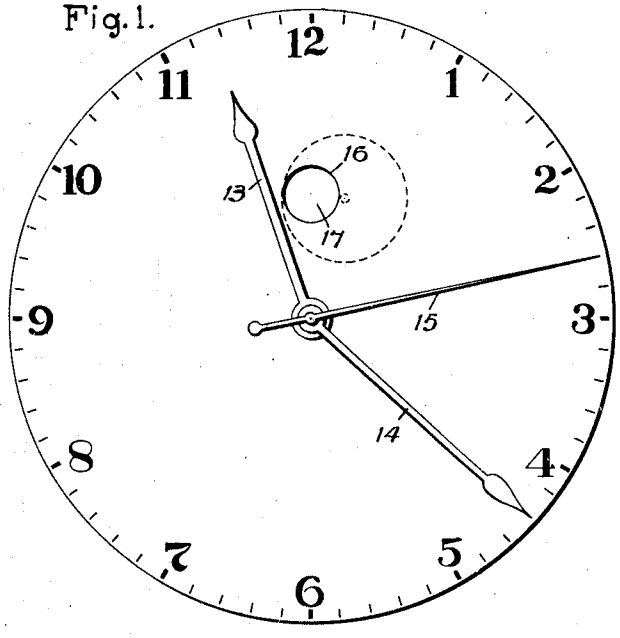


Fig. 2.

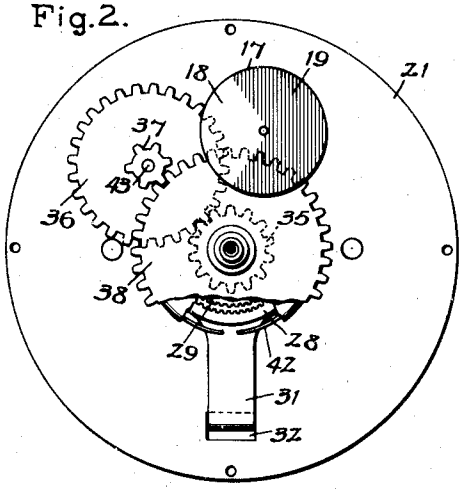
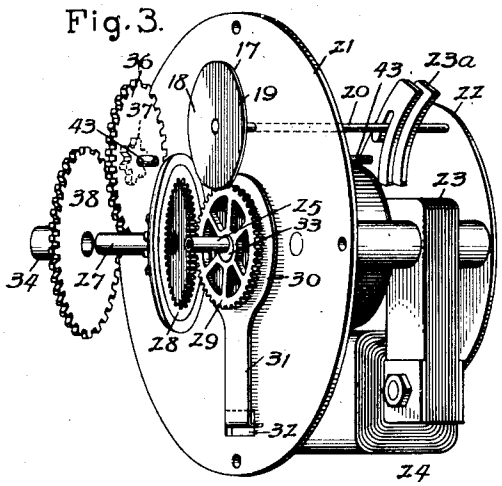


Fig. 3.



Inventor:
Henry E. Warren,
by Alexander F. Lowe
His Attorney.

Jan. 25, 1927. 1,615,664

H. E. WARREN

CLOCK MOVEMENT

Filed Aug. 18, 1926 2 Sheets-Sheet 2

Fig. 4.

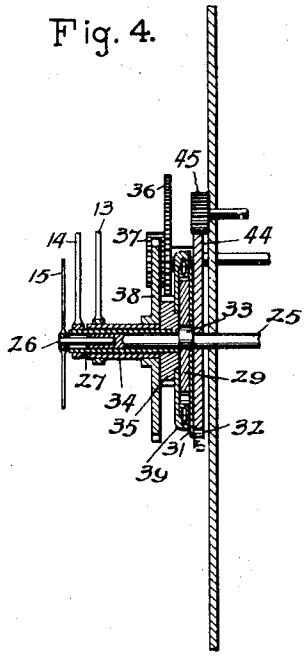


Fig. 5.

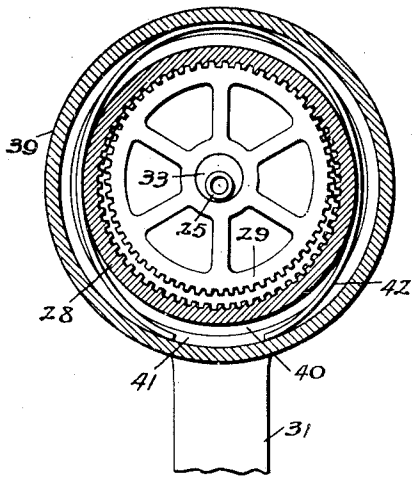
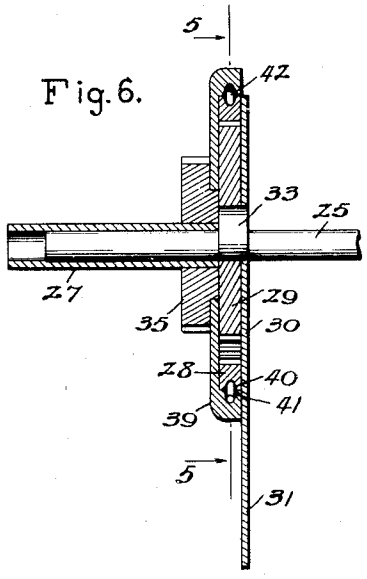


Fig. 7.

Fig. 6.



Inventor:
Henry E. Warren
by Alexander S. Lewis
His Attorney.

Patented Jan. 25, 1927. 1,615,664

UNITED STATES PATENT OFFICE.

HENRY E. WARREN, OF ASHLAND, MASSACHUSETTS, ASSIGNOR TO WARREN TELECHRON COMPANY, OF ASHLAND, MASSACHUSETTS, A CORPORATION OF MAINE.

CLOCK MOVEMENT.

Application filed August 10, 1926. Serial No. 129,062.

My invention relates to clock movements, and in particular to a simple, compact driving connection between the clock motor and the hands thereof whereby second, minute and hour hands may be mounted on the same axis and cooperate with the same dial, and whereby the slower moving hands may be readily adjusted with respect to the driving motor for the purpose of setting the clock. Another feature of my invention is an improved signaling device to be employed when the clock is driven by an electric motor to indicate when the power has been off and the clock needs resetting.

The features of my invention which are believed to be novel and patentable will be pointed out in the claims appended hereto. For a better understanding of the invention, reference is made in the following description of one form of my invention represented in the accompanying drawings, in which Fig. 1 represents the face of the clock showing the three clock hands mounted on the same axis and the signaling device; Fig. 2 shows the arrangement of the driving mechanism directly behind the clock face, the latter being removed; Fig. 3 is a partially exploded perspective view of the driving mechanism, including the driving motor; Fig. 4 is a sectional view taken on the central axis and shows an additional automatic clock setting feature to be explained; Figs. 5 and 6 are sectional views taken at right angles to each other, showing the gear reduction and the friction device employed to enable the clock hands to be set by hand; and Fig. 7 shows a spring rod before it is bent into a circular shape and inserted between the relatively adjustable parts of the friction device.

The general appearance of the clock face in the embodiment of the invention hereinafter explained is shown in Fig. 1; 13, 14 and 15 represent hour, minute and second hands, respectively, all mounted on the same axis and cooperating with the same dial. An opening 16 is provided in the clock face and back of this opening is a circular indicator 17 represented in dotted lines. As shown in Figs. 2 and 3, this indicator has a sector 18 painted white, and has another sector 19 painted red, or other appropriate colors. It is secured to a shaft 20 which is rotatably mounted in the clock plates 21 and 22, and extends rearward above the laminated field core 23 of the self-starting synchronous driving motor 24. Adjacent the magnetic core 23, an iron armature 23^a is secured to the shaft 20. This armature is overbalanced with respect to the axis of rotation of the shaft, and in the position shown in Fig. 3 the heavier portion is just off the vertical axis above the shaft, while the lighter portion is out of contact with but closely adjacent the magnetic core 23 of the motor, where it is held by magnetic attraction due to the field flux of the motor when the latter is energized. This is the normal position of the indicating device which brings the white portion of the indicator 17, which is preferably the same color as the clock face, over the opening 16. When the voltage of the distribution system to which the motor is connected fails, the armature is no longer held in this position by magnetic attraction, and due to its overbalanced position rotates the shaft 20 through approximately 180 degrees, bringing the red portion of the indicator signal 17 over the opening 16, thereby indicating to the next observer of the clock that the power is off or has been off and that the clock should be reset. If the power has come on again, the motor will start up, but will not rotate the armature 23^a into its original position because the armature is now held in the new position by magnetic attraction as well as by the force of gravity. After the clock hands are reset, the shaft is turned by hand to bring it back to its normal position. By positioning the armature 23^a slightly out of contact with the core 23, when in its attracted position, the alternating flux of the motor does not produce the chattering noise which would be occasioned if the armature made direct contact with the core. The shaft 20 extends to the rear of the clock so that this indicator may be readily reset without opening the clock case, not shown.

In describing the driving connection between the motor and clock hands, it will be assumed that the terminal shaft 25 extending forward from the motor drive is geared down to normally rotate in a clockwise direction at one R. P. M. The forward end of this shaft is hollow, and a short shaft 26 to which the second hand 15 is secured is

frictionally held in the hollow part of shaft 25, so that the second hand is driven directly at the correct speed.

The minute hand 14 is secured to and driven by a hollow shaft 27 surrounding the shaft 25. The 60 to 1 gear reduction necessary between the main drive shaft 25 and the minute hand shaft 27 is made by means of an epicyclic gear reduction comprising a gear 28 with inwardly extending teeth secured to the shaft 27 by means of a frictional connection to be explained later, and a cooperating gear 29. This last mentioned gear is secured to a plate 30 which is normally held against rotation by reason of the arm 31 which has its outer end bent rearward through an opening 32 in one of the stationary clock plates in Figs. 2 and 3. The plate 30, together with gear 29, is mounted on an eccentric 33 secured to the main drive shaft 25. It is thus seen that as the shaft 25 rotates the gear 29 and the plate 30 to which it is secured will be given a rotary eccentric motion while being held from actual rotation. The opening at 32 is large enough to permit this movement of the plate 30 without binding. The external diameter of gear 29 is sufficiently less than that of the internal diameter of gear 28 so that they mesh only on one side as best shown in Fig. 5, which is a full face view taken on line 5—5 of Fig. 6. Gear 29 has 59 teeth and gear 28 has 60 teeth. Now, as the shaft 25 rotates in a clockwise direction at one R. P. M., it will cause gear 29 to oscillate in a clockwise direction at one R. P. M. The point of contact between gears 29 and 28 will thus move around one R. P. M. in a clockwise direction, and because of the difference in the number of teeth, gear 28 will be rotated on its axis 1/60 R. P. M. in a clockwise direction. This can be understood from a consideration of Fig. 5, where it is seen that the two gears are in mesh at the top. The teeth are directly opposite each other at the bottom, and at the right the teeth in gear 29 are advanced ¼ tooth pitch with respect to those in gear 28. Now, when the eccentric 33 moves ¼ revolution, the teeth at the righthand side will move into exact mesh, which will necessitate gear 28 rotating ¼ revolution in a clockwise direction. In this way, the gear 28 is moved around and is advanced the distance of one tooth for each revolution of shaft 25, thereby providing the 60 to 1 gear reduction between shaft 25 and the minute hand shaft 27, all on the same axis.

The hour hand is secured to a hollow shaft 34 having a bearing on shaft 27, and an ordinary back gear having a reduction gear ratio of 12 to 1 is provided between shafts 27 and 33. This back gear comprises a wheel 35 secured to shaft 27 which meshes with a gear 36. Gear 36 is integral with a gear 37 which meshes with a gear 38 secured on shaft 34. Thus we have the three concentrically arranged shafts 25, 27 and 34 secured in the driving relation necessary to move the various clock hands at the proper speeds when the speed of the main drive shaft 25 is correct.

As best shown in Fig. 6, the gear 35 is pressed on shaft 27 and is provided with a shoulder on its back side onto which the holder 39 for the gear 28 is pressed. The holder has an overhanging portion at its periphery into which the gear 28 is fitted so that the two may be rotated with respect to each other. Peripheral grooves 40 and 41 are cut in the adjacent abutting surfaces of gear 28 and the holder 39. Before the gear 28 is slipped into place in the holder 39, a piece of piano wire 42, or other rod of spring steel or other suitable material, such as is represented in Fig. 7, is sprung into a circular shape and placed in one of the grooves. Then when the gear 28 is fitted into its place in the holder, this piece of spring tends to straighten out. As a result, it takes the general shape shown in Fig. 5 with its ends and middle pressed against the bottom of the outer groove 41 in the holder 39 and with portions intermediate the ends and the middle pressed against the bottom of the groove 40 in the gear 28. This serves the purpose of locking these parts together and provides a friction coupling between them which will not slip under ordinary conditions, but which will slip when the hands are adjusted for the purpose of setting the clock.

Where the clock is to be set by hand, the back gears 36 and 37 will be secured to a shaft 43, Figs. 2 and 3, which extends through the clock plates to the back of the clock so that these gears and the clock hands secured thereto may be set without opening the clock case, not shown. This provides for setting the hour and minute hands, but not the second hand. If it ever becomes desirable to set the second hand, it can easily be done because the shaft 26 on which it is mounted is frictionally inserted in the hollow end of shaft 25.

In certain clock systems the secondary clocks are reset from a central point and in such a system the clock may be modified to the extent shown in Fig. 4. Here the arm 31 instead of being secured in a stationary clock plate is secured into a normally stationary gear wheel 44 which is connected by gear 45 to a second electric motor, not shown. When it is desired to set the clock from a remote point, this second motor is energized and the gear 29 is rotated due to the driving connection between it and the gear 45 comprising gear 44, arm 31, and plate 30 to which gear 29 is secured. In this case the 60 to 1 gear reduction is not involved be-

cause gears 29 and 28 will rotate together and the clock hands will be set quickly, after which the clock setting motor is deenergized. This in no way interferes with the normal operation of the apparatus, as previously explained. Where the secondary clocks are set from a remote point, the indicator 17 and the manual clock setting features will not be necessary, but either may be provided as desired.

In accordance with the provisions of the patent statutes, I have described the principles of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown and described is only illustrative and that the invention may be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. In a clock, a drive shaft arranged to normally rotate at one R. P. M., a hollow minute hand shaft concentric with said first-mentioned shaft, a sixty to one gear reduction between said shafts comprising a gear wheel concentrically mounted on said hour hand shaft, said wheel having sixty inwardly projecting teeth, a gear wheel having fifty-nine teeth in point contact with said first-mentioned gear, an eccentric on said drive shaft upon which said fifty-nine tooth gear is mounted, and means for normally holding said eccentrically mounted gear from rotation, but allowing it to be bodily moved by said eccentric.

2. In a clock, a pair of shafts having the same axis of rotation, a gear reduction between said shafts comprising a pair of gear wheels having different numbers of teeth and meshing at one point of contact, one of said wheels being mounted concentrically on the driven shaft, an eccentric on the driving shaft upon which the other gear is mounted, means for normally holding said eccentrically mounted gear from rotation during normal operation of the clock, the arrangement causing the point of contact between said gears to rotate with the eccentric and clock-setting means for rotating the eccentrically mounted gear.

3. In a clock, a friction device in the clock driving mechanism to permit the setting of the clock comprising a pair of concentrically mounted parts in contact with each other, said parts being provided with aligned peripheral grooves in their adjacent abutting surfaces, and a rod of spring steel or other suitable material constrained in a circular shape in said aligned grooves which, due to its tendency to straighten out, takes a position partially in one groove and partially in the other groove, thereby forming a frictional driving connection between them.

4. In a clock, a clock face, an electric motor behind said face for operating the clock, an opening in said face, a rotatably mounted shaft extending from a point adjacent said opening to a point adjacent the magnetic structure of said motor, an indicator on said shaft back of the opening in said face, and an overbalanced armature member of magnetic material on said shaft adjacent said motor structure, said armature member being capable of adjustment so as to be held in the overbalanced position by magnetic attraction when the motor is energized and to move by gravity, rotating said shaft and indicator when the motor is deenergized, said indicator being arranged to give different indications through the opening in the face of the clock when in the two different positions mentioned.

5. In a clock, an electric motor for operating said clock, means for indicating when the electrical energy supplied to said motor fails, comprising a signal and an overbalanced armature member for operating said signal, said armature being positioned adjacent to, but out of contact with, the magnetic structure of said motor so as to be held in the overbalanced position by magnetic attraction when the motor is energized, and to move by gravity to operate the signal when the motor is deenergized.

In witness whereof, I have hereunto set my hand this 11th day of August, 1926.

HENRY E. WARREN.