

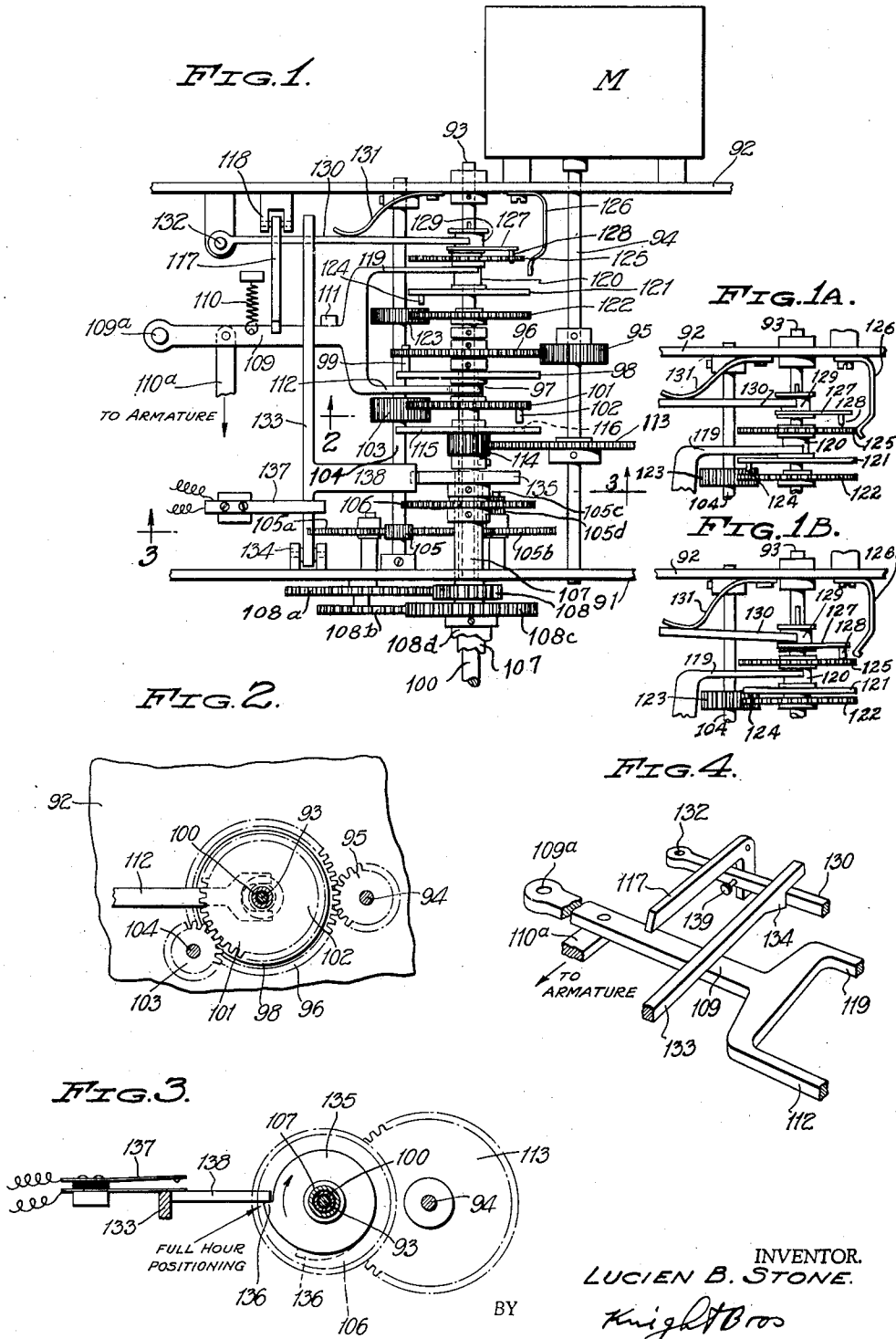
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SYNCHRONIZED MOTOR CLOCK MOVEMENT

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SYNCHRONIZED MOTOR CLOCK
MOVEMENT

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5 Claims. (Cl. 58—34)

My invention relates to synchronized motor clock movements and has the purpose of synchronizing the clock movement by the motor power, as soon as the distinct synchronizing impulse is received in the conventional manner. It is an object of the invention to effect the synchronization by the direct action of the motor power.

The present application is a division of my copending application, Serial No. 297,649, filed October 3, 1939, now Patent No. 2,274,221, granted February 24, 1942.

The invention will be described in detail by reference to the accompanying drawing, showing one illustrative form.

Fig. 1 is a top plan view of a clock movement having a synchronizing arrangement in accordance with the invention;

Figs. 1a and 1b are fragmentary views showing a part of the mechanism of Fig. 1 in two different positions;

Fig. 2 is a sectional elevation substantially on the line 2—2 of Fig. 1;

Fig. 3 is another sectional elevation substantially on the line 3—3 of Fig. 1; and

Fig. 4 is a fragmentary perspective of the upper left hand portion of Fig. 1.

M represents the motor which drives, through its shaft 94 and pinion 95, a central arbor 93, through a gear 96 fixed thereon, so that this arbor performs one revolution per minute. The arbor is journaled in the front plate 91 and the rear plate 92 of the clock movement, to the latter plate of which the motor M is attached. On its forward portion, central arbor 93 carries the seconds and minute sleeves 100 and 107 respectively. The hour drive is shown in Fig. 1, comprising a pinion 108 fixed on the minute arbor 107, from which the hour hand is driven in the conventional manner as through the reduction gear 108a, 108b, 108c and hour sleeve 108d. The seconds sleeve extends up to gear 96 and carries adjacent to this gear a hub 97 splined on the seconds sleeve. On this hub are fixed a disc 98 adjacent to gear 96 and a spur gear 101 at the other end of the hub. Disc 98 carries near its periphery a coupling pin 99 which engages in a hole provided in gear 96 so that thereby the seconds arbor becomes coupled with the central arbor 93 and is driven at one revolution per minute during the normal operation of the clock train.

In the two end plates 91, 92 of the clock movement is further journaled a countershaft 104 which carries a comparatively wide pinion 103

and a pinion 105. Pinion 103 meshes with gear 101 fixed on the hub 97 so as to drive the countershaft from the said hub, and pinion 105 drives a gear 106 fixed on the minute sleeve through an intermediate reduction gearing comprising an idler 105a meshing with pinion 105 and with an intermediate gear 105b rotatably mounted on a pin 105c. To the hub of gear 105b is fixed a pinion 105d which meshes with the gear 106. The ratio of the gearing is such that the minute sleeve rotates at one revolution per hour.

On drive shaft 94 is further mounted a gear 113 (partly broken away in Fig. 1), and in mesh with this gear is a pinion 114 located on the seconds sleeve 100 together with a disc 115 which is provided near its periphery with a hole 116 in which a pin 102 fixed on gear 101 can engage when the latter is shifted by its splined hub 97 towards disc 115. Pinion 114 and disc 115 are freely rotatable on seconds sleeve 100. The gear ratio between pinion 114 and gear 113 is such that if the seconds sleeve is coupled to disc 115 by the aforementioned pin 102, the seconds sleeve is rotated at greatly increased speed over its normal speed of one revolution per minute. Normally, disc 98 is held in engagement by its pin 99 with gear 96 of central arbor 93 (which, it should be remembered, is constantly driven at normal speed of 1 R. P. M.) through an arm 112 of a forked lever 109 pivoted at 109a, through engagement of the outer end of arm 112 with hub 97, this outer end being forked in the conventional manner. Lever 109 is normally held in the position shown against a fixed stop 111 by means of a tension spring 110. It is connected by means of a link 110a to the armature of an impulse magnet, not shown here but of a conventional character and, for instance, similar to the electromagnet 45 shown in Figs. 1 and 2 of my copending application, Serial No. 297,649, now Patent No. 2,274,221. The connection is such that when the electromagnet is energized, the armature pulls lever 109 in the direction of the arrow shown in Fig. 1 and thereby shifts arm 112 of the forked lever downwardly in Fig. 1 whereby the pin 99 of disc 98 becomes disengaged from the central arbor drive gear 96, and gear 101 mounted on the hub becomes engaged by its pin 102 with disc 115 of the high speed drive. Thus, when the electromagnet is energized, the seconds arbor, and through it the minute arbor and hour drive, is driven at high speed so long as the electromagnet remains energized.

Thus, in case the clock should be slow when

the synchronizing impulse arrives, the clock trains are speeded up by the high speed gearing 113, 114. Since, however, usually the synchronizing impulses last only a few seconds, in some cases this would not be sufficient time for the high speed gear to bring the clock train up to its synchronized position. In order, therefore, to maintain the forked lever 109 in high gear position, a bell crank 117 is provided which is pivotally attached at 118 to the rear plate 92 of the clock movement. This bell crank together with the cooperating elements is shown in fragmentary perspective in Fig. 4. Normally, that is to say, when forked lever 109 is in the position shown in Fig. 1 with the clock train running at normal speed, this bell crank rests with its long end on top of lever 109. As soon, however, as lever 109 is shifted downwardly in Fig. 1, arm 117 drops in front of lever 109 and thus prevents it from returning under the influence of spring 110 when the synchronizing impulse ceases. Bell crank 117 is prevented from dropping beyond lever 109 by an adjustable screw 139 which is threaded into the other arm of the bell crank and which abuts against a shifting arm 130 to be described later.

It is now necessary, after the clock train is once in high gear, to return the train to its normal speed as soon as the clock hands are synchronized. If the synchronizing impulse is received hourly, the hands may be set by the high speed gear on the full hour. This is accomplished in the following manner. On central arbor 93 is loosely mounted a hub 120 which carries at one end a disc 121 carrying near its periphery a pin 124 at a radial distance to engage one of the holes provided in the disc of gear 122 which is loosely mounted on arbor 93. This gear is in mesh with a gear 123 of countershaft 150 so that normally gear 122 is driven at the same speed at which the seconds arbor 100 rotates. The other end of hub 120 carries a ratchet wheel 125 into which engages the pin 128 of an arm 127 splined through a hub 129 on central arbor 93. Therefore, this hub and arm 127 always rotate at normal speed of 1 R. P. M. Hub 129 is engaged by the aforementioned arm 130 pivoted at 132 on the rear clock plate 92. The other hub 120, which carries ratchet wheel 125 and disc 121 which is loose on arbor 93, is engaged by the other arm 119 of forked lever 109, and therefore this hub with its ratchet wheel 125 and disc 121 moves downwardly in Fig. 1 when the forked lever 109 moves down for the purpose of shifting the clock train into high gear as described. Normally, when the elements are in the position shown in Fig. 1, the ratchet wheel 125 engages arm 127 through the pin 128. When the forked lever 109 is shifted downwardly, ratchet wheel 125 becomes disengaged from pin 128, and comes into engagement with a spring detent 126, which holds it stationary at the position it had reached when the synchronizing impulse arrived. The downward movement of hub 120 is not sufficient to bring pin 124 into engagement with the gear 122. This position of the parts is shown in Fig. 1a. The previously mentioned shifting arm 130 is under the influence of a spring 131 which tends to throw it downwardly in Fig. 1 or forwardly towards the front of the clock, but it is normally prevented from doing so by a latch bar 133 which with its nose 134 (see Fig. 4) normally engages shifting arm 130. This latch bar 133 is pivoted at the front plate 91 of the clock movement at 134. Thus when forked lever 109 has

been shifted by the synchronizing impulse and is held locked in shifted position by bell crank 117, shifting arm 130, though under the influence of spring 131, cannot follow and thus the rotating arm 127 is held in the axial position on central arbor 93 shown in Fig. 1, while the ratchet wheel 125 is disengaged from it.

On the minute arbor is fixed a cam 135 which is shown in face view in Fig. 3. The cam is set on minute arbor 107 so that its nose 136 is in the position shown in Fig. 3 when the clock hands have the full hour position.

The aforementioned latch bar 133 is provided with a lateral detent 138 the outer end of which is located in the path of the cam nose 136 so that every time the cam nose passes latch detent 138, latch 133 is lifted and thereby lifts nose 134 from shifting arm 130 (Fig. 4). When latch bar 133 is lifted, spring 131 is free to exert its influence on arm 130 and throw the latter, together with hub 129 and arm 127, forwardly on central arbor 93. Normally, that is to say, with the elements in the position shown in Fig. 1, this cannot occur in spite of latch bar 133 being lifted, because forked lever 109 holds ratchet wheel 125 against rotating arm 127 and thus prevents the hub from being shifted. If, however, forked lever 109 has shifted the clock train into high speed as described before, ratchet wheel 125 has moved away from arm 127 and thus rotating arm 127 can be shifted forward as soon as latch bar 133 is lifted.

The device operates as follows: Let us assume that at the arrival of a synchronizing impulse at the full hour, the minute arbor should be ten minutes slow. This would bring the nose 136 of cam 135 into the position shown in dotted lines in Fig. 3. At the arrival of the impulse, as was described, fork 109 shifts the clock train into high speed and lever 109 becomes locked in shifted position by bell crank 117 and now the clock train is moved at high speed toward the full hour position. This shifting of fork lever 109 has simultaneously also disengaged ratchet wheel 125 from normally rotating arm 127, and engaged it with spring detent 126. The hole in wheel 125 withdrawn from pin 128 thus retains a fixed position from the moment the synchronizing impulse was received. As soon as the clock hands have arrived at the full hour position, the nose 136 of cam 135 has arrived in the position shown in full lines in Fig. 3. This nose now lifts detent 138 and thus lifts bar 133 off arm 130 (Fig. 4) and thereby releases this arm. The latter can now follow the force of its spring 131 and thereby shifts arm 127 on central arbor 93 toward ratchet wheel 125. Thus, pin 128 of arm 127 strikes the face of ratchet wheel 125 thrusting the latter and disk 121 forward until pin 124 strikes the face of gear 122 (see Fig. 1b). This gear is rotating at the higher speed and the pin 124 soon drops into one of the holes in it. The disk 121 and wheel 125 now rotate at the same higher rate as the minute arbor and the hole in wheel 125 starts to gain on the pin 128. When the hole reaches the pin the pin drops into it. This has the effect of permitting arm 130 under the influence of its spring 131 to shift still further down and thereby engage screw 135 of bell crank 117 so that the latter is lifted off forked lever 109, permitting the latter under the influence of its spring 110 to shift back into its normal position shown in Fig. 1, and to thereby throw the clock train from high gear back into low gear (by disengaging pin 102 from high speed

disc 115 and re-engaging pin 99 with normal speed gear 96). As a consequence of this motion of forked lever 109, hub 120 together with disc 121 and ratchet wheel 125 are also thrown back into their normal positions shown in Fig. 1, and thus arm 127, now in engagement with ratchet wheel 125, is shifted also back into its normal position against the tension of spring 131. This releases the bell crank 117 from the control of arm 130, and this bell crank now can drop back on top of lever 109, as shown in Figs. 1 and 4, on which the bell crank normally rests. There is thus a sequence of four functions following the moment the nose 136 of cam 135 arrives at the full hour position. First, latch bar 133 is lifted, which allows normally rotating arm 127 to drop onto the ratchet wheel 125, pushing the latter free of the detent 126 and the pin 124 against the gear 122. Second, the pin 124 finds a hole in disk 122 and the disk 121 and ratchet wheel 125 take up the higher speed of the disk 122. Third, the ratchet wheel hole meets pin 128 and the pin drops in and permits arm 127 to shift further and to free fork 109 to permit the shifting from high to low speed. Fourth, arm 130 is shifted back to normal position by the fork 109, which permits latch bar 133 to drop back into normal position, shown in Fig. 4, in which arm 130 is locked. The provision of rotating arm 127 is made for the following reasons: If we take the example, for instance, of the clock being ten minutes late, it takes the high speed gear an appreciable time to move the clock train to the full hour position; let us say, it would take ten seconds. Therefore, if the clock train were returned from high speed to low speed at the time the nose 136 of cam 135 arrived in the full hour position, the clock hands, having then also arrived at the full hour position, would still be ten seconds slow, because central arbor 93 has in the meantime moved the distance of ten seconds ahead. If, however, as described before, the arm 127 rotating with central arbor 93 controls at the last instance the shifting of the clock train from high speed to low speed, it can, with the arrangement of elements described, occur only when pin 128 of arm 127 meets the hole in ratchet wheel 125. In other words, while arm 127 has moved ten seconds ahead during the synchronizing operation, ratchet wheel 125 must follow arm 127 at high speed until it catches this arm, namely at the moment when the hole in ratchet wheel 125 registers with pin 128 of arm 127. Thus the clock hands are in reality moved in this arrangement at high speed further than the full hour position in order to make up for the time lost during the synchronizing operation, the arm 127 and the hole in wheel 125 serving to measure the resetting time during which the clock train is operated at high speed to synchronize the hands and to determine the moment at which the high speed drive is to be terminated.

In order to avoid unnecessary shifting from normal speed to high speed in case the clock should be exactly on time when the synchronizing impulse arrives, an electric contact 137 is provided, as shown in Fig. 3, by which the electromagnet, such as is shown in Figs. 1 and 2 of my aforesaid copending application, is short-circuited. This contact is closed through the lifting of latch bar 137 by nose 136 every time it arrives at the full hour position. Thus at the arrival of the impulse, the electromagnet cannot be energized if the clock is on time and all syn-

chronizing elements remain in their normal positions shown in Fig. 1.

I claim:

1. In a mechanism for synchronizing motor driven clocks directly by the power of the driving motor, a normal speed gearing continuously driven by the motor, a high speed gearing continuously driven by the motor, a clock train, a clock train coupling permanently geared to said clock train and having a limited shifting movement between two positions, said clock train coupling having means to establish driving connection with said normal speed gearing and with said high speed gearing, respectively, in said two positions, means continuously urging said clock train coupling toward the position in which it has driving connection with said normal speed gearing, actuating means to shift said clock train coupling to the position in which it has driving connection with said high speed gearing, means to lock said clock train coupling in said latter position, and means set in operation by said clock train on reaching a certain position to release said locking means.

2. In a mechanism for synchronizing motor driven clocks directly by the power of the driving motor, a normal speed gearing continuously driven by the motor, a high speed gearing continuously driven by the motor, a clock train, a clock train coupling permanently geared to said clock train and having a limited shifting movement between two positions, said clock train coupling having means to establish driving connection with said normal speed gearing and with said high speed gearing, respectively, in said two positions; a reset timing means comprising a rotary timing member permanently geared to said normal speed gearing and a rotary control member coaxial with said timing member, said timing and control members having disengageable reset coupling means adapted to couple them together in only a single angular relation; actuating means adapted simultaneously to shift said clock train coupling from said first position to said second position and to disengage said reset coupling means, means for holding said rotary control member stationary as said timing member continues to rotate after the disengagement of said reset coupling means; means operated by said clock train on reaching a certain position for establishing a driving connection between said high speed gearing and said rotary control member and for simultaneously adjusting said reset timing means to a position for automatic reengagement of said reset coupling means when said rotary control member assumes said single angular relation to said timing member, and means set in operation upon reengagement of the reset coupling means to restore said clock train coupling to said first position.

3. In a mechanism for synchronizing motor driven clocks directly by the power of the driving motor, a normal speed gearing continuously driven by the motor, a high speed gearing continuously driven by the motor, a clock train, a clock train coupling permanently geared to said clock train and having a limited shifting movement between two positions, said clock train coupling having means to establish driving connection with said normal speed gearing and with said high speed gearing, respectively, in said two positions, means continuously urging said clock train coupling toward the position in which it has driving connection with said normal speed

gearing, actuating means to shift said clock train coupling to the position in which it has driving connection with said high speed gearing, means to lock said clock train coupling in said latter position, means set in operation by said clock train on reaching a certain position to release said locking means, and means adapted to be operated by said clock train in said certain position to disable said actuating means.

4. In a clock synchronizing mechanism, a clock train, a normal speed drive therefor, a high speed drive for resetting said clock train, means to measure the resetting time during which said clock train is operated by said high speed drive, and means controlled by said resetting time measuring means to terminate the drive of said clock train by said high speed drive.

5. In a clock synchronizing mechanism, the combination with a clock train, a normal speed driving gear, a high speed driving gear, and coupling means shiftable from normal position in which it couples said normal speed gear to said clock train to high speed position in which it couples said high speed gear to said clock train; of reset timing means, means for setting the latter in operation simultaneously with the shift of said coupling means to high speed position, and means controlled by said reset timing means to restore said coupling means to normal position at the instant the travel of said clock train past a predetermined synchronizing position equals the total elapsed time since the shift of said coupling means to high speed position.

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